ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
SCHOOL OF INFORMATION STUDIES FOR AFRICA

EXPLORING THE POSSIBILITIES OF USING EXPERT INTERFACES TO HYPERTEXT DATABASES FOR BUSINESS INFORMATION STORAGE AND RETRIEVAL: A CASE STUDY OF THE ADDIS ABABA BUSINESS COMMUNITY

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ABSTRACT

Information Technology (IT) has brought significant changes in the business world. The business community in Addis Ababa can get significant benefit from the appropriate use of IT. Integration of hypertext and expert systems technology has brought a new dimension to modern information retrieval, because it can help expert users in browsing and navigating while non-expert users can get an expert guidance to retrieve relevant information.

Definition, components, historical developments of hypertext and its differences with conventional information retrieval systems have been discussed followed by a discussion on the expert systems technology. The benefits of integration of these two technologies have been discussed along with brief description of some software tools with particular reference to KnwoledgePro.

Addis Ababa Chamber of Commerce (AACC) provides trade information to its members. However, almost all the respondents in a survey underlined that their information requirements are not met by the existing facilities. This result is found to be statistically significant at any acceptable significance level ($\chi^2_{(1)}$=87.8370, p=0.0). Information requirements of various business sectors have been identified. More than seventy percent of the business houses surveyed possess IT equipment ranging from fax, computers and communication facilities though computer usage is mostly related to word processing applications. Most respondents of the survey indicated their willingness to expand the IT facilities and were willing to pay for their required business information.

Design considerations of an integrated expert and hypertext business information system have been discussed and a quick prototyping approach has been used to develop a prototype business information system. Hardware and software requirements and the implementation issues have been discussed. The prototype system consisting of a hypertext database coupled with an expert user interface would improve the business information facilities in AACC.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Revolutionary advances in information technology (IT) reinforce economic and social changes that are transforming business and society. A new kind of economy - information economy - is emerging from the revolution. In this economy, information is the critical resource and is the basis for competition. Old ways of doing business will be attacked and sometimes defeated (Talero and Gaudette 1995).

At the social level, a corresponding new society is also emerging. This society's information capabilities are pervasive, making it substantially different from an industrial society. IT is much more competitive, more democratic, less centralized, less stable, more able to address individual needs, and friendlier to the environment (Talero and Gaudette 1995).

IT is changing how we work, play, learn, travel and govern. The diffusion of IT to all areas of human activity causes accelerating change in economies and societies. Knowledge, inputs, and work products of industries, governments, and professions can be captured as digitized information, which can then be processed, duplicated, stored, and transmitted at ever lower costs. Moreover, information can substitute for other factors of production: land, labour, capital and energy.

Less widely recognized, but even more significant, key organizations' markets, products, and services from all sectors depend increasingly on information technology. Companies can raise the efficiency of production and management with networks of facilities and

markets. Sophisticated information processing capabilities are within reach of small and medium enterprises, communities, and private homes.

Entire enterprises and industries could not exist at their present scale and complexity without IT, including financial market transaction volume, credit card charge volume, mutual funds, video games, travel reservations, international telephony, and discount retailing.

Information processing capabilities combined with reliable inexpensive telecommunication has spawned an unprecedented kind of information infrastructure. Established networks attract a broadening base of participants, and they interconnect nationally and globally. The end point is a global information infrastructure (Talero and Gaudette 1995).

As a result of this global information infrastructure, global trade and investment are increasing. International trade in goods has increased to the point where global production and sourcing is prevalent. International trade in services is increasing its share of total trade. Investment and money flow globally through an increasingly integrated and volatile financial market. Increased participation in the world economy has become the key to domestic economic growth and prosperity. Those that lag behind risk shrinking market share or extinction.

In developing countries, specially in Africa, access to this global information infrastructure (GII) is inadequate which leads to the aggravation of the domestic economy's problem which is in turbulence and chronic recession. Even if some of the African countries have established links to the GII, they only have access to external information. They do not use

the GII in advancing and advertising their tourism sites, investment potentials, products and services, etc. because of the absence of a digitized information to be shared with the others through the GII.

The scenario in the Ethiopian situation is not different from other developing countries. There is no digitized information which can be displayed on the GII for popularizing and advertising its tourism sites, investment potentials, products and services. Let alone a digitized information for the GII, there is no digitized information at the national level to be used by different sections of the indigenous population (businessmen, researchers, educators, ordinary citizens, etc.).

In line with this, in this research an attempt has been made to develop a prototype information system for the Addis Ababa Business Community using hypertext and expert systems technologies that would provide digitized information to the business people.

1.2 STATEMENT OF THE PROBLEM AND JUSTIFICATION

1.2.1 Statement of the problem

Business community plays a pivotal role in the economic development of a country. The same is true with Ethiopia. But the community is not provided with adequate information in Ethiopia in general and in Addis Ababa in particular. So, in this research a survey of information requirements of the Addis Ababa business community is conducted and an attempt is made to develop a prototype business information system based on the hypertext and expert systems technology to provide the information online (in digitized form).

The technologies of hypertext and expert systems provide new ways of storing and retrieving information, very different from traditional ways of storing and retrieving information.

The goal of this research is to determine whether the Addis Ababa Business community gets adequate information for daily business operations, if not to determine the main reasons for the inadequate provision of information, to develop a prototype hypertext database based on the information requirement and to develop expert user interfaces for the hypertext database so that the users can easily find the required information from the database.

1.2.2 Justification

In this study an attempt is made to explore the possibilities of using expert interfaces to hypertext databases and developing a prototype for business information storage and retrieval. The reasons for choosing business information include:

- Recent government change which brought about the shift from centrally command economy to a market oriented economy in which the private sector has to play its role of engine in the economic development of the country. In line with this, the government has taken various measures to encourage the business community like, new investment code, new tax policies, new foreign trade policies, new urban land-lease legislation, new labour code, elimination of most price controls and new financial sector policies;
- The business community is faced with abject information poverty as discussed by the Business Development Action Plan (BDAP) study team (1994). The BDAP team explained that the business community was not even in a position to indicate their information needs as a result of the abject information poverty. Not

only were Ethiopian enterprises in the "dark" about modern ways of doing business, they also appeared to lack information (which is generated internally) about new or proposed policy initiatives at both the national and regional level. At the firm level, enterprise owners also appeared to be equally in the "dark" about the mechanics of the functions and activities of "distributors", who often purchase their products in bulk "at the factory door" and then onward sell them in the market. Other evidence of the information problem is manifested in such ways as lack of knowledge about foreign markets, the role of international trade agreements and new technological developments. These evident gaps in knowledge are thus indicative of a major information related market failure which constrains the ability of existing enterprises to grow and which equally constrains the ability of potential entrepreneurs to access the information they need to perceive business opportunities and to assess their associated business risk. Therefore one of the critical actions to be taken for facilitating business development in Ethiopia entails developing methodologies and allocating resources for creating the needed business related information sources throughout the country; and

- to experiment the technology with business information storage and retrieval within the Ethiopian situation.

1.3 OBJECTIVES

The general objective of this research was to explore the possibilities of using expert interfaces to hypertext databases for business information storage and retrieval with a view to designing and developing a prototype business information system taking the Addis Ababa Business Community as a case.

The specific objectives were to :

- investigate the potential of hypertext and expert systems for business information storage and retrieval;
- investigate the methods of designing expert user interfaces;
- explore the different software tools available for developing hypertext and expert systems;
- to determine the information requirements of the business community in Addis Ababa;
- examine the information seeking behaviour/habit of users of the proposed business information system so as to design appropriate human-computer interaction; and
- design a general framework of the system and develop a prototype business information system;

1.4 SCOPE AND LIMITATIONS

The study covered those Businessmen who are listed in the 1994 Trade Directory published by the Addis Ababa Chamber of Commerce and the prototype information system is expected to be installed and maintained at the Addis Ababa Chamber of Commerce. This is because:

- The Addis Ababa chamber of Commerce is one of the oldest chambers of commerce in Ethiopia. It has the largest number of members from other chambers within Ethiopia. This implies that the prototype system can possibly be extended to other chambers within the country if tested and found to be reliable;
- The main aim of the Addis Ababa Chamber of Commerce like any other chamber of commerce is to collect and disseminate commercial information and statistical databases and promotion of linkages with domestic and foreign partners. Being in the capital city, it is very much accessible to the business community either

within the country or those coming from outside. So, to base the prototype system at the Addis Ababa Chamber of commerce is reasonable.

In collecting data, the respondents did not respond as expected which is manifested in the low response rate of the questionnaire (below 60%). The low response rate can be attributed to the lack of time on the part of the respondents; suspecting that the questionnaire has something to do with government and hence tax (even though there was a covering letter from the university); and low level of recognition and literacy.

Furthermore, the study identified the information requirements and is limited only to developing a prototype database on some aspects of the information requirements. So a full-fledged information system development is beyond the scope of this research.

For the development of the prototype, the research has been limited to the development tools (hardware and software) available at the School of Information Studies for Africa (SISA), Addis Ababa University.

1.5 METHODOLOGY

1.5.1 Data Collection Methods

The questionnaire method is used to gather data about the information requirement of the business community. The questionnaire was designed by referring to questionnaires designed for a similar study by other researchers (Gezahegn 1995 & Bekele 1992), by consulting with business people as well as thesis advisors and colleagues at the school. The questionnaire consists of questions relating to the type of information the different sectors of the business community need, what their source of information is, the extent of the use of

IT, the willingness to pay for information, whether there is a plan to introduce or further develop the use of IT, the choice of a place for the proposed information system, etc.

The business people who are listed in the Trade Directory of the Addis Ababa Chamber of Commerce (AACC) published in 1994 were used as a sampling frame. In the Trade Directory the business people are classified into five business areas (sectors); namely, Import, Export, Agency, Manufacturing and Service sectors. Taking this classification as a base, a stratified random sampling method with five strata was used. There were 4961 business organizations in the Trade Directory which constituted the sampling frame. The sample size was taken to be ten percent of the population size which was 497. In the Trade Directory, there are 900 exporters, 3000 importers, 244 agencies, 410 manufacturers, and 407 service providers. Using proportional sampling, the sample size for each stratum was taken to be 90, 300, 25, 41 and 41 for export, import, agency, manufacturing and services, respectively. After determining the sample size for each stratum, the table of random numbers was used to draw the sampling units for each stratum.

Furthermore, an interview method was used to gather data about the AACC to determine the major problems in providing business information, to assess their willingness to accept the proposed system and to assess the availability of technical expertise and appropriate IT facilities to implement and maintain the proposed system and to determine how they provide and categorize information. Three people were interviewed, namely the Secretary General, Head of the Trade Information Department and the Head of Information Service, under the Trade Information Department at the AACC.

Literature review/document analysis was conducted on hypertext and expert systems technologies, their application to business areas and their integration in providing a good solution to conventional information storage and retrieval problems.

1.5.2 Development methods

The system development methodology with the prototyping approach was used in developing the prototype system as this approach enables developers to evaluate the system at nearly real scale and at very low cost at different stages of the system development process. The approach was used to test the screen layouts, colour combination, button designs, link strategies, interaction methodologies, expert user interfaces and various other design parameters.

The development of the prototype system can be done using either (i) a programming language or (ii) an expert system development tool called a shell. Some expert system shells, for instance knowledgepro, provide a complete software toolset for constructing and developing expert systems and hypertext. Shells have facilities for knowledge representation and can help in the creation and validation of knowledge bases. Their chief advantage lies in the development time they save and their ease of use over Artificial Intelligence programming languages (Poulter et al 1994). In addition, shells offer good help facilities for users, and they are comparatively low in cost. Because of these reasons and its availability at the School, an expert system shell called Knowledge Pro was used for developing the prototype system.

1.6 ORGANIZATION OF THE THESIS

The Thesis is divided into six chapters. Chapter one deals with the Introduction. Chapter two deals with hypertext and expert systems technologies and their application in business.

This chapter deals with hypertext and expert systems, i.e., definitions and basic concepts, how hypertext and expert systems can be integrated, software tools available for developing hypertext and expert systems, and available business applications using both hypertext and expert systems. Chapter three deals with business information which encompasses definition of business information, classification, business information in Ethiopia, organizations engaged in rendering business information; and finally survey results are presented. Chapter four deals with system design issues in developing hypertext databases with expert user interfaces which includes node design, link design and expert user interface design. Chapter five deals with prototype development. The last chapter, chapter six, deals with conclusion and recommendations. Finally, the bibliographic references and appendices consisting of the questionnaire and the interview guide used for the data collection and sample program listing have been presented.

CHAPTER 2

HYPERTEXT AND EXPERT SYSTEMS

2.1 INTRODUCTION

Conventional keyword based textual information retrieval systems attempt to attain high precision and recall by means of indexing exhaustivity and term specificity but suffer from a number of drawbacks such as (Gudi 1995):

a) Exploratory information retrieval is often not feasible, thus requiring a prior identification of information needs;

b) A user must translate his information needs into a Boolean query using a specific indexing language or must convey his needs to an intermediary (human or machine) who must translate them faithfully into a Boolean query. Given the inherent limitations of content analysis, indexing language and Boolean logic itself, queries often do not reflect the users' information needs faithfully;

c) If the items retrieved in response to a query are either too many or too few the query has to be refined and resubmitted. This is a time consuming and frustrating experience; and

d) the search and retrieval process is often slow and tedious.

Hypertext refers to a non-sequential, non-linear method for organizing and displaying text. It enables the user to access information from a text in ways that are most meaningful, based upon the assumption that the organization that the reader imposes on a text is more meaningful than that preferred by the author(Jonassen et al 1993).

Expert systems can make hypertext more usable. Expert systems fall under a broader area of Computer Science known as artificial intelligence, which also includes the fields of natural language processing and robotics.

Nowadays there is a possibility of merging hypertext with expert systems although they were seen as alternate or competing approaches to problem solving.

2.2 HYPERTEXT

2.2.1 Definition and Meaning

Hypertext has been defined by different scholars. Seyer (1991) defined that the word "hyper" in hypertext has the meaning of "extending into another dimension" as in hyperspace, hypersphere, or hyperdimensional.

Hall and Papadopoulos (1990) defined hypertext as follows:

> *"Hypertext is data maintained as a network of interconnected discrete blocks of information. Hypertext systems are computer systems used to create and maintain hypertext databases and provide mechanisms for users to access the information"*

Hall and Papadopoulos (1990) went on explaining that a hypertext document is a collection of nodes interconnected by links. The nodes contain discrete blocks of information of text. When the nodes contain graphics and other items like digital images, animation sequences, sound, and interaction video, it is called hypermedia. A hypertext link is a machine-supported, 'hardwired', direct connection between a specific source and destination node.

Furthermore, Jonassen et al (1993) defined hypertext as a non-sequential, non-linear method for organizing and displaying text. It was designed to enable the reader to access information from a text in ways that are meaningful, based upon the assumption that the

organization that the reader imposes on a text is more meaningful than that preferred by the author.

According to Jonassen et al (1993), the most pervasive characteristic of hypertext is the node, which consists of chunks or fragments of text. The size and modality of a node varies from a few words to the size of a large document. Nodes are the basic unit of information storage in a hypertext. Modularizing information enables the user of the information system to determine what chunk of information to access next. Another important characteristic of a node in many hypertext systems is that they are amenable or modifiable by the user. The user may add or change the information in a node or create his or her own nodes of information.

The organization of a hypertext, that is, the interrelationships between the nodes, is defined by the links that interconnect the nodes. Links in hypertext systems are typically associative, that is, they define an associative relationship between the node pairs that they connect. The links transport the user through the information space on the nodes that are selected.

Gudi (1995) identified the following characteristics of typical hypertext systems:

1. Information in the database is divided into small units called 'information items' displayed one per window.
2. Information is organized as a 'network' of 'nodes' interconnected by 'links', which may be of many types. The 'network' provides an information structure. It is possible to build a number of such structures over the same database. Nodes in the network are related to

information items in the database. This relationship may be one to one, one to many or many to many.

3. Navigation through the network is by following links from one node to another, leading to browsing facility.
4. Users are permitted to build their own information structures by creating and modifying their own network.
5. In shared hypertext systems multiple users can simultaneously access the same database.

2.2.2 Historical Background

Hypertext has arisen within a scientific community that shares a view of human beings that is seldom explicitly articulated, at least within the hypertext community. The principal component of this view is that human memory is associative. It was within this intellectual backdrop that the original paper was produced by Vannevar Bush in 1945(Hall and Papadopoulos 1990).

Hypertext builds upon the relative strengths of the human mind and the digital computer; the computer holds the data and presents it to human, the human chooses which way to go by pointing at each juncture. It is an intuitive approach in which the ability to link associated text matches the brain's natural tendency to think associatively (Berk and Delvin 1991a).

Hypertext has a fascinating history. Although Theodore Holme Nelson coined the term hypertext in 1965, Vannevar Bush was probably the first to discuss the concept in print- 20 years earlier. Berk and Delvin (1991b) gave the following timeline that shows the historical development of hypertext .

Table 2.1: Hypertext timeline

Year	Event
1945	Vannevar Bush proposed the 'memex' system that foreshadowed the advent of hypertext.
1962	Douglas Engelbart published a paper, 'Augmenting Human Intellect: A Conceptual Framework,' which envisaged the present-day hypertext.
1965	Theodore Holme Nelson invented the term "hypertext" and presented it to the world. He constructed Xanadu, a hypertext engine based on his version of hypertext.
1968	Andries Van Dam and his team at Brown University developed the Hypertext Editing System. Van Dam's second hypertext project at Brown was called the File Retrieval and Editing System (FRESS, completed in 1982). The latest hypertext project at Brown is called Intermedia. One of the seminal ideas derived from Van Dam's work is that of the "web", a set of links that belong together.
1972	The last of the "first generation" hypertext systems, ZOG, was developed at Carnegie-Mellon University.
1983	The "second generation" of hypertext authoring products began in the early 1980s with the emergence of workstation-based, research-oriented systems such as Intermedia and KMS.
1985	In 1982, Peter Brown invented the first commercial hypertext authoring system for a personal computer, which was called Guide in 1985 when Office Workstations Limited (OWL) began to market it for the Apple Macintosh.
1986	Xerox PARC's NoteCards was released. NoteCards pioneered in the application of metaphor to hypertext; each node in NoteCards is represented on screen as a card. NoteCards can be of any length necessary.
1987	HyperCard came out. HyperCard does not allow text-to-text links. Also in 1987, the IBM-PC version of Hyperties, which began life in 1983 as The Interactive Encyclopedia System (TIES) at the University of Maryland's Human-Computer Interaction Laboratory, was introduced.
1990	There are now plenty of commercially available hypertext authoring systems running on a variety of platforms. New versions of existing hypertext products such as HyperCard, Hyperties and Guide are released regularly. Hypertext conversion programs such as Texas Instrument's HyperTRANS, OWL's IDEX, and Big Science's SmarText (now owned by Lotus), which convert existing electronic documents into hypertext, are becoming viable options or additions to business documentation plans.

2.2.3 Elements of Hypertext

Nodes and links form the nuclear elements of all hypertext systems.

2.2.3.1 Hypertext Nodes

Hypertext information consists of conventional text and graphics, but partitioned into discrete blocks or nodes. The fundamental unit of information in a hypertext document is a node. A node consists of data organized around a single topic. In different hypertext systems, different terms are used for nodes. In HyperCard, a card is a node. In HyperPad, the node is Pad. HyperWriter and xText talk about nodes as pages (Seyer 1991; Berk and Delvin 1991a).

In most hypertext systems the node size is determined by the author, who can express his idea or concept in as many words as seems appropriate using a single node to optimize the organization of information. However, there are other more practical considerations in deciding the node size. One constraint is that it takes some time to retrieve a node when a link is activated, hence many small nodes are generally not created. Further, many small nodes increase the amount of navigation the reader must perform. Shneiderman advises nodes of 100 to 1000 words, arguing that more smaller nodes are preferable to fewer larger nodes. Some current generation systems restrict the size of a node to be a screenful. This reduces reliance on scrolling, as scrolling is an inefficient way to navigate in a database. Other factors to be considered in determining the node size are the nature of the task, session duration, and experience of the user (Hall and Papadopoulos 1990).

In early hypertext systems nodes were always text nodes. But, there are other possibilities. A node can be anything that can be presented to a user. Seyer (1991) suggested that a node might be text display, graphic display, videotape or videodisk segment, animated graphics, recorded speech, digitized speech, music and another person. Seyer (1991) further argued that this view of nodes focuses on the display attributes of the nodes and said that there are

other ways of looking at nodes, too. He argued that nodes can be structured, semi-structured, unstructured, typed, context sensitive and composite.

In some hypertext systems nodes are considered to be untyped: nodes can be thought of as boxes holding information. Other systems support a variety of typed nodes, given a label and a descriptor to help determine the style of the information contained in the node. Types also help classify nodes or define specialized operations (Hall and Papadopoulos 1990).

2.2.3.2 Hypertext Links

Nodes are connected to each other by electronic cross-references called links. To access more information about a specific topic, the hypertext reader simply points to a link anchor, an on-screen indicator of the presence of a link. When a reader selects a link in this way, the computer screen immediately changes to reveal the contents of the nodes to which the link refers (Berk and Delvin 1991a).

Links provide an efficient and easy way to follow references between the 'link source' and the 'link destination'. Links are usually directed, although it is common to support going 'backwards' along the link. In most common implementations of hypertext, link sources are individual text items or icons or buttons and link destinations are nodes. Some systems allow link sources or destinations to be blocks of text within a node.

A button in hypertext is an object that shows that more information is available. A button, also called a point, "points out" that there is a link between the current node and another node. A button might look like the kind of button you press - a doorbell button, for example. Or a button might be a word, special character or other symbol. A button might

be text that is highlighted in some way. In other cases, a button might be invisible or it might be a reference to another file or topic (Seyer 1991).

Most hypertext systems provide a number of different link types. For example, one specific type of link is used to connect the sources with comment or annotations, while another is used for cross-references. Some systems provide the facility to place attribute/value pairs on links and to query the network for them. Another useful feature is to have procedural attachments to links so that traversing a link also performs some side effect, such as customizing the appearance of the destination node or running an external program; this could make a hypertext program intelligent. Typed links help in having some advance information about the nature of the destination node before traversing a link. (Hall and Papadopoulos 1990)

2.2.4 Hypertext versus other systems

Table 2.2 summarizes the difference between hypertext systems and other systems as explained by different scholars (Hall and Papadopoulos 1990; Slatin 1991).

Table 2.2 Hypertext versus other systems

1. **Hypertext versus Database managers**	
Hypertext	Database managers
- The storage engine contains only one 'uninterpreted' data type that can contain arbitrarily large passages of text, digitized voices, graphics bitmaps, etc. - Links in hypertext system are directed and predetermined	- Stores information in the form of fields and records differentiating between fields that contain character strings (text) and those that contain numbers. - Provides link mechanisms through associative access using key fields and indexing mechanisms. Retrieving information from a linked set of files require the construction of a join query.
2. **Hypertext versus Text retrieval**	
Hypertext	Text Retrieval
- breaks the text up into pieces called nodes - access is through navigation or browsing	- Store information as text plus diagrams, like hypertext, but do not break the text up into pieces like hypertext nodes. - Access is by creating indexes for some (or all) of the words and phrases contained in the text.
3. Hypertext versus word processors	
Hypertext	Word Processors
- major function is to create documents that are meant to be stored and retrieved on computers - the document created can be multilevel, cross-referenced, and annotated in a way that is impossible with paper.	- major function is to prepare and print documents, to enable the user to organize his ideas so that they can fit onto paper.
4. **Hypertext versus outline/idea processors**	
Hypertext	Outline/Idea Processors
- can have a hierarchical tree structures or a network structure	- allow users to structure their thoughts and ideas for analysis or as an outline for writing a project - allow only hierarchical or treelike structures - has the ability to suppress lower level details in an outline

2.3 EXPERT SYSTEMS

2.3.1 Definition

Expert systems emerged as a discipline in the late 1960s. However, little progress was made until the Japanese announced their entrance into the scene in 1981 for building the first fifth Generation Computer, capable of incorporating intelligence approaching that of a humanbeing which gave a mass boost to research in expert systems and their applications around the world, as the United States and Europe strove to keep up with Japan (Poulter et al 1994).

Alberti and Micco(1990), as cited by Ford(1991), defined expert systems as:

> *"Computer programs, along with knowledge, information and databases, which act together to simulate the problem solving and decision making processes of a human expert within a relatively narrow domain."*

Morris (1991) defined expert systems as computer programs that incorporate human knowledge and offer advice and explanations on request. Further more, O'Neill (1988) defined expert systems as a computer system which operates by applying an inference mechanism to a corpus of specialist knowledge of a particular domain. According to O'Neill (1988) the intention is that it should perform functions similar to those normally performed by a human expert in that domain.

Expert systems are one of the products of work into artificial intelligence (AI), as a subfield of computer science that directs its efforts towards developing computer programs that can emulate human responses, i.e. programs that can solve problems, learn from experience, understand language, interpret visual signs and in general behave in a way that would be considered intelligent if was observed in a human. They arose from the realization that computers, although capable of magnificent feats of calculation, fail in areas that human beings excel particularly, sensory perception and common sense reasoning. For a computer to display intelligence, would therefore require it to be provided with lots of high quality, specific knowledge of a particular domain. Research along these lines culminated in the development of programs encoding narrow areas of specialist knowledge, known as Knowledge Based Systems (KBS). Expert systems are that subset of KBS that deal in particular with human knowledge, as applied and practiced by acknowledged experts in specific domains (O'Neill 1988).

Expert systems differ from conventional programs in the following ways (Zahedi 1993; Hollingum 1990; O'Neill 1988):

- The kind of problem that expert systems solve is a problem that cannot be solved by a person who has not been trained in the domain of the problems. The problems that expert systems solve typically require several years of training or experience for people.
- The problem has not been formalized or expressed as an algorithm.
- Expert systems methodology separates the expertise itself (the knowledge base) from the mechanism which applies the expertise (the inference engine).
- Expert systems work with interpretative rather than compiled languages allowing the expression of concepts difficult to encode in conventional languages.
- Expert systems work with symbols, for example, patterns, graphs, languages, etc. rather than numbers, thereby opening up new areas for computer manipulation.
- Expert systems are designed for solving unstructured and semistructured decision problems. Conventional programs computerize structured aspects of decision problems.
- Expert systems contain domain knowledge which must be attained through the arduous process of knowledge acquisition and knowledge modeling. Conventional programs need data, whose method of collection and storage are easier to attain.
- Expert systems normally come up with an answer, such as categorizing an object, diagnosing a problem, or taking an action. Conventional programs give input to the user, normally without producing a definite recommendation. This means an expert system requires the added steps of validation and verification for establishing the correctness or, at least, the acceptability of its answers.

Expert systems are intended as aid to decision making in areas where human expertise may be expensive, scarce, being lost or needed in several places at once. Expert systems are useful because (Ford 1991; Zahedi 1993; O'Niell 1988):

- Expert systems can work 24 hours a day in hostile environments, they can increase productivity and profitability, and sometimes outperform human experts who need food and rest while expert systems are untiring.
- Expert systems can release experts from tedious tasks and free them for more important or creative work.
- Expert systems are consistent. Such programs make the same recommendations. They are not by nature biased, unless they are programmed to do so.
- Expert systems can make the development of new levels of expertise, by speeding up problem solving. High speed reasoning or problem solving can allow more effective, rapid and flexible response to client/customer requirements where services or products are complex (e.g. equipment configuration). It also allows the exploration by professional staff of more ways to solve complex problems than would otherwise be feasible within time and resource constraints.
- Expert systems 'archive' expertise that would otherwise be lost through staff retirement or resignation. This means expert systems are immortal and permanent. If maintained regularly, they do not retire, die, or resign.
- Expert systems enhance training. The ability of a knowledge based system to explain its line of reasoning and its conclusions can allow novices to observe and analyze the performance of the experts, and compare it with their own.

An Expert system approach is best suited to clearly and narrowly defined tasks where (Ford 1991; and O'Neill 1988):

- the task is based on knowledge and not common sense;
- the task can be performed without the need for imagination, creativity or reasoning;

- the task can be performed without the need for physical (non-cognitive) abilities such as balance, smell, manipulation, etc.;
- expertise is clearly specifiable;
- there is a consensus about solutions;
- the task is well-bounded and clearly understood;
- the task cannot be solved readily by algorithmic methods; and
- the task requires applying rules to complex conditions to derive conclusions.

2.3.2 Structure of Expert Systems

In any expert system, one can distinguish four major factors (Lu and Poo 1991; Zahedi 1993): *domain knowledge*, *knowledge base*, *human component*, and *expert system software*, as shown in Figure 2.1 (Zahedi 1993:66).

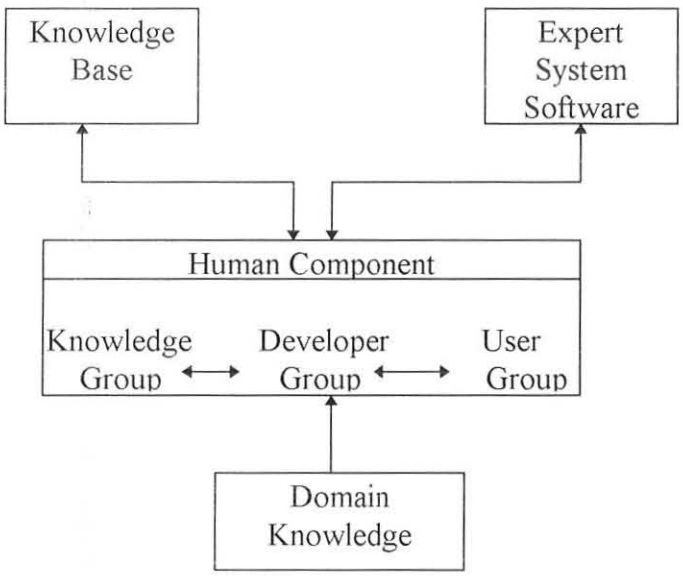


Figure 2.1 Factors in an Expert System

An expert system normally is given knowledge within a particular area for which it is designed to solve problems or make recommendations. This area is called domain

knowledge. Determining what part of the domain knowledge should be included in an expert system can be a major hurdle in expert system development (Zahedi 1993).

The knowledge base is the part of the domain knowledge that the expert system must contain. The representation schemes of the knowledge vary greatly and it is the design of the representation scheme that has the greatest impact on the design of the inference engine (Poo and Lu 1991). As a larger portion of the domain knowledge is incorporated into an expert system, its knowledge base grows in size.

People play a major role in expert systems. One can group the human players in expert systems into three general categories (Zahedi 1993): knowledge group, developer group and user group. The knowledge group consists of individuals who create the content of the knowledge base. They determine, through many iterations of trial and error, what constitutes expertise within the domain knowledge, and formalize its structure. This group consists of the *domain expert* and the *knowledge engineer*. The *domain expert* is the person or group whose knowledge of the domain must be emulated by the expert system. The *knowledge engineer* works with the human expert to formalize the domain expertise in such a way that it can be transferred to the machine.

The developer group either programs the system from scratch or works with an existing expert system software product. This is the group that builds an expert system in close collaboration with the knowledge group and the user group (Zahedi 1993).

The user group consists of individuals who will use the expert system. Depending on the purpose of the expert system, the user could be a regular user, or an irregular user. The needs of the system users have an important role in the design of the expert system.

2.3.3 Structure of Expert System Software

A typical expert system software has the following components (Zahedi 1993): *Coded knowledge base, Knowledge representation, Inference engine, Knowledge management, Outside hooks and Meta knowledge*, as shown in Figure 2.2 (Zahedi 1993: 70).

2.3.3.1 Coded Knowledge Base

The coded knowledge base is the knowledge base coded for the expert system software. There are several methods for encoding knowledge. Even when two expert system products use the same method, their syntax of encoding knowledge may vary, depending on the design of the software. Once the knowledge is coded according to the software syntax, then the other components of the software can access and process it.

When an expert system is consulted about a particular problem, the expert system must get the relevant facts about the problem. The system combines these facts with the coded knowledge base to derive new conclusions and make recommendations.

2.3.3.2 Knowledge Representation

The knowledge representation component of the expert system software provides the syntax for encoding the knowledge. A human expert will use a number of different types of knowledge when making decisions during his or her work, including: causal or event knowledge, knowledge about objects, performance knowledge, meta knowledge(how and why to apply knowledge), knowledge about relationships and knowledge about processes (O'Niell 1988).

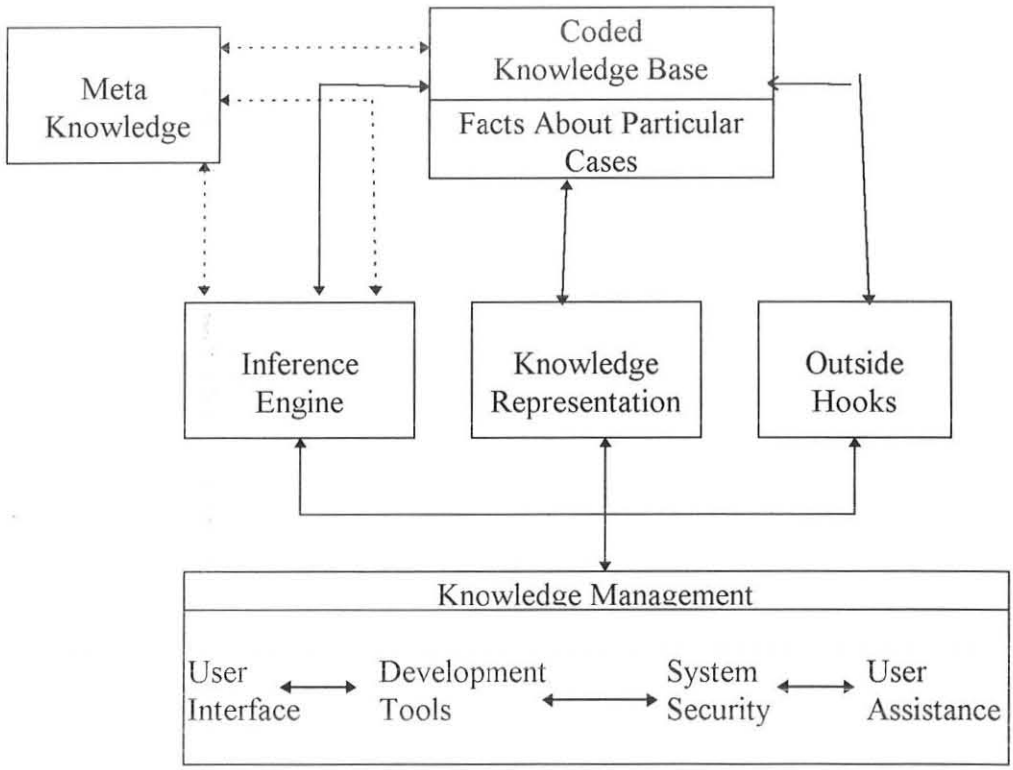


Figure 2.2 Components of Expert System Software

Once human knowledge has been extracted (e.g. through interviews, observation, or protocol analysis) from experts or other sources by knowledge engineers, it must be organized and structured for use in a knowledge base. In a knowledge base, there are a number of knowledge representation schemes. Some of the knowledge representation schemes are rule based systems, semantic networks, frames, object-oriented systems and blackboard systems (Zahedi 1993; Ford 1991; Littleford 1991).

2.3.3.3 Inference Engine

The *inference engine* processes and combines facts related to a particular problem, a case, or a question with the knowledge from the knowledge base in order to come up with a result, a conclusion or an answer. Depending on the form of knowledge representation, an inference engine may apply one or more strategies for processing knowledge. Furthermore, to link one piece of relevant knowledge to another in order to derive a conclusion, the inference engine may adopt backward chaining or forward chaining. In all cases, the

approach of the inference engine is a heuristic one. That is, the inference engine uses rules of thumb that in most cases would result in *good enough* or *humanlike* answers. (Zahedi 1993; Ford 1991).

2.3.3.4 Knowledge Management

The *knowledge management* component of expert systems software consists of the following facilities: User interface, Development tools, System security and User assistance.

The *user-interface* facility allows the user to interact relatively easily with the expert. The user can enter the facts pertinent to the problem at hand by answering questions asked by the system. He or she can interrogate the system for the reason behind a question the system poses or the system's conclusion. These are called the *why* and *how* capabilities.

The *development tools* are the facilities for entering encoded knowledge to the system, checking for errors and inconsistencies within the system, and programming special features into the expert system.

The *system security* allows the developers to protect parts of the knowledge base from unauthorized access. Expert systems containing crucial and confidential knowledge could have layers of authorized access to various or all parts of the knowledge base.

The *user-assistance* facility of the expert system consists of help features provided by the software manufacturer, as well as assistance features programmed by the developer group for the special needs of the system's user group.

2.3.3.5 Outside Hooks

The *outside hooks* component of the expert system software gives the system a channel of communication to other systems. At present, most expert systems are designed to work as stand-alone systems. However, as the role of expert systems grows within organizations, the need to exchange data, information, and knowledge with other systems will increase. Thus, expert system software products that can interact with other expert system software products as well as with other types of software (such as popular database management, spreadsheet, and graphics products) will have a better chance of survival in the market.

2.3.3.6 Meta Knowledge

The *meta knowledge* component is not a common component in expert system software. Meta knowledge means knowledge about knowledge. When the expert system is large and complicated, the presence of a meta knowledge base and the ability of the inference engine to use it could contribute greatly to the system's efficiency and versatility. The meta knowledge base also could include information about the expert system's limitations in order to tell the user whether it has enough expertise for making a recommendation.

2.4 INTEGRATING EXPERT SYSTEMS AND HYPERTEXT

2.4.1 Problems of hypertext

Hypertext is a two-edged sword. On the one hand, it permits the development of flexibly structured computer-based documentation with convenient information hiding, yet its very flexibility can lead to problems (Littleford 1991). Users may find themselves going from one document in which their freedom to move about is very restricted, to another in which they are challenged to navigate through a seemingly infinite number of links to a seemingly infinite number of topics (Glover 1994).

2.4.1.1 Linkitis

One of the main complaints about hypertext is the links that reflect what the author thinks important more often than they reflect what the reader hopes to find. This is because the relevance of a link depends heavily on how the document is currently being used and the use to which the information will be put.

Attempts by an author to solve this problem often result in linkitis- linking anything and everything in sight to something else. Frustration and confusion result for the reader. Given an overabundance of links, it is necessary for the authors to also give the reader and idea of what will be found if a link is traversed (Littleford 1991). Too many links can be worse than too few links. The challenge is to select the appropriate links to represent to a reader at any given time

2.4.1.2 Lost in Hyperspace

Lost in hyperspace refers to the feeling of disorientation a reader can experience when he is following a connected trail of hypertext links. Each link in the trail may make perfect sense, but by the time, the reader is several links deep the relevance of his current position in the document to where he started from may be far from clear (Littleford 1991; Conklin 1987).

Reducing the depth of a document (the maximum length of any chain of links) and providing maps of links can help alleviate this disorientation, but these approaches begin to get clumsy when dealing with exceptionally large hyperdocuments. Documents infected with linkitis are likely to exacerbate the lost in hyperspace syndrome.

The linkitis and lost in hyperspace problems of navigating through a hypertext can be solved or minimized by merging of hypertext with expert systems; although hypertext and expert systems were seen as alternate or competing technologies for problem solving.

Smith and Wilson (1993) pointed out that hypertext and expert systems can be combined in one of three ways:

1. expert systems with hypertext interfaces;
2. hypertext with expert interfaces; and
3. intelligent hypertext which is defined as an expert system within a hypertext environment where the nodes correspond to the knowledge base and the links provide the inference mechanisms.

Smith and Wilson (1993) concluded that carefully constructed combinations may be a mutually beneficial path for expert systems and hypertext to follow.

Glover (1994) argued that combining expert systems with hypertext will make hypertext more usable:

1. by providing an effective way to do run time audience analysis and needs assessment. In this case rules may be integrated with hypertext at any or all of three stages in the user's interaction with the document; before the document is opened, in a front-end rule base; while the document is being used, in a concurrent-rule base; and after the document is closed, in a back-end rule base.
2. By tailoring document characteristics to fit users' requirements. Some of the ways that expert systems can provide user support by tailoring hypertext documents are: customizing hypertext documents; implementing progressive disclosure; adjusting levels of detail; providing transitions; providing introductions and overviews; providing conclusions and summaries; configuring hypertext for people with special needs; and conducting computer based training
3. by advising users about how to use the document.

More recently the literature has described several applications that successfully integrate expert systems with hypertext. Some of these applications include the work done by Barta et al (1991) for developing a three dimensional hypertext structure for referencing housing discrimination library, Briggs et al (1993) for developing a computer based training package for community pharmacists and Jonassen et al (1994) for developing the physics tutor-an intelligent tutoring system.

2.5 TOOLS FOR HYPERTEXT AND EXPERT SYSTEMS DEVELOPMENT

2.5.1 Tools for Hypertext Development

There are at least three levels of hypertext development. At first and simplest level, the developer may not, strictly speaking, be a programmer. At this level the developer is simply setting up a network of nodes and ensuring that the proper links appear where they should.

On another level, a programmer might be developing an original hypertext authoring system (which on PC systems has an .EXE or .COM extension). In developing such a program, the programmer might use a language such as C, BASIC, Pascal, assembly language, or PROLOG.

A third type of programming involves writing a series of instructions that are interpreted by an existing hypertext system. These category of hypertext systems are the most commonly used ones. Some of the available software packages used for development of hypertext systems are given below in table 2.3 (Shneiderman et al 1989; Seyer 1991; Belkin and Delvin 1991; Conklin 1987).

Table 2.3: Software tools for hypertext development.

Software	Features
Xanadu	– implemented in UNIX and available in several forms – intended to provide a machine-independent database server that can be connected up to a specific machine and user interface.
Augment	– text editing system marketed by McDonnell Douglas for multi-user network environments – uses powerful command language for file addressing operations – provides many features for collaboration (electronic messages, archived messages, shared screen teleconferencing)
Intermedia	– supports different types of applications (e.g., word processors, database programs, various editors, etc.) to be linked together. – has a text editor, graphics editor, timeline editor, scanned image viewer, and 3D image viewer.
Notecards	– primarily developed to support information analysis tasks, including reading, categorization, interpretation, and technical writing. – consists of four basic elements: notecards, links, browsers, and file boxes. – runs under LISP and provides a programmer's interface and LISP functions to extend or customize notecard functions.
KMS	– basic element of KMS database is a frame which can contain text, graphics, or digitized images. Each frame has a name, title, body, tree items, and command line. – no distinction between navigation and editing; and is suitable for collaboration
Hyperties	– used in a wide range of applications including museum exhibits on the holocaust, archeology, and photography; an online maintenance manual; orientation to the university student union and computer science department; and an introduction to database searching for a major library
NEPTUNE	– the design separates the user interface (implemented in the smallTalk language) from the hypertext processor called Hypertext Abstract Machine(HAM). This separation allows the nature of the user interface and the structure of the hypertext database to be modified independently. – allows multiple versions of nodes and links to be defined and keeps track of the version of any node or link.
WE	– designed around a model of the cognitive process that underlie writing activities. – support four modes of authoring using four separate screen windows: network mode, tree mode, editor window and text mode. – includes a tracking capability that records the path history of the user
Guide	– the first to be released for PCs, preceding Apple's HyperCard by two years. – provides three forms of links: replacement buttons, note buttons and reference buttons.
HyperCard	– each document is organized as a set of cards called stack. Each card corresponds to a single screen image. links between cards are controlled by buttons. Buttons can be arrows, icons, words, or shaded areas. It has built in text and graphics editors. – provides programming capability called Hypertalk
Knowledge Pro	– one of the first programs to combine hypertext and artificial intelligence capability. – the links can be rules that initiate a series of questions to be answered in order for the system to reach a conclusion.

2.5.2 Tools for Expert Systems Development

The developer of an expert system has a choice of ready-made inference engines (expert systems shell), the gamut of programming languages, some of which excel at inference engine building, and of knowledge engineering environments to build inference engines.

In the early development of computer programs for expert systems, it became clear that a number of programming tasks were repeated in every program, while the coding of the

knowledge specific to the problem area changed from one program to another. This leads to the development of expert system *shells*. In expert system shells, the components common to all expert systems are separated from the knowledge base. This means shells are basically knowledge based systems stripped off their domain knowledge, which permit relatively easy building of a new system by adding a new knowledge base (Ford 1991).

However, shells are only one type of software designed to facilitate the building of knowledge-based and/or intelligent systems. They are relatively constrained and inflexible compared to artificial intelligence *programming languages*, although increasingly shells come with built-in procedural languages (in which case the user can devise customized routines to do things not already provided for in the shell) and with interfaces to external programming languages.

A number of programming languages have been developed which are particularly well suited to building intelligent computer systems. An increasing number of intelligent knowledge based systems and shells are being written in languages such as C to ensure maximum efficiency and portability to a variety of computers. LISP and PROLOG are two of the best known artificial intelligence languages. A shell can enable a system to built quickly with relatively little (in some case minimal) programming expertise. Languages are flexible but require relatively high levels of programming skill requiring a lot of training time and effort to achieve reasonable levels of expertise (Ford 1991).

Some of the popular expert systems shells which have been used in the development of expert systems include Advisor-2, Crystal, Explorer, 1st Class, Intelligence-1, Knowledge maker, Knowledge Pro, Leonardo, and Level 5 Object (Ford 1991).

Some commercial development tools which combine aspects of expert systems and hypertext are already on the market. These include Neuron Data's Nexpert object which allows the association of expert systems with HyperCard stacks; Texas instruments HyperTrans which performs, using AI techniques, an analysis of documentation and suggests the most appropriate hypertext links to create; Hyperbase, from cogent software Ltd., which permits the development of intelligently adaptive documents; 1st class HT, from 1st class expert systems which has been used to develop diagnostic systems which can access maintenance documentation online; and KnowledgePro for Windows, from knowledge Garden, Inc. which features support for decision trees & hypertext (Littleford 1991).

2.5.3 KnowledgePro

The expert system shell KnowledgePro for windows will be used for this research because of the facilities that it offers and its availability at the School.

KnowledgePro has a full-blown language especially designed for creating expert systems with hypertext capability. Its built-in language has about 120 commands. It includes commands for list manipulation, string operations, screen and file input/output, debugging, and logic and arithmetic operations (Seyer 1991).

KnowledgePro allows to create intelligent hypertext that can provide structure and guidance to users as they explore a hypertext network. The problem with many hypertext systems is that users get lost and do not know what nodes they have and have not seen. With KnowledgePro, one can avoid this problem by structuring an intelligent hypertext that can carry on a dialogue with the user. For example, the system might say: "you looked at nodes

A, X, L, and M, but it seems you might have missed the main idea that connects these nodes. You might want to see node Q for further information." Or "you have been reviewing nodes about (say) computer music. Which particular aspect of this computer music do you want to consider next?". KnowledgePro helps the user structure and control hypertext presentations. User can download KnowledgePro's run-time system and a few simple knowledge bases (Seyer 1991).

KnowledgePro has special functions for returning values from what are called "topics". A topic in KnowledgePro is a kind of amorphous object that can behave in different ways. A KnowledgePro topic can:

- hold commands, like a procedure;
- share values, like a variable;
- return values;
- inherit values;
- be linked into a hypertext network.

An interesting feature of KnowledgePro is that when a user asks a question in the process of working through a decision tree, it is possible to easily mark certain words or phrases as hypertext buttons.

2.6 HYPERTEXT AND EXPERT SYSTEMS IN BUSINESS

The emerging technologies of hypertext and expert systems offer a powerful new mechanism for solving common problems of information management faced by commercial and industrial organizations.

Commercial organizations are beginning to learn that their business is information at least as much as it is steel, or automobiles, or paper goods (Parunak 1991). The information challenge facing a modern business is huge, not just in terms of the amount of information that must be integrated, but also in terms of different kinds of material to be handled. Few of the many categories that any firm needs to manipulate include contracts, standards, government regulations, corporate mission and policy, project plans, supplier information, product documentation, product design, production programs, maintenance instructions, internal business reports, etc.

These diverse documents refer to each other copiously and often exhibit dependencies on each other. A hypertext is currently the most promising technology to cope with this challenge.

Various hypertexts systems developed by various authors have been discussed in the literature. Glasgow online was a hypertext project created using Apple's HyperCard in 1988-89 at the University of Strathclyde. It was a community database designed for end users wanting information about Glasgow, and included information on accommodation, food and drink, travel, places of interest, shopping, commercial and business etc. (Anderson 1992).

MacPhail (1991) developed two hypertext systems. One is a hypertext guide to researchers who are looking for alternative causes of AIDS. The second hypertext is a guide to immigration and new immigrants to the Hamilton area, Ontario, Canada. The two systems were created using PC-Hypertext. MacPhail is striving to marry journalism and hypermedia.

Winters et al (1991) developed DaTa KnowledgeBase systems which contains all accounting and auditing information. DaTa provide rapid, easy access to specific answers without presuming any knowledge of the material by the user.

Diaz and Minor (1991) developed ML-INFO, an online multimedia information center, to help financial analysts trying to access information distributed across a local area network for a large New York-based financial institution using ToolBok as a development tool. Bannon (1991) developed the Perseus project which presents students with a world of ancient Greek literature and culture in which to travel, explore and learn.

Hypertext has also been used in guide to opportunities in volunteer archeology (Plaisant 1991), conversion of Oxford English Dictionary to electronic format and automation of Dr. Dobb's Journal (1991), etc.

A number of expert systems in routine use are achieving dramatic cost reductions and other benefits in business applications. Ford (1991) listed as an example of expert systems which brought about significant benefits to be: Reuters' Topic Identification System which automatically indexes news stories for input to their Country Reports and Textline database; Rolls-Royce's MEEPLES expert system that helps plan some 1500 meetings per annum and produce personal diaries for staff; Marks and Spencer's GASS expert system which helps to screen applicants for graduate management interviews; British Nuclear Fuel's TRANAID which helps in advising on regulations produced by the International Atomic Energy Agency; OCEX (Order Clearing Expert System) which is in use at Hewlett Packard's Boblingen Medical Division in Germany that checks orders for medical products and helps staff deal with orders; the UK Department of Social Security's Retirement Pension Forecast

and Advice expert system which has halved the time to prepare a personal pension forecast to approximately ten times; XCON (Expert Configurer) which is used by Digital Equipment corporation to configure orders for DEC computers; CONFIGURER which aids in computer hardware and software configuration and selection; RBEST which diagnoses failures in disk drives, etc.

CHAPTER 3

BUSINESS INFORMATION IN ETHIOPIA

3.1 INTRODUCTION

3.1.1 Background

Ethiopia, with an area of 1.1 million square kilometers, is the 8th largest country in Africa. It has a population of about 55 million, and is located in East Africa. Agriculture is the mainstay of the economy, accounting for 42% of GDP, 80% of total employment and 85% of the country's foreign exchange earnings. The manufacturing sector is still in its infancy, with a share of 12% of GDP and 11% of export revenue; whereas the service sector accounts for about 38% of GDP. This implies that the contribution of the business and industry sectors is insignificant in the share of the country's economy. This condition was aggravated by the absence of an enabling environment for business expansion and start-up during the previous regime (Ministry of Planning & Economic Development 1994).

The government change in 1991 brought about the shift from a centrally command economy to a market-oriented economy in which the private sector has to play its role of engine in the economic development of the nation. In line with this, the government has taken various measures to encourage the business community, some of which are (Business Development Action Plan (BDAP) 1994): new Investment Code, new tax policies, new foreign trade policies, new urban land-lease legislation, new labour code, elimination of most price controls; and new financial sector policies.

Since the beginning of these liberalization measures, various business projects have been started. But besides these measures, accurate and timely information should be provided. This is what necessitated this study.

3.1.2 Definition

Organizations can be classified according to whether they are intended to meet the needs of the entire population or just a portion, and whether profit is an objective. Those organizations whose primary aim is profitability are business organizations. Some of the long-term aims of a business organization are expansion, diversification and monopolization of products and markets. These aims are facilitated through the use of information to improve the company's competitive advantage (Clifton and Sutcliffe 1994).

Within a business environment, any information that supports business decision can be considered business information. This encompasses such fields as current affairs, science, technology, psychology, government regulations, economic, demographic and social trends.

Business information encompasses the range of published and electronic sources and services which are available to the businessman to aid him in reaching commercial judgments and decisions (Campbell 1981). The generation of information and its flow through an organization's different functional areas is a prerequisite for the efficient support of the operational and management structure of that organization. However, effective use of the information can only come about if the entire process is undertaken in an orderly fashion. The mechanism which enables an organization to achieve this is an information system in general and business information system when it refers to business organizations.

Clare et al (1987) defined an information system as the mechanism which provides the means of storing, generating and distributing information for the purpose of supporting the operations and management functions of an organization.

Garland (1986) defined business information system as a consortium of information systems professionals, computing equipment, systems software, data communications, application programs, business data, and text and graphics information. Its purpose is to provide business end users - managers and professionals - with better control over their environment.

Furthermore, Tom (1988) defined business information systems as a set of procedures that provides data for planning, controlling, and managing an organization.

In any case, business information encompasses the range of published and electronic sources and services which are available to the business manager or employee to aid him in reaching prudent judgments and decisions. The cross-disciplinary and cross-institutional nature of business information calls for information delivery from divergent sources.

3.1.3 Classification of business information

Business information can be classified into different categories. Some of which are discussed below.

3.1.3.1 Internal and external information

In any business decision situation, required information is derived from both internal and external sources. Internal information is taken from the records of a firm. Internal sources provide information concerning the firm's financial structure, personnel characteristics, organizational structure, production problems, and so on. External information is derived from industry related publications. External sources provide information about environmental characteristics such as legal requirements, political circumstances, the economic scenario, and competitors activities. Internal information sources indicate internal strengths and weaknesses of the firm while external information sources indicate business

opportunities and threats from competitors (Campbell 1981). This study deals mainly with external information.

3.1.3.2 Intersectoral Information

Business information can also be classified into the following sectoral categories (Somogyi et al 1987):

1. General management information which is common to most business concerns which includes personnel and labour relations, productivity, finance, accounting, data processing, advertising, marketing, and bibliographic information.
2. Company information which includes information on specific activities, financial conditions, capital structure, size, charges against the company, areas of trade in which the company engages, sales and personnel of particular companies, as well as joint ventures, holdings or subsidiary companies, analysis of payment record, recommendations on credit limits, mergers and acquisitions.
3. Industry information which encompasses trends, forecasts, government regulations affecting the industry, leading companies within an industry, and interlocking directorates.
4. Economic and demographic information which consists of prices, business cycle, regional trade statistics, corporate statistics, consumption patterns, money supply, interest rates, exchange rates, stocks and shares, bonds, future markets, predictive models and economic theory.
5. International business and foreign trade which includes all of the areas listed above dealing with foreign sources.

Many sources contain information spanning several of these categories. Indeed the categories themselves are not mutually exclusive.

Clifton and Sutcliffe (1994) classified information into five levels; namely international information, national information, corporate information, departmental information and individual information based on the usage of information. Furthermore, information can be classified as strategic information which is related to long-term planning policies and most important to top management; tactical information which is used for short-term planning; and operational information which applies to short-term, perhaps hourly, running of a department.

Business information system can be classified as transaction processing systems, management information systems and decision support systems based on their usage by the three levels of management; namely, operational, tactical and strategic, respectively (Tom 1989).

Business information can also be classified into two broad categories based on the source of information; namely, electronic sources and published sources.

3.1.3.3 Electronic Sources of Business Information

Electronic sources of business information may be available in the form of either online databases or CD-ROM databases. Though CD-ROM databases are not as up-to-date as online databases, they are now in wide use all over the world. Databases available on CD-ROM can be classified as bibliographic databases, catalogue and book trade databases, quick-reference databases and multimedia databases (Rowley 1993). The number of publishers and products in the CD-ROM database market-place is continuing to increase. A major issue for the future of the medium is the success with which the consumer market can be established. This market is particularly likely to develop for multi-media products. The

Australian Business Journal on CD-ROM which features more than 970,000 current records and provides a complete profile of Australia's business sector; PAIS on CD-ROM which provides bibliographic indexes to the social and political literature of business, political and other social sciences; Wilson Business Abstracts which is a comprehensive database providing abstracts of current bibliographic information from over 345 major business journals; BNI- British Newspaper Index on CD-ROM which provides electronic guide to ten quality British newspapers; 1996 Guide to Building Products and Book Publishing in Britain are examples of CD-ROM databases that provide indexes and bibliographic information about business literature (CD-ROM directory 1996).

Most online business databases are obtained through subscriptions from online vendors. The online hosts or vendors are organizations with sufficient hardware capacity which have developed software systems to enable users to search the database on the host's computers. Some of the online vendors that provide online business databases are: DIALOG, BRS, Mead Data Control, ADA data services, Reuters, British Telecom, Financial Times Group, Data Star, Euronet, European Space Agency Information Retrieval Service, Blaise Line, ORBIT, Dow Jones News, and The Information Bank (Rowley 1993; Convey 1989).

Some of the most common online databases are: News Banks and News databases which provide information in all subjects including legal, business, financial, industrial and economic information; INFORM which covers the literature of management and provides abstracts; Management Contents which is a database of business and management information; NNI (National News Index) which provides complex index to articles published in the Wall Street Journal, The New York Times and The Christian Science Monitor; NDEX (Newspaper Index) which provides comprehensive index to articles

(business and nonbusiness) which have appeared in major US newspapers; Standard and Poor's News Online which contains full text information and weekly news covering over 9000 US companies (Rowley 1993; Convey 1989; Hartley 1990).

There are also online patent databases. The major online patent databases are WPI (World Patent Index), CLAIMS (CLass code, Assignee, Index, Method Search), USPATENTS, CA Search, INPADOC (International Patent Documentation Center), APITAT, European Patents Register, and PatSearch.

3.1.3.4 Published Sources of business information

The published sources of business information are directories, magazines, services, trade association publications, government publications, books, yearbooks, encyclopedias, and pamphlets or books published by organizations working in special fields. *Business magazines* carry the story of changing methods in meeting continuing problems, list the market records that indicate the costs of production, report on new developments, and in general reflect the ever-changing pattern of industry today. *Services* are developed to meet particular needs in special fields and are adapted to their purpose through publication format and timing. *Trade directories* open the door to markets and to sources of study, and reflect the status of a particular industry and those it serves. *Government reports*, in their utilization of nationwide questionnaires, return to the businessman in usable form the over-all average by which his progress may be measured. *Trade associations*, by cooperative effort, provide data on the problems best solved through united action. *Book publishers* recurring questions and provide the answer in texts that, through their intensive treatment of different phases of business activity, aid in progress. All the publications and their contents form part of the great reservoir of information at the disposal of the executive ware of the power that lies in effective use of print (Campbell 1981).

3.2 PROBLEMS OF EXISTING BUSINESS INFORMATION IN ETHIOPIA

Skilled use of business information can mean the difference between success or failure in the business world. There is no doubt about the hunger of Ethiopian businessmen for the very fast information service. But unfortunately this is a subject on which the business community is strangely reticent. There is no public outcry on the part of potential users for a better information service. Only those attempting to satisfy the need are aware of the scale of it.

Some of the reasons for the existing poor business information infrastructure in Ethiopia are identified to be (BDAP 1994): lack of public business libraries, lack of business publications, lack of commodity market news, lack of patent information, inability of Ethiopian businesses to issue financial reports, lack of publicly available market information about prices, absence of literature dealing with industrial technology, lack of professional information services, sources or advisory services, absence of business guide information, absence of cooperative schemes and restriction of access, absence of company and trade libraries, lack of private business news services or databases, unavailability of specialized financial services and absence of a national information policy.

Gezahegn (1995) also identified problems of the current business information in Ethiopia to be: the difficulty of information seeking activity which requires to gather information by visiting all concerned organizations as the information is scattered throughout many sources; lack of user education and sensitization of users on the importance of business information; and lack of proper mechanism for updating available statistical information which minimizes the value of information.

There are different organizations involved in providing business information. Some of the organizations and institutions are (Gezahegn 1995): Ministry of Trade and Industry, Region 14 Trade, Industry and Tourism Bureau, Ethiopian Chamber of Commerce, Investment Office of Ethiopia, Central Statistical Authority of Ethiopia, Addis Ababa Chamber of Commerce, Ethiopian Standardization Authority, Maritime and Transport Corporation of Ethiopia, Ethiopian Air Lines, Ethiopian Customs Authority, National Bank of Ethiopia, Ethiopian Freight Transport corporation, Ethiopian Shipping Lines, Inland Revenue Authority and Commercial Bank of Ethiopia.

Because of the large number of businessmen in Addis Ababa, and its direct link with the business community as well as being a bridge between the government and the business community, the Addis Ababa Chamber of Commerce has been taken as a case and further discussed in the section that follow.

3.3 ADDIS ABABA CHAMBER OF COMMERCE

Addis Ababa is the capital city of the Federal Democratic Republic of Ethiopia. It has a population of 2,112,737 as of October 1994. Addis Ababa is divided into six administrative zones, 27 woredas and 305 kebeles (Central Statistical Authority 1995).

The first Chamber of Commerce founded in Ethiopia was the Addis Ababa Chamber of Commerce (AACC), established in 1947 by the General notice No. 90. The AACC is the oldest and relatively better equipped to meet the growing demand of entrepreneurs of all city chambers in the country. Its establishment was necessitated because of the felt needs to:

- advance industry and commerce;
- render information to members;
- create relationships with chambers of commerce and industry in other countries;
- provide forums where members can come together to discuss business and economic problems and seek solutions;
- train members and potential members in various areas of business activities; and
- publicize the country's products and services to domestic as well as foreign markets.

In order to realize its objectives, the AACC has the following organizational structure (See Figure 3.1): General assembly, Broad of Directors, and a Secretariat. Furthermore, several working committees, each of which is focusing on specific line of trade, are designated to assist the board. These committees include: foreign trade promotion, domestic trade and services, finance and tax affairs, and industry. The AACC has three departments under the Secretary General; namely, Trade Information Department, Trade Promotion Department and Administration and Finance Department.

The AACC provides its members with trade information service through its trade information department as one of its basic activities. The information needed by entrepreneurs are wide-ranging and include information on: products and sources of supply, sales prospects for exportable products, market trends and developments, consumption patterns, import rules and regulations of different countries, marketing conditions and requirements, price levels, distribution channels, bilateral and multilateral trade agreements, trade fair and exhibitions in other countries, technology transfer opportunities, finance and investment and joint ventures.

To enhance the fulfillment of these tasks, the Trade Information Department of the AACC has:

- an Information Service Division responsible for collecting, analyzing, processing, and distributing of business information;
- a Publication Division responsible for the publication of a monthly newsletter and directories of its members;
- a Documentation Center which contains works of references, directories, trade journals, government publications and trade inquiries; and
- a systems and programming division for its computerization activities.

The AACC undertakes and/or facilitates promotional activities, involving trade fairs and organization of seller's missions abroad through its Trade Promotion Department.

This study did not investigate the problem within AACC but rather concentrated on determining the information requirements of the business community

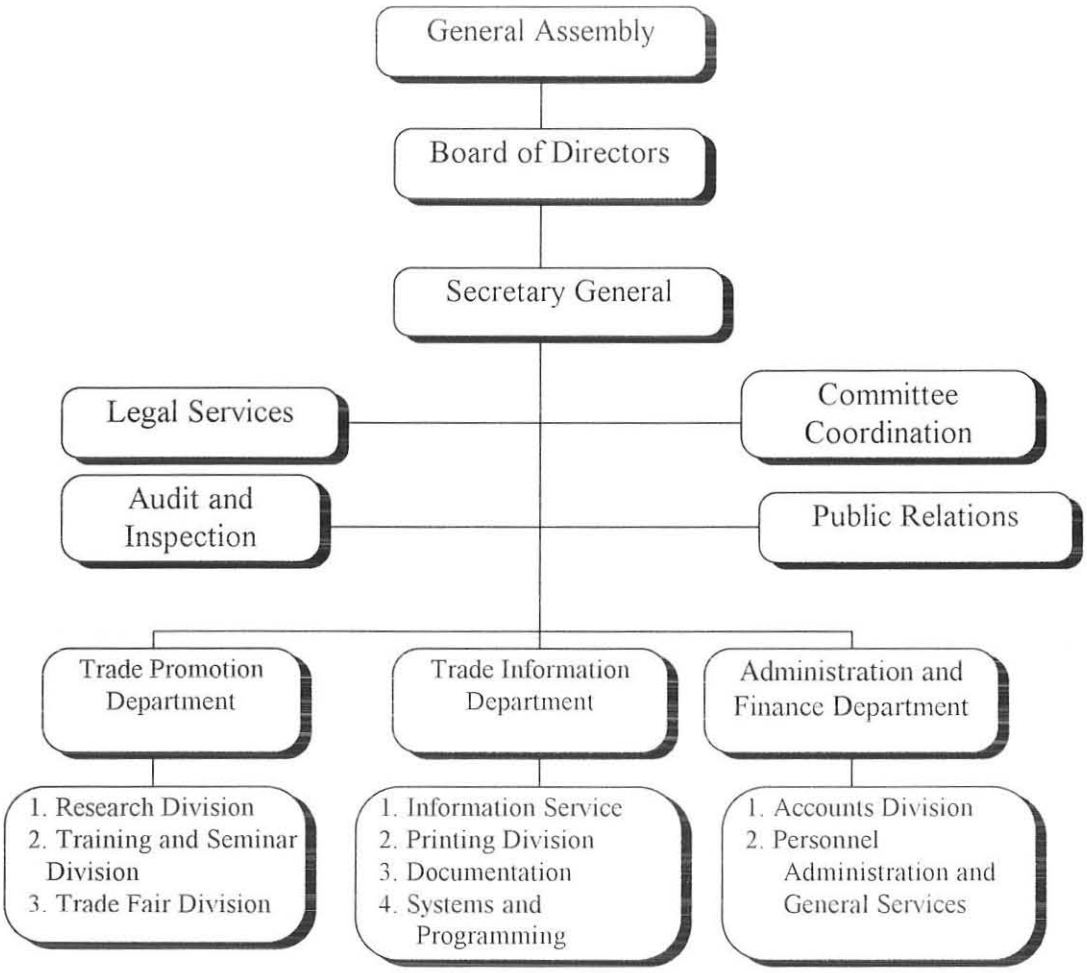


Figure 3.1: Organizational Structure of the Addis Ababa Chamber of Commerce

3.4 SURVEY OF THE INFORMATION REQUIREMENTS OF THE ADDIS ABABA BUSINESS COMMUNITY

A questionnaire was distributed to the selected sampling units and responses obtained (See Section 1.5 for the sampling method). Data on the responses of the sampling units were entered into a computer using Data Entry II and analyzed using SPSS PC+ version 4.0 Statistical package. The total sample size was taken to be 497 and the sample size for agency, Import, Export, Manufacturing and Services was taken to be 25, 300, 90, 41 and 41 respectively. The response rate was found to be 54.3% for the total sample (270 respondents) and 50% for export (45 respondents), 52.3% for import (157 respondents), 63.4% for services (26 respondents), 72% for agencies(18) and 58.5% for manufacturers (24 respondents).

The organizations surveyed fall into one of the three categories: private, partnership and public/government organization (see Table 3.1).

Table 3.1 Percentage of organizations surveyed by type

Type of organization	Agency	Import	Export	Manufacturing	Services	Total
Private company	66.7	98.7	88.9	75.0	92.3	83.7
Partnership	33.3	1.3	8.9	8.3	7.7	14.1
Public/Government	0.0	0.0	2.2	16.7	0.0	2.2

As can be seen in Table 3.1, 83.7% of the respondents were private companies, 14.1% were partnership and 2.2% were public/government organizations.

3.4.1 Information Requirements

Almost all (98.9%) of the respondents underlined the importance of information in their daily business activities. This percentage varied slightly for the different strata as 94.4% of

agency, 98.7% of import, 100% of export, 100% of manufacturing and 100% of the services sector underlined the importance of information in their daily business activities.

Once it was determined that the respondents believed that information was vital for their daily business activities, an attempt was also made to assess which type of information is needed by which sector. Foreign trade information was chosen as first and second priority by 46.7% and 15.6% of the export respondents, respectively. Out of the importers, 64.3% and 15.3% of the respondents chose foreign trade information as their first and second priorities, respectively; furthermore information on customs procedures was chosen by import respondents among which 2.9% chose it as their top priority, 33.8% as their second priority, and 29.3% as their third priority. Regarding agencies, 38.9% and 11.1% chose foreign trade information as their first and second priority, respectively. Furthermore, information on banking procedures was needed by agency respondents, out of which 16.7% chose it as their first priority; 5.6% chose it as their second priority; and 27.8% as their fourth priority.

In the manufacturing sector, information on commodity prices, exchange rates and interest rates was chosen by 20.8% as their top priority while 25.0% chose business opportunities as their top priority. In the services sector, as that of the manufacturing sector, information on commodity prices, interest rates and exchange rates was needed by 18.2% of the respondents as their top priority, and 23.4% and 25.1% chose company directory and business opportunities as their first priority respectively.

Table 3.2 shows percentage of respondents by different business areas showing their top priorities.

Table 3.2 Percentage of respondents by business area showing their top priority information

Type of Information	Business Area				
	Agency	Import	Export	Manufacturing	Services
Foreign Trade	38.9	64.3	46.7	16.7	2.8
International agreements on trade	5.5	2.9	6.7	12.5	0.0
Economic and Social indicators	16.7	3.8	11.1	8.3	6.7
Company directory	0.0	10.2	15.6	16.7	23.4
Customs procedures	16.7	2.9	4.4	0.0	0.0
Banking procedures	16.7	5.4	2.2	0.0	18.2
Company formation and registration procedures	0.0	0.0	2.2	0.0	3.8
Business Opportunities	0.0	3.2	4.4	25.0	23.1
Commodity Prices, exchange rates and interest rates	0.0	5.4	6.7	20.8	18.2
Investment Code	5.5	0.0	0.0	0.0	3.8
Customs Tariffs	0.0	1.9	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

In relation to where they are currently getting information, 76.7% of the agencies said they are getting it from the Ethiopian Chamber of Commerce (AACC) and mass media; 11.1% said from government offices; and another 11.1% from government offices and mass media. 21% of the importers are getting the information they need from the AACC and informal contact with people; 10.2% from informal contact with people; 8.9% from AACC and 7.0% from AACC and mass media. Concerning exporters, 26.7% indicated AACC as their main source of information; 11.1% get information from Ethiopian chamber of commerce; another 11.1% from other means; and still another 11.1% from AACC and mass media. In the manufacturing sector, 16.7% said they are getting information from the AACC; another 16.7% from AACC, Ethiopian Chamber of Commerce and mass media; and 33.3% from AACC and government offices. Regarding the service sector, 23.1% get information through informal contact with people; 15.4% from government offices; 19.2% from informal contact with people and mass media; 7.7% from AACC and 7.7% from mass media.

In the questionnaire, a question about the type of information the business people use was also included. In response to the question, 27.8% of the agencies indicated that they use market information; 11.1% use management information; another 11.1% use both statistical and management information; 11.1% use statistical, market and management information; and 11.1% use statistical, market, bibliographic and management information. Regarding importers, 58.6% use market information while 10.2% use market and bibliographic information and 8.3% use market and management information. Out of the export respondents, 59.1% use market information; 13.6% use statistical and market information; and another 13.3% use market and bibliographic information. In the manufacturing sector, 37.5% use market and bibliographic information; 33.3% use market information; 25% use statistical and market information. Regarding the service sectors, 62.5% use market information while 12.5% use market and management information.

Generally, taking all the respondents of the sectors as a whole, it was found out that 54.7% of use market information; 12.4% use market and bibliographic information; 7.9% use statistical and market information; and the rest various combinations of statistical, market, bibliographic and management information.

Regarding the purpose to which information is needed, 50% of agencies needed for economic analysis, financial management and planning, 16.7% needed for economic analysis, financial management, planning and to be informed and another 16.7% for planning (Table 3.3).

Table 3.3 Purpose of using information in agencies

Purpose	Percent
Planning	16.7
Economic analysis, financial management and planning	50.0
Economic analysis, financial management, planning and to be informed	16.7
Others	16.6

Information usage for importers is shown in Table 3.4; 18.5% of importers needed information for being informed; 14.6% for economic analysis, financial management, planning and to be informed and so on.

Table 3.4 Purpose of using information by importers

Purpose	Percent
Planning	12.7
To be informed	18.5
Economic analysis & planning	10.8
Economic analysis	9.6
Financial management	7.6
Economic analysis, financial management, planning & to be informed	14.6
Others	26.2

Table 3.5 shows percentage of exporters classified by the purpose for which information is used. Out of the exporters, 28.9% needed information for economic analysis and financial management; and 17.8% for economic analysis; and so on.

Table 3.5 Purpose of using information by exporters

Purpose	Percent
Economic analysis	17.8
Financial management	15.6
Planning	13.3
To be informed	11.1
Economic analysis and financial management	28.9
Others	13.3

Table 3.6 shows percentage of manufacturers classified by the purpose to which information is used. Out of the respondents, 37.5% needed information for economic analysis, planning,

financial management and to be informed; 25% needed information for planning and 20.8% needed information for economic analysis and planning.

Table 3.6 Purpose of using information by manufacturers

Purpose	Percent
Planning	25.0
Economic analysis & planning	20.8
Economic analysis, planning, financial management and to be informed	37.5
Others	16.7

As shown in Table 3.7, 23.1% of the service sector needed information for planning purposes; 15.4% just to be informed; and another 15.4% for financial management and planning.

Table 3.7 Purpose of using information by services sector

Purpose	Percent
Planning	23.1
To be informed	15.4
Financial management	11.5
Financial management & planning	15.4
Economic analysis	7.7
Economic analysis & financial management	7.7
Others	19.2

As far as the satisfaction of the users with the available information is concerned, the responses received were as follows: 66.67% of the agencies, 80.8% of importers, 80% of exporters, 70.8% of manufacturers and 76.9% of services were unsatisfied (Figure 3.2). The result showed that there is really an acute shortage of information for the business community.

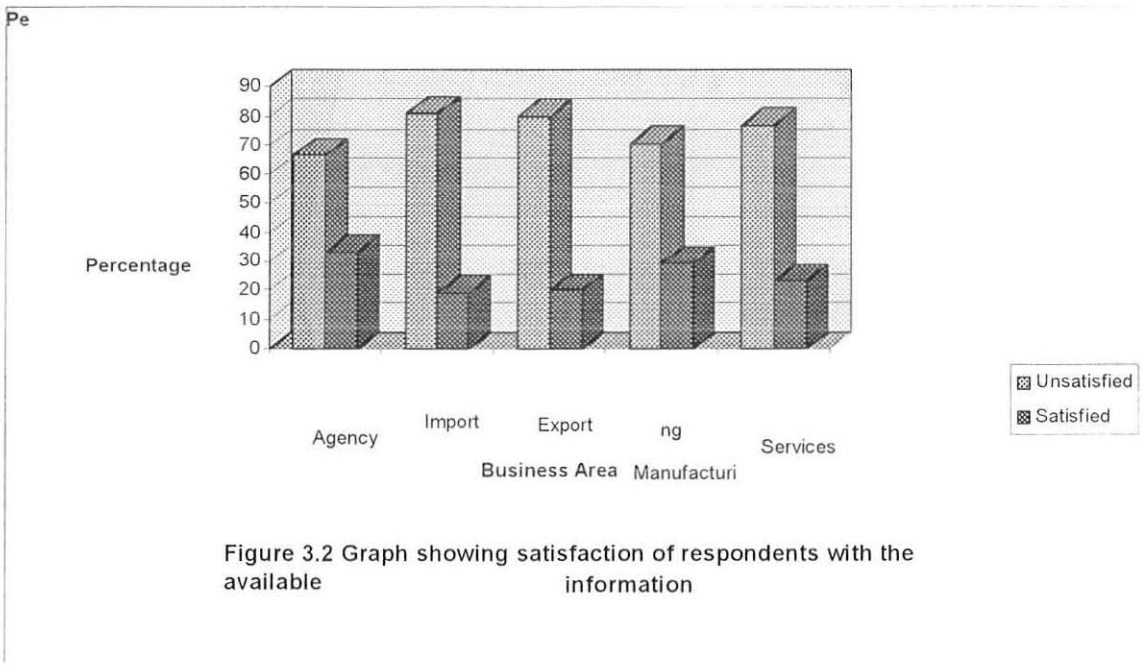


Figure 3.2 Graph showing satisfaction of respondents with the available information

It was also attempted to test the null hypothesis that the business people are satisfied with the available information. The test result was found to be significant at the 5% significance level except for agencies indicating that the null hypothesis should be rejected($\chi^2_{(1)}$ = 2.0 with p=0.1573 for agencies, $\chi^2_{(1)}$=59.93 with p=0.0 for import, $\chi^2_{(1)}$=16.20 with p=0.0001 for export, $\chi^2_{(1)}$=3.1667 with p=.0412 for manufacturing, $\chi^2_{(1)}$=7.5385 with p=0.006 and

$\chi^2_{(1)}$=87.8370 with p=0.0 for the total sample size) and conclude that the business people are not satisfied with the available information.

Major problems for the absence of adequate information for their business activities were identified. The respondents were given three major problems to choose, namely, absence of an organized and integrated information service, low level of recognition of the value of information and inadequate financial capability. Out of the agencies who responded "unsatisfied" with the available information; 55.6% said that the main reason is the absence of an organized and integrated information service; 22.2% said that it is because of the absence of an organized information service, low level of recognition of the value of information and inadequate financial capability. Out of the import respondents, 69.7% attributed the lack of information to absence of an organized information service; 11.4% to absence of an organized information service and low level of recognition of the value of information. Regarding exporters, 58.3% believed that the major problem is absence of an organized information service; 13.9% to low level of recognition of the value of information and 11.1% to absence of an organized information service and low level of recognition of the value of information. In the manufacturing sector, 47.1% blamed the absence of an organized information service as the major problem, 17.6% blamed low level of recognition of the value of information. As regards the service sector, 60% responded that the major problem was the absence of an organized information service while 15% attributed the problem to absence of an organized information service and low level of recognition of the value of information. Some also mentioned outdated and unreliable statistics.

In general, taking the respondents of the different sectors wholly, it was found out that 64.5% of the respondents attributed the problem to the absence of an organized and

integrated information service; 7.5% attributed the problem to low level of recognition of the value of information; 4.7% attributed the problem to inadequate financial capability; 11.7% attributed the problem to both the absence of an organized and integrated business information system and low level of recognition of the value of information; and 8.4% attributed the problem to the absence of an integrated and organized information service, low level of recognition of the value of information and inadequate financial capability.

This implied that almost all of the business organizations had recognized the value of information (to the extent that their level of recognition of the value of information is low) and called for the development of an organized and integrated information system which caters for their information needs.

Furthermore, a question was included in the questionnaire to rate the information they get in relation to quantity, quality, up-to-dateness, cost and coverage. The result is given in Table 3.8.

3.4.2 Information Technology (IT) usage

With regards to IT, 72.2% of agencies used a combination of computers, fax machines and telephones; while 32.3% of importers used computers, fax and telephones, 26.9% used fax machines & telephones and 19.2% used telephones only. Regarding exporters, 39.5% used computers, fax machines & telephones; 16.3% used telephones & fax machines & 18.6% used telephones only. In the manufacturing sector, 47.8% used computers, fax machines & telephones, 21.7% used telephones. In the services sector, 69.6% used telephones and 21.7% used computers, telephone & fax machines.

Table 3.8 Percentage of respondents in relation to quantity, quality, up-to-dateness, cost and coverage of information they get

	Quantity				Quality				up - to - dateness				cost				coverage			
	VG	G	F	P	VG	G	F	P	VG	G	F	P	VG	G	F	P	VG	G	F	P
Agency	22.2	27.8	33.3	16.7	22.2	33.3	16.7	27.8	22.2	38.9	22.2	16.7	35.3	17.6	41.2	5.9	0.0	47.1	11.8	41.2
Import	6.4	31.2	28.7	33.8	10.8	12.7	20.4	56.1	10.3	21.9	33.5	34.2	20.6	13.5	38.1	27.7	5.8	18.1	26.5	49.7
Export	11.1	11.1	62.2	15.6	13.3	24.4	40.0	22.2	15.6	22.2	46.7	15.6	13.3	33.3	42.2	11.1	2.2	31.1	40.0	26.7
Manufacturing	13.0	17.4	17.4	52.2	21.7	17.4	8.7	52.2	26.1	17.4	30.4	26.1	34.8	8.7	30.4	26.1	4.8	0.0	33.3	61.9
Services	4.0	24.0	36.0	36.0	0.0	36.0	28.0	36.0	0.0	17.4	56.5	26.1	26.1	8.7	52.2	13.0	0.0	17.4	43.5	39.1
Overall response	8.6	25.7	34.3	31.3	11.9	18.7	23.1	46.3	12.5	22.3	36.7	28.4	22.1	16.3	39.5	22.1	4.2	20.7	29.9	45.2

VG- Very Good

G - Good

F- Fair

P-Poor

The purpose to which the computer is put to use also varied (for those who used computers). Out of agency respondents, 18.8% said that they used the computer for word processing, financial analysis, statistical analysis and records management. Regarding importers, 27.8% said that they used the computer for word-processing. Concerning exporters, 56.0% responded that computers were used for word processing. In the manufacturing sector, 53.3% said that they used for word processing whereas 30% of the services sector said that they use for word processing, and another 30% for other purposes (See Table 3.9).

Table 3.9 Percentage of respondents by purpose to which computer is used and by sector

Purpose	Agency	Import	Export	Manufacturing	Services	Total
Word Processing and Desktop Publishing (WPDP)	18.8	27.8	56.0	53.3	30.0	34.8
Financial Analysis and Forecasting (FAF)*	0.0	0.0	0.0	0.0	0.0	0.0
Statistical Analysis(SA)	0.0	1.4	0.0	6.7	0.0	1.4
Records Management (RM)	6.3	9.7	0.0	0.0	0.0	5.8
Others (like Ticket Preparation) (O)	12.5	2.8	0.0	6.7	30.0	5.1
WPDP, FAF, SA and RM	18.8	6.9	0.0	0.0	10.0	5.8
WPDP and FAF	6.3	2.8	8.0	0.0	10.0	4.3
WPDP and RM	6.3	19.4	0.0	0.0	10.0	10.9
WPDP and SA	6.3	5.6	12.0	6.7	0.0	5.8
FAF, SA and RM	0.0	0.0	0.0	0.0	0.0	1.4
WPDP, FAF and SA	0.0	0.0	16.0	0.0	0.0	2.9
FAF and RM	12.5	6.9	0.0	0.0	10.0	5.8
FAF and SA	6.3	4.2	8.0	13.3	0.0	5.8
WPDP, FAF and RM	0.0	12.5	0.0	0.0	0.0	8.0
WPDP, SA and RM	6.3	0.0	0.0	13.3	0.0	2.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Regarding the acquisition of the IT, 77.8% of the agencies said they purchased while 22.2% said by other means(like lease, borrowing, etc.). Out of the import respondents, 76.0% said they acquired through purchase, 20.9% said by other means (lease, borrowing, etc.). As regards the exporters, 76.2% said they bought the equipment and 21.4% said by other means (lease, borrowing, etc.). In the manufacturing sector, 77.3% said they bought the IT while 22.7% said they acquired through other means whereas 63.6% of the services sector said that they acquired the IT through purchase, 31.8% through lease or borrow and the other 4.5% acquired through gift.

* The value 0.0% for all sectors means that it was chosen in combination with other purposes but not alone.

As regards their plan to introduce or further develop the use of IT, 100% of the agencies, 85.6% of the importers, 100% of the exporters, 79.2% of the manufacturers, 72.2% of the services sector have a plan to introduce or further develop the use of IT (See figure 3.3).

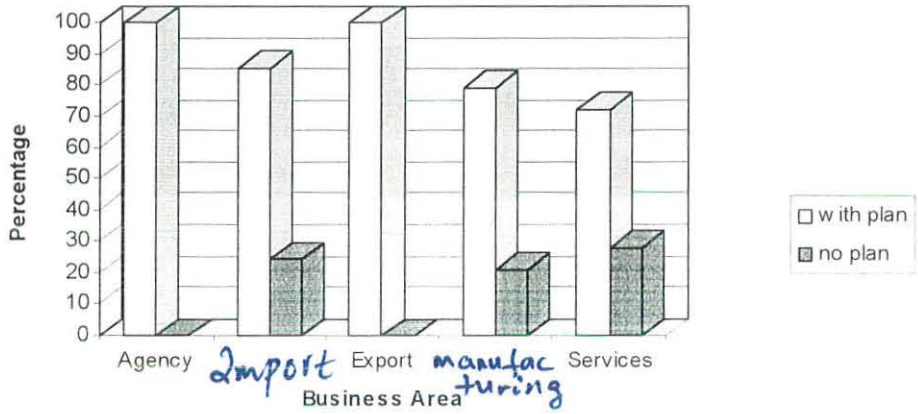


Figure 3.3 Graph Shw oing percentage of respondents with regards to their future plan for IT

The respondents were also asked whether they will make use of the proposed system if some aspects of their information requirements were automated; 94.4% of the agencies, 69.4% of the importers, 88.9% of exporters, 83.3% of the manufacturing sector and 50% of the services sector said they will use.

Since costs are incurred in the production, processing, and dissemination of information, a question was included in the questionnaire to assess their willingness to pay for the information they will be getting. The responses were very encouraging as most of the respondents agree to pay. This is really a good indication of the dying away of the old belief " information is free" (See Table 3.10 and Figure 3.4).

Table 3.10 Percentage of respondents by sector as regards their willingness to pay for information.

	% in favour	% against	% Non response
Agency	77.8	22.2	0.0
Import	65.0	3.1	31.8
Export	88.9	0.0	11.11
Manufacturing	91.7	0.0	8.3
Services	38.5	15.3	46.2

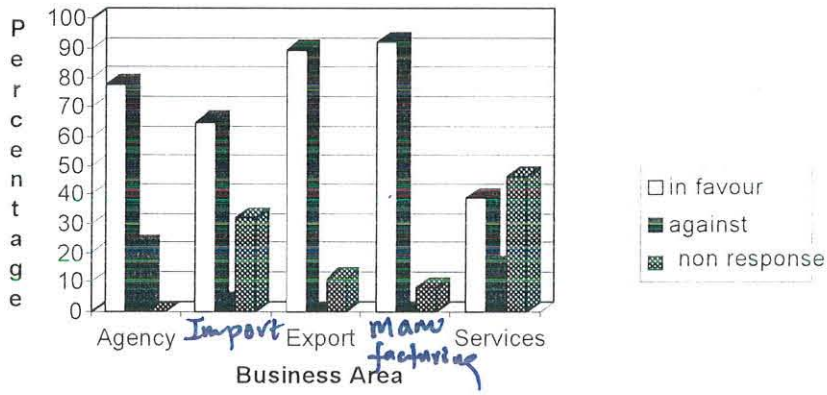


Figure 3.4 Graph showing percentage of respondents opinion to pay for information

The technical capacity of the respondents was also asked. Almost all agencies (94.4%), 43.9% of the importers, 42.2% of exporters, 50% of the manufacturers and 15.4% of the services sectors responded that they have the technical capacity. Whereas 5.6% of the agencies, 29.9% of the importers, 46.7% of the exporters, 41.7% of the manufacturers and 46.2% of the services sector said that they do not have the technical capacity.

If some of their information requirements are automated, they were asked through which medium of information they want to get the information. The result is tabulated in Table 3.11.

Table 3.11 Percentage of respondents by choice of medium of information provision by sector

Medium of information provision	Agency	Import	Export	Manufacturing	Services	Total
Hard copy (paper) (HC)	23.5	43.3	50.0	45.0	50.0	43.6
Floppy disk (FD)	35.3	14.4	7.5	0.0	28.6	14.9
Through E-mail (EM)	5.9	3.0	2.5	0.0	0.0	1.5
Central Database (CD)	23.5	15.4	15.0	20.0	14.3	16.4
HC and FD	5.9	8.7	7.5	15.0	7.1	8.7
EM and CD	5.9	2.9	0.0	0.0	0.0	2.0
FD and CD	0.0	9.6	10.0	0.0	0.0	7.9
HC, FD and CD	0.0	2.7	0.0	10.0	0.0	2.0
HC and CD	0.0	0.0	2.5	10.0	0.0	2.0
FD and EM	0.0	0.0	5.0	0.0	0.0	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

A question was asked to determine the appropriate place in which the proposed automated system would be installed and maintained. The responses obtained were tabulated and presented in Table 3.12.

Table 3.12 Percentage of respondents by choice of the place to install the system and by sector

Chosen Place	Agency	Import	Export	Manufacturing	Services	Total
Addis Ababa Chamber of Commerce(AACC)	50.0	45.5	67.5	55.0	47.1	51.2
Ethiopian Chamber of commerce (ECC)	0.0	1.8	5.0	0.0	11.8	2.9
Ministry of Trade and Industry (MTI)	16.7	15.2	20.0	20.0	17.6	16.9
Others (any place or own premises) (O)	11.1	8.9	0.0	15.0	23.5	9.2
AACC, ECC and MTI	16.7	9.8	0.0	0.0	0.0	6.8
MTI and O	5.5	0.0	0.0	0.0	0.0	1.0
AACC and ECC	0.0	3.6	2.5	0.0	0.0	2.4
AACC and MTI	0.0	6.2	5.0	0.0	0.0	4.3
AACC, MTI and O	0.0	4.5	0.0	0.0	0.0	2.4
AACC, ECC and O	0.0	4.5	0.0	10.0	0.0	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

An open ended question was also included in the questionnaire in which the respondents were asked to forward their opinion about the usefulness of IT in their business activities. Almost all of the respondents have underlined that IT is vital for the success of their business.

The majority of the respondents chose AACC to be the best place for the proposed system to be installed and maintained. Accordingly, an interview was conducted with the officials of

the AACC, Secretary General and Trade Information Department to assess their willingness to host the system and their technical capacity (see Annex II and III for Interview Guide and Persons Interviewed) as well as the approach they use in providing information to the business people.

There are various ongoing and planned projects related to information at AACC among which a project to link to the world chambers of commerce and another project for training are worth mentioning, according to the Trade Information Department Head. They have adequate capacity (both in terms of equipment and skilled manpower) to provide high-tech based information services to the business community and they have shown high interest in this research in its immense contribution to solving the information problem that the business community is facing.

The AACC provide information services to researchers, members as well as nonmembers. Until now they are providing information free of charge but they are now contemplating to introduce charges. In their conclusion, they underlined that they have a plan to provide accurate and timely information by employing the latest IT equipment.

3.4.3 Summary

As the survey result showed, there is a general awareness about the usefulness of information in business activities as 98.9% of the respondents underscored the importance of information. The survey result also showed that different areas of business activities need different types of information as those engaged in foreign trade (import-export) need foreign trade information and information on customs procedures as their top priority while the manufacturing and the services sectors need information on commodity prices, exchange rates and interest rates as a top priority. Regarding the sources of information, almost all of

the respondents had mentioned the AACC. Concerning the satisfaction of the business community with the available information, 78.52% of the respondents were unsatisfied with the available information as can be seen in Figure 3.2.

It was also found out that most of the business community use either or all of computers, fax machines and telephones as an IT equipment. Concerning Computer usage, most of the respondents are using it for word-processing (as can be seen in Table 3.9) which indicates that computers are not used for storage and retrieval of business information and hence under utilized. The business community has also recognized the absence of an organized and integrated online information service to cater for their needs as 64.5% of the respondents attributed the problem of inadequate information to the absence of an organized and integrated information service.

Furthermore, 87.3% of the respondents have a plan to introduce or further develop the use of IT and 69.6% of the respondents agreed to pay for the information they will be getting. This implies that the business community has recognized the global trend in taking advantage of the advances in IT as a major factor in their business activities although they are not using it for the time being because of the absence of an organized and integrated information service or low level of technical capacity. The business community has also indicated AACC to be the ideal place for the proposed automated information system to be installed and maintained (See Table 3.12). The AACC has also shown interest to host the system and also has the technical capacity.

The emerging technology of hypertext offers a powerful new mechanism for solving common problems of information management faced by commercial and industrial

organizations. Hypertext is becoming a popular means of storing and presenting large bodies of online information. The increasing use of hypertext to store information has been matched by increased interest in retrieval techniques for hypertext systems. Unfortunately, users often become disoriented while navigating a body of information represented as a hypertext. Several approaches to alleviating the problem of disorientation have been proposed, one of which is usage of expert-system as a front-end to a hypertext database.

Therefore, based on the information requirements of the business community discussed above and the different groupings of information the AACC use in providing information (i.e., information on Government Regulations, Business Opportunities, Indicators, Foreign Trade, different procedures, etc.), in this research an attempt is made to develop a prototype hypertext-based business information system with expert interface to be used by the business community after appropriate testing and validation.

CHAPTER 4

SYSTEM DESIGN ISSUES IN THE DEVELOPMENT OF THE PROTOTYPE

4.1 INTRODUCTION

The major challenge facing a hypertext author is that of organizing complex material in a suitable way. Therefore, a systematic approach to hypertext structure is essential in the design of hypertext.

Most hypertext authors agree that hypertext developers face two different (but strongly correlated) tasks: developing a network of nodes and links, and filling the nodes' content. By analogy with the software engineering field, the terminology *authoring-in-the-large* is used to refer to the development of the structure of the network and *authoring-in-the-small* to refer to the development of the contents of the nodes (Schwabe et al 1992).

Authoring-in-the-large can exploit commonalties between applications of a given domain, and it can be to some extent independent of the medium - establishing a connection between two nodes is somewhat independent of the representation of the contents of the node.

Authoring-in-the-small is strongly dependent on the medium (filling in the text in a node is much different from filling in animation, a sound, or a picture). Moreover, authoring-in-the-small is more dependent on specific applications.

On the other hand, Shneiderman et al (1991) argued that a hypertext has two sets of structures:

- The *logical structure* of a hypertext which is imposed by the author. This includes the relationship between links in the database (tree, network, graph), the relationship of links to nodes and the content and design of individual nodes and networks of nodes.
- Authors usually have much less freedom when it becomes to define the *physical structure* of a hypertext. Layout, typography, user input, and other aesthetic concerns are always heavily influenced by the hypertext delivery platform and development system.

Thus, the author of a hypertext must design the logical structure keeping possible physical configurations of both the development and delivery systems in mind.

4.2 NODE AND LINK DESIGN CONSIDERATION

The size of nodes is an important design consideration. Shneiderman et al (1991) recommended the following techniques to chunk articles into small pieces:

- Instead of discussing a subsidiary topic which is not the main subject of an article, you can just allude to it and designate a phrase that refers to it as a link. You can make that topic the subject of its own article, or at least give the topic a description which can be called up by readers. If readers are interested in more information about this peripheral topic, they can follow its link.
- The same technique can be applied to details. Rather than including detailed information in an article, you can simply reference it and create separate articles from it. This shields readers from unnecessary details, but provides a path readers can follow when it seems relevant.

Moreover, an algorithm suggested by Shneiderman et al (1991) for the design of hypertext links is given below.

- Identify the domain of discourse so that a context is established. Meaningfulness is highly dependent upon context.
- Identify pre-existing knowledge which the individual needs for complete understanding. Make such knowledge available through the links so that the reader can access it and process the remainder of the information meaningfully.
- Present the information in logical sequence so that the information that comes first provides context for the information that follows.
- Identify details that the individual can obtain to elaborate the information in the initial presentation. When constructing a detail level, apply these same rules to it.

After discussing nodes and links, the next consideration is storage of links. Hypertext systems must have some way of permanently storing nodes and links of the user's networks. The most common forms of storage are file systems and databases (Hall et al 1990).

There are two ways to implement nodes in a standard file system: storing each node in a file or putting all the nodes in one big file. One advantage of having each node as a separate file is that each node is individually accessible without locking out the other nodes from the other users. The disadvantage is that the speed of creation and access is limited by the speed of file creation and access in the operating system. The major disadvantage of putting all the nodes into a single file is that there can not be multiple concurrent users of the same hyperdocument, unless special file locking and concurrency control facilities are provided. Another problem with a single file for all nodes is that if some of the nodes are large then the file may become unmanageable. In this research a single file is used for storage of nodes.

Database storage (specially relational) has several advantages, the main one being that database technology is designed precisely to address the problems of using files for permanent storage. But, relational databases do not necessarily provide a natural fit with the network structure of hypertext, and this imposes a number of problems.

There are a number of different approaches in representing nodes and links on window - based interfaces. One approach is to have each node in a separate window, with multiple overlapping windows. Another approach is to have a single window where each node is expanded in place.

The structure of the hypertext database is a major factor that determines how easy it is to create, use, and update. One way of organizing a hypertext database that simplifies browsing and authoring is a hierarchical structure.

In a hierarchical structure, each node has a parent (superconcept) and a child (subordinate concept) unless the node is a starting point(root) or an end point (leaf). A hypertext database organized as a hierarchy can be drawn as a tree structure with no cross-over links. A hypertext database that allows multiple links between parent and child nodes is not a strict hierarchy but a network (Shneiderman et al 1989: 7)(See Figure 4.1).

The advantage of hierarchical structure is that all links must follow an orderly route through the tree, connecting the superordinate and subordinate concepts. The disadvantage of hierarchical structure is that flexibility of the link among nodes is limited. All nodes must be linked together via some super/subordinate concepts, not in an arbitrary manner. Being able

to link any pair of nodes results in a much richer network of relationships - albeit more difficult to create, use and maintain.

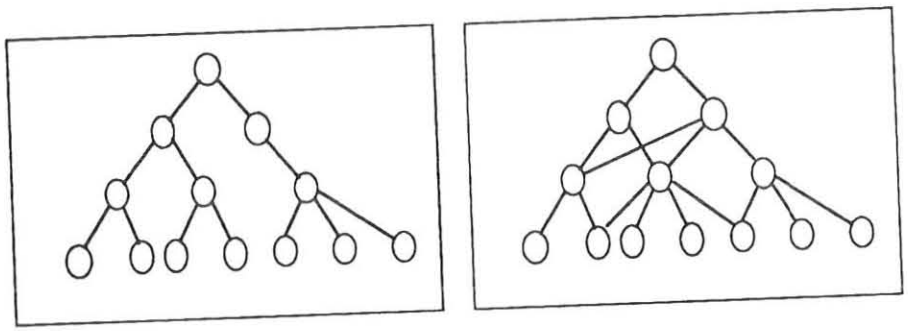


Figure 4.1 Hierarchical tree structure (left) and network structure (right).

In this research, the main hypertext database is hierarchical in structure but some of the nodes will have a network structure.

4.3 USER INTERFACE DESIGN CONSIDERATIONS

Hypertext systems should offer a powerful and user-friendly interface to enable rapid and convenient access to large volumes of information. In designing a user interface for hypertext, researchers must know how users seek information in traditional print systems and existing electronic systems and have an understanding of the basic cognitive processes that guide information seeking.

In the prototype system, an expert system is to be used as a front-end to a hypertext information base. In general, there are three methods of exploring a hypertext (Smith and Wilson 1993):

- following links and opening successive nodes;
- searching by text string, keyword or attribute value;
- using a browser (graphical representation of the network).

Research has shown that there are differences between the procedural and often iterative types of information retrieval employed by experts and the more informal methods used by naive users (Smith and Wilson 1993). Thus expert users tend to use one of the search methods whereas naive users are more likely to browse. The use of an expert system as a front end to a hypertext information base gives another method of information extraction. In effect the expert system provides a fourth information retrieval strategy which allows more focused search methods to be employed by naive and expert users alike. Smith and Wilson (1993) draw such a system schematically as shown in Figure 4.2.

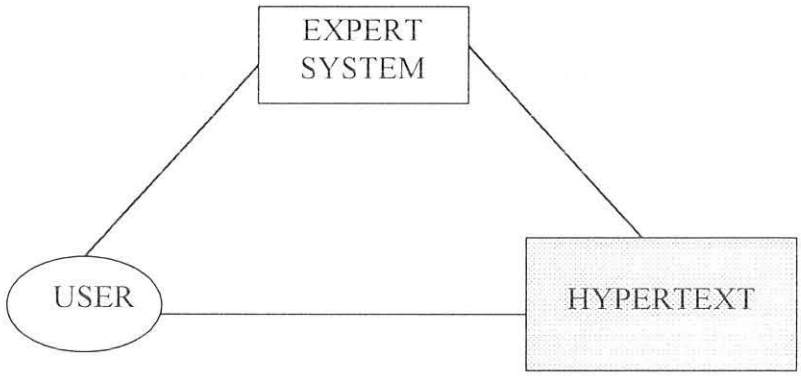


Figure 4.2 Hypertext with expert interface

It has been suggested that hypertext systems are only useful when users already know what they are looking for and can identify information by how it is referenced (that is, linked) or labeled within the system. In these instances the user can search the information base using keywords or by following successive links. When a user is exploring the network for general information a browsing strategy may be more appropriate. However, there are situations in which none of these information retrieval methods are satisfactory (Smith and wilson 1993):

- browsing may lead to dead ends;
- links may not be meaningful to the user;

- the user may know what information is required but not know where or how to find it;
- the user may not know what information is required or may even be unaware that additional information is required.

In these situations an expert system interface can be used to narrow the search for information based upon the user's needs. This type of hybrid hypertext-expert system is a hypertext information base with an expert information retrieval support tool. With these systems, control over the information rests mainly with the user who hands over to the expert system when required. Control returns to the user when the requisite information is found so that the user can continue to browse or follow links. In other words, the expert system is acting as an additional information retrieval method which assists both expert and naive users in identifying their information needs and search methods and in finding the relevant information. Therefore, these systems greatly reduce the problems expert systems have had in catering for different user abilities and experience.

The expert interface to hypertext database reduces both the amount of irrelevant material seen and also the degree of unnecessary interaction. The navigation problems of hypertext associated with browsing are also largely overcome with these systems as they facilitate more formal methods of information retrieval within hypertext. Thus, while users may be permitted to browse parts of the hypertext network they will have entered the network at a point known to be relevant to their information need and their current task, and therefore their chances of becoming 'lost in hyperspace' are much reduced (Smith and Wilson 1993).

4.3.1 Human-Computer-Interface (HCI) considerations in hypertext design

Designing a hypertext places a number of demands on the author in terms of the presentation of material used and the ways in which the reader should interact with the material. These demands can be divided into two general categories - *static* and *dynamic*. Static design issues cover the layout and presentation of both the material delivered by the hypertext and the links on a particular screen to other parts of the hypertext. Dynamic design issues address navigation through the hypertext and the ways users are able to combine or compare information in different parts of the hypertext. The handling of these two groups of design issues can be aided by the application of appropriate design principles and guidelines, with *design principles* representing the general concepts which underlie the hypertext design process and the *guidelines* indicating specific features which have to be considered (Hardman et al 1990).

Hardman et al (1990) identified design principles applicable to hypertext authoring to be consistency, mental processing, ease of learning and use, flexibility, and task compatibility. They further classified design guidelines into four functional areas, namely, user action, information display, dialogue design and online assistance which are discussed below.

4.3.1.1 User action guidelines

Display of links - When reading a hypertext, the data input from the reader is restricted to selecting and actioning a link. To help the reader with choosing a link, the positions of the links on the screen should be obvious.

4.3.1.2 Information display guidelines

Highlighting critical information- certain parts of the information contained in the hypertext may be particularly important. This information should be highlighted in order to draw readers' attention to it. Highlighting should only be used for a small proportion of the information on the screen.

Display necessary information- the items a reader requires on a screen are: (i) a clear title; (ii) the information the reader is interested in; (iii) indications of where the links are within this material; (iv) other links to known places in the hypertext; and (iv) sufficient context information to inform readers where they are currently.

4.3.1.3 Dialogue design guidelines

Context for displayed information - readers should not be required to remember where they are; so when they arrive at a new screen after actioning a link there should be sufficient information to reorient themselves. Information on what the current section is, and where in the current section the reader is, should be either immediately available on the screen, or directly accessible by a mechanism made known to the reader. In hypertext systems which allow scrolling, extra care is needed to ensure that sufficient context information is available.

Reading extended information - where immediately relevant information takes up more than one screen the reader should be able to move easily between the relevant displays.

Terminology and Wording - any wording the author uses to guide the reader should follow standard guidelines: (i) terminology should be familiar (or there should be easy access to definitions) and consistent; (ii) abbreviations should be explained; (iii) sentence structures should be simple; (iv) instructions should be affirmative and in the active voice.

Consistent formats - the layout of the material across different screens should remain as consistent as possible. For example, always keep the contents and help section buttons in

the same place, arrange similar types of information in similar ways. Fonts and styles should be used consistently throughout the hypertext.

4.3.1.4 Online assistance

Help in using links - the hypertext author has only to deal with a small part of aiding the reader since the hypertext system itself should take care of many of the reader's requirements. The "errors" a reader is likely to make are clicking on an item which is not linked, or actioning the wrong link. In the first case some hypertext systems allow the author to display a message. In the second case some hypertext systems allow readers to backtrack to where they just came from, otherwise the author can include links to take the reader back.

Help always available- help at a general level and help specific to the reader's current position should always be available and obtained through a standard procedure, e.g., a help icon is always displayed on the screen.

These guidelines and principles suggested by Hardman et al (1990) have a dual function. At the outset, the principles and guidelines alert the author to the features that need to be designed into the hypertext. At a later stage when a prototype hypertext is available, the guidelines can be used as a check list to view the structure, presentation and potential readability of the hypertext.

Therefore, these design guidelines and principles are followed in the design of the prototype system.

4.4 DEVELOPMENT MODELS

A basic hypertext development model given by Barker (1993) is given in Figure 4.3. One fairly obvious limitation of this model is its linear nature. While many well-defined hypertext projects are likely to follow a linear strategy, many others will not. Indeed, many more complex development projects will often involve the creation of a 'prototype' system. Inherent in this approach will be the use of iteration and back-tracking in order to identify the most beneficial way to proceed (Barker 1993).

Despite its obvious limitations, Figure 4.3 serves the useful purpose of indicating two important aspects of a hypertext development project: first, the nature of the basic processes involved; and second, the rough order in which these different processes should be performed.

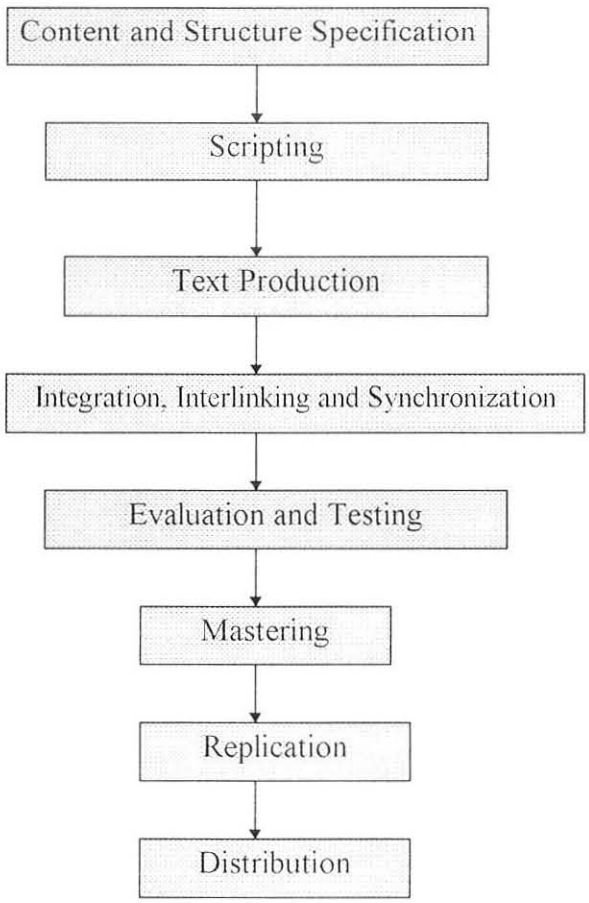


Figure 4.3 Basic Hypertext Development Model

4.5 PROTOTYPING

Because hypertext systems can be far complex than conventional interactive systems, the linear development model described in Figure 4.3 is frequently an inappropriate one to use. Instead, a cyclic, iterative development approach is often a more suitable one to adopt. Inherent in the use of this approach is the creation of a development 'prototype'(Girma 1996).

Prototyping is a method for systems development in which the system developer produces a system prototype in a short time. The prototype is a rough version of the system on a small scale. Developing a prototype helps the developer understand the problem and its domain, identify the scope of the system, and choose its future expansion. By nature prototyping involves a number of iterations, through which the prototype is gradually altered and expanded to meet organizational needs (Zahedi 1993).

A prototype is not a 'real' system, it may not have full versions of all data files or support all the procedures and functionality of the desired system, but it should be able to perform in a way which demonstrates the most pertinent characteristics. Prototyping is often found useful for exploring particular parts of a system that have the most direct relationship with the operating environment, for example interactive user interfaces (Avgerou et al 1993).

One fundamental idea which permeates the notion of prototyping is the development of a working system - or some part of a system - using facilities which speed up its construction and facilitates subsequent change and refinement. Prototyping should be thought of as the method of quick systems component construction, which is adopted within the framework of a broader systems development approach or methodology to solve contentions between analysts, users, software and hardware (Avgerou et al 1993).

Quick prototyping or rapid prototyping is the process of quickly building and evaluating a series of prototypes and requires the availability of tools that offer modularity and plasticity. It allows one to create and test input designs, terminal dialogues, and simple procedures. In other words, in developing a hypertext, the prototype would be used to test out the screen layouts, color combinations, button designs, link strategies, interaction methodologies and various other design parameters on just a part of the system (Girma 1996).

Wong (1993) suggested that like all approaches to software development, quick prototyping consists of three generic phases: definition, development, and maintenance. The definition phase focuses on what. That is during the definition, attempts are made to identify what information is to be processed, what function and performance are desired, what interfaces are to be established, what design constraints exist, and what evaluation criteria are required to define a successful system. Thus, the key requirements of the system and the software are identified.

The development phase focuses on how. The development phase of the prototyping approach involves a quick design. The quick design focuses on representation of those aspects of the software requirements outlined. Quick design also leads to construction of a prototype.

The maintenance phase focuses on change that is associated with error correction, adaptation required as the software evolves, and modification due to enhancements brought about by changing requirements. The maintenance phase reapplies the steps of the definition and development phases, but in the context of existing software. Thus, the

prototype is evaluated and used to refine requirements for the software to be developed. A process of iteration occurs as the prototype is tuned to satisfy the requirement until a software which meets the objectives has evolved.

In this study the quick prototyping approach is used for developing the system.

4.6 GENERAL STRUCTURE OF THE PROTOTYPE SYSTEM

Before discussing the design of the prototype system, it is important to determine what the new system is expected to perform in terms of its functional specification. Therefore, the functional specification of the new system can be stated as:

- Even if the information requirement of the business community was studied, given the time limit for the thesis, only foreign trade information (import, export, customs tariffs, import-export procedures) is addressed in the prototype.
- The prototype system displays the requested information in a window which can be scrolled up, down, left and right as well as saved in a file and/or printed on paper.
- The prototype system would inquire the user and depending on the response the user accesses the hypertext database either through the table of contents screen in which case the user navigates freely at his own pace or through the expert interface which enables the user to access the database by displaying the needed information and then browse.
- Since users came with different abilities in using computers, the expert interface facility is expected to help them in finding the right information by guiding them to the requested information.

In the design of the prototype system, design of the hypertext database and the design of the expert interface are involved each of which is discussed below.

4.6.1 Hypertext database design

From the interviews held with the officials of the AACC and observing their files, it was found out that they classify information into Indicators, Company Directory, Business Opportunities, Foreign Trade classified by commodity type, country of source and destination, Procedures, Government Regulations, Prices, Useful Addresses, and Places of Interest. Each of these classifications in turn is categorized into different categories. These categories are the basis of the hypertext database design. The conceptual diagram of the hypertext database showing the classifications and their further subdivisions is given in Figure 4.4. Furthermore, the tree structure shown in Figure 4.5 shows in detail the relationship between the different classifications of the business information in a hierarchical fashion. In this study it is assumed that this categorization presents a satisfactory working model.

For developing the prototype, foreign trade related information have been used. This is because, most of the respondents indicated that foreign trade information is their top priority as discussed in Section 3.4, Chapter 3. The hierarchical diagram for foreign trade information showing the nodes and the links is given in Figures 4.6 (for export) and 4.7 (for import). The links are indicated by the underline and the relationship between links (which link is linked to which link) is shown by the numbers preceding them. For example, as can be seen in figure 4.6, 7.0 is linked to 7.1, 7.2 and 7.3. Furthermore, 7.1 is linked to 7.1.1 and 7.1.2; and 7.1.1 is linked to 7.1.1.1, 7.1.1.2, etc. The nodes which contain the actual information are indicated by the node headings.

Foreign Trade information can be classified into Import, Export and Commercial representatives. Export and Import information are further classified by country and

commodity type (according to AACC). Government Regulations can consist of, among other things, customs tariffs which is classified into 21 Sections and different chapters under each section. For instance, Section I contains 5 Chapters whose hierarchical structure is shown in Figure 4.8 (Customs Authority 1993). Related with foreign trade information, in addition to customs tariffs are, Import export procedures. The Import-Export Procedures can be classified into methods of International Trade Payment, Application for Letter of Credit(L/C), functions of L/C, and documents supporting L/C whose hierarchical Structure is Shown in Figure 4.9 (AACC).

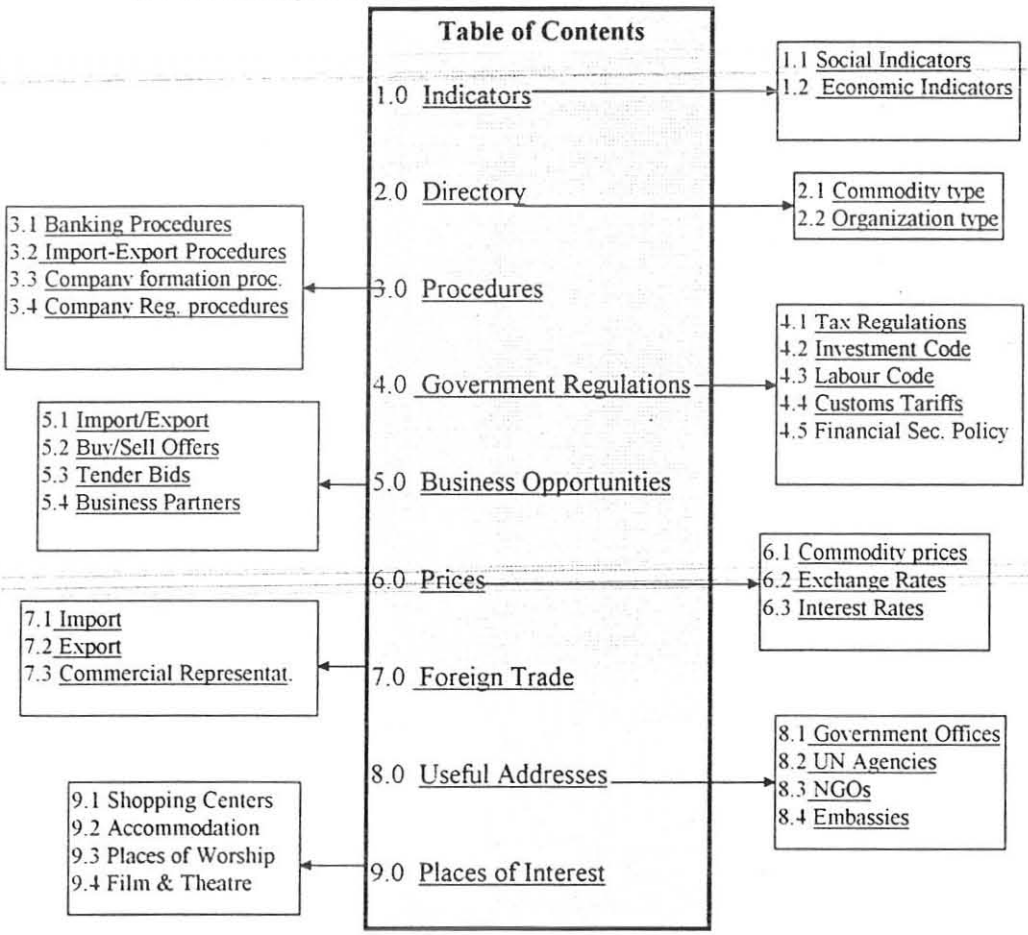


Figure 4.4 Context Diagram of the hypertext database

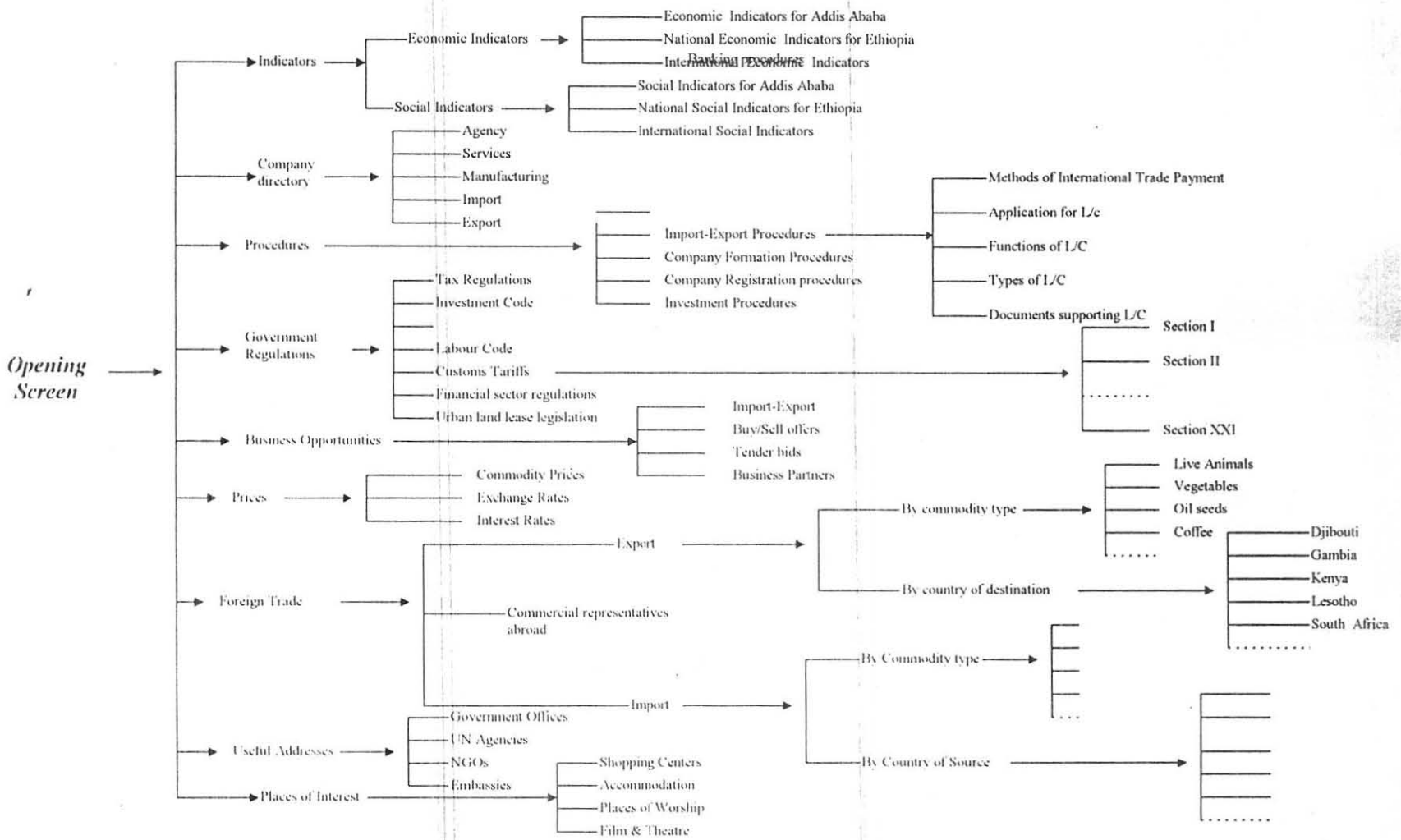


Figure 4 5 Tree Structure showing the general structure of the system

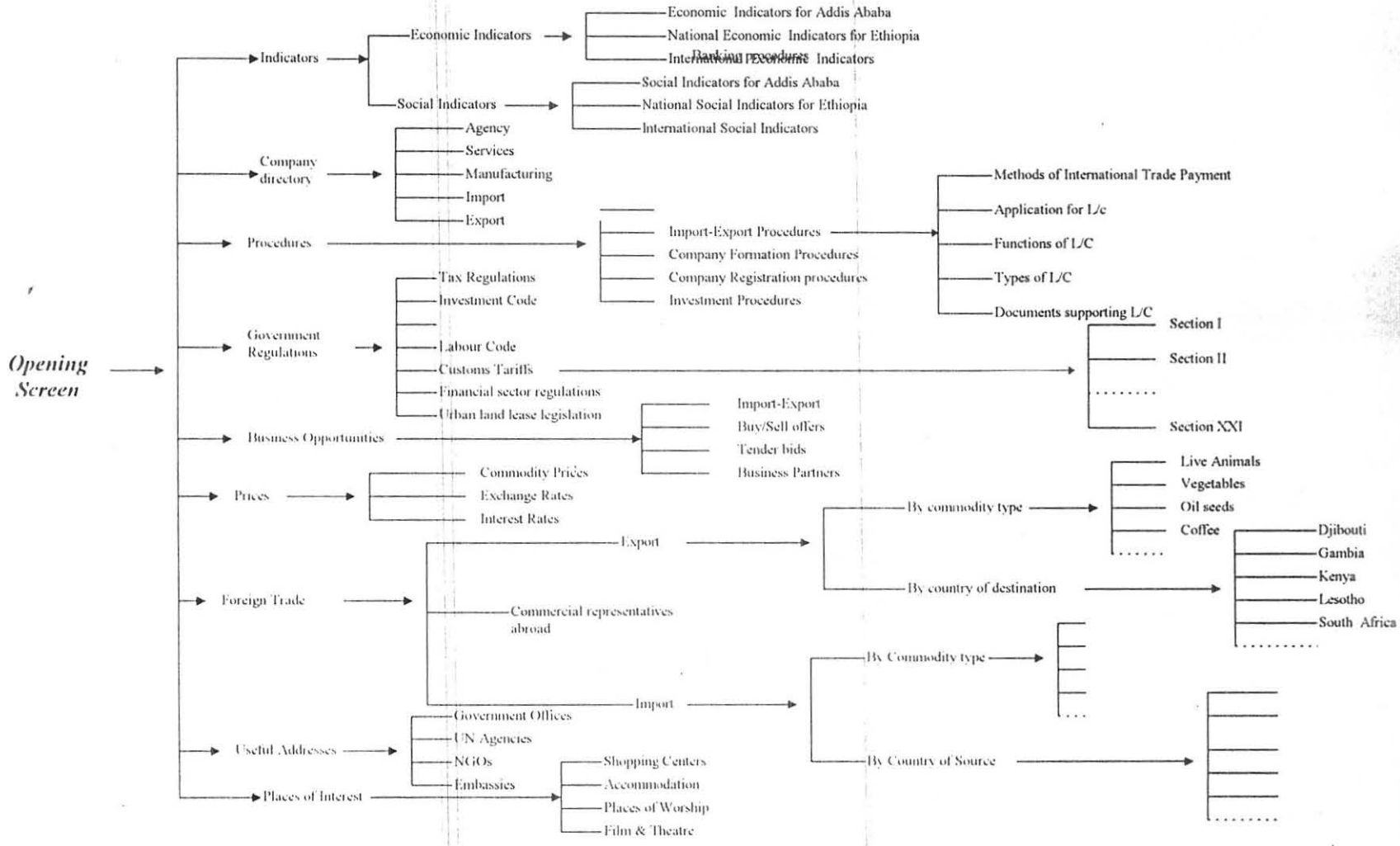


Figure 4 5 Tree Structure showing the general structure of the system

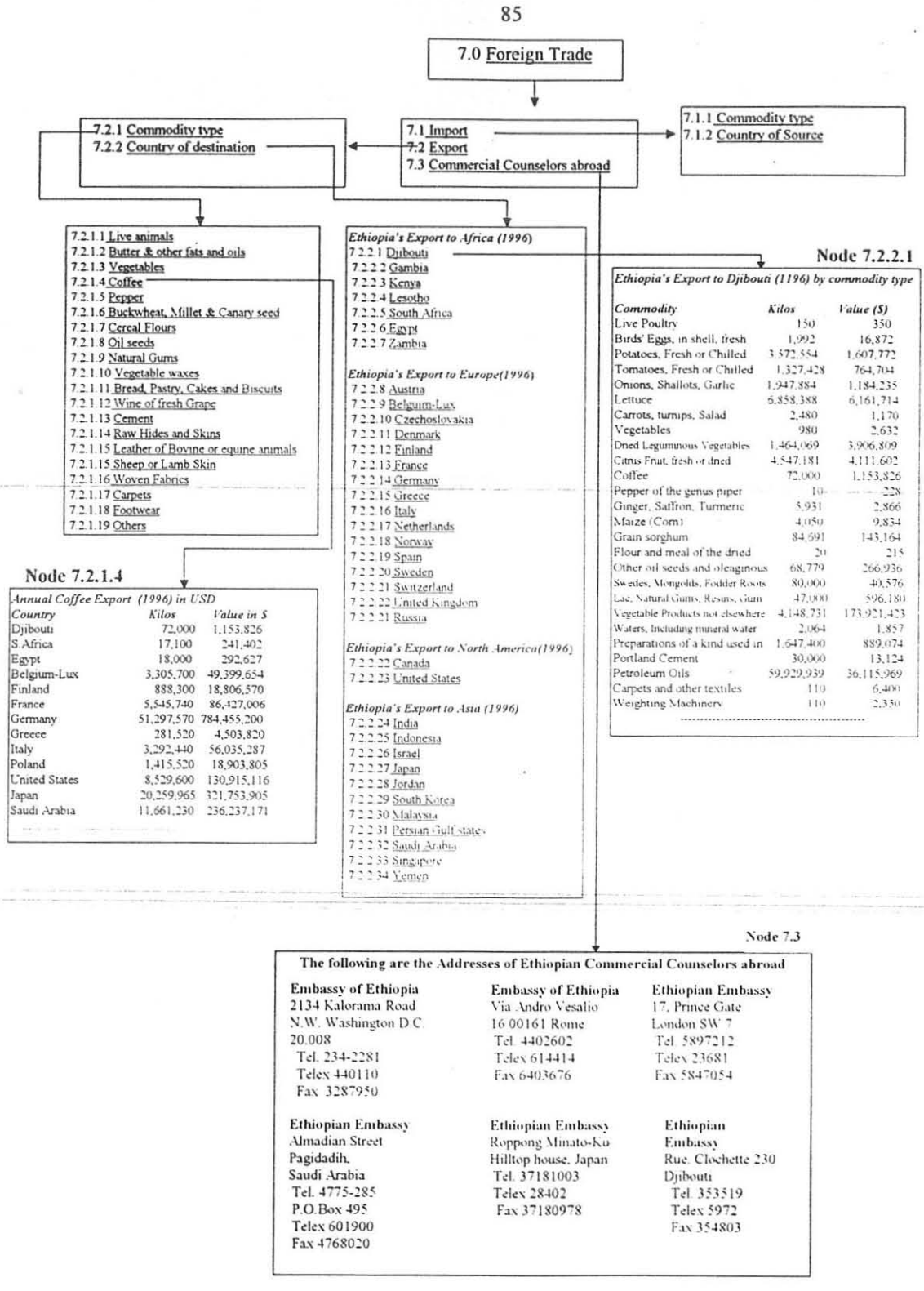


Figure 4.6 Hierarchical Structure Showing Export Information

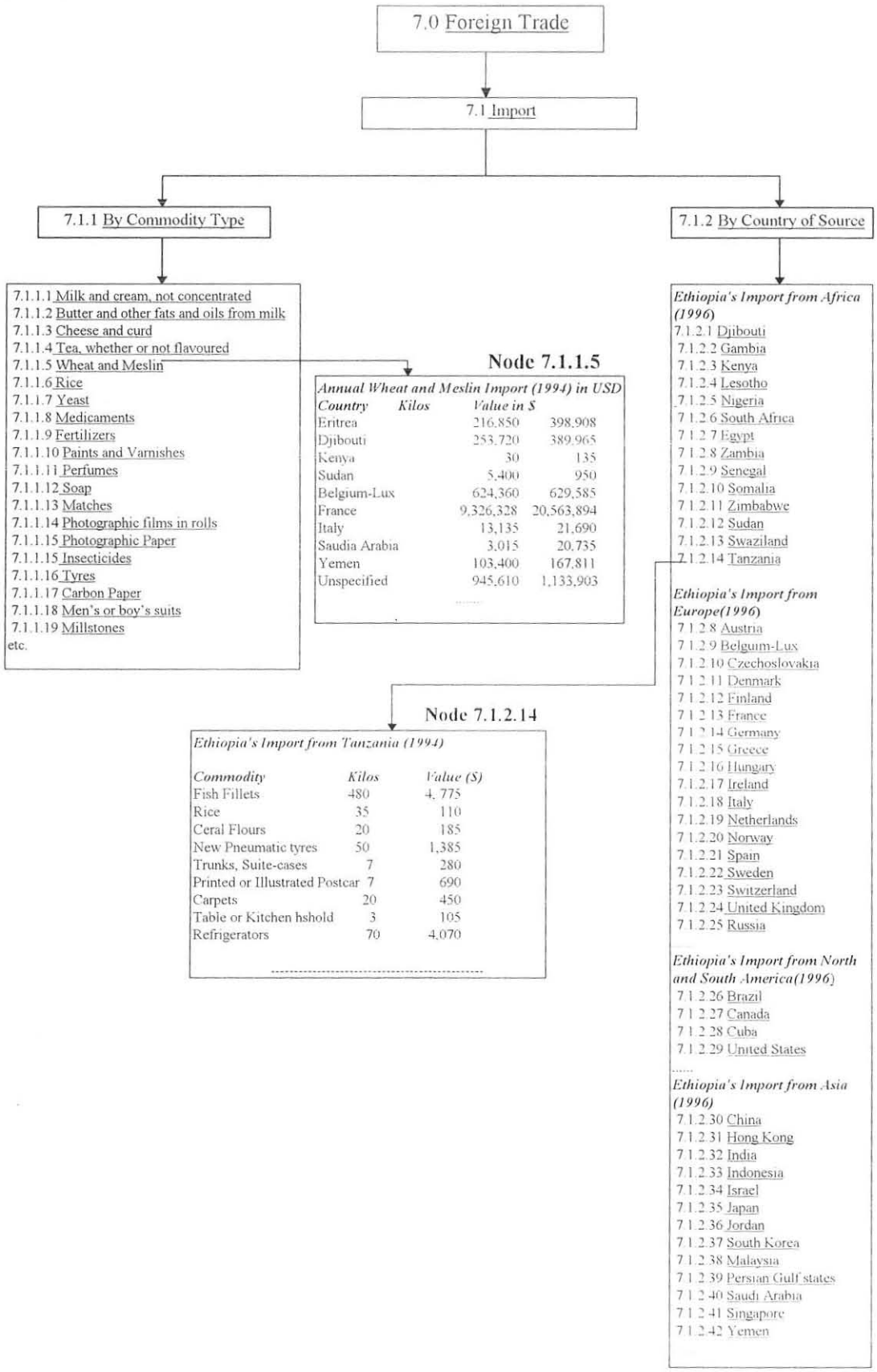
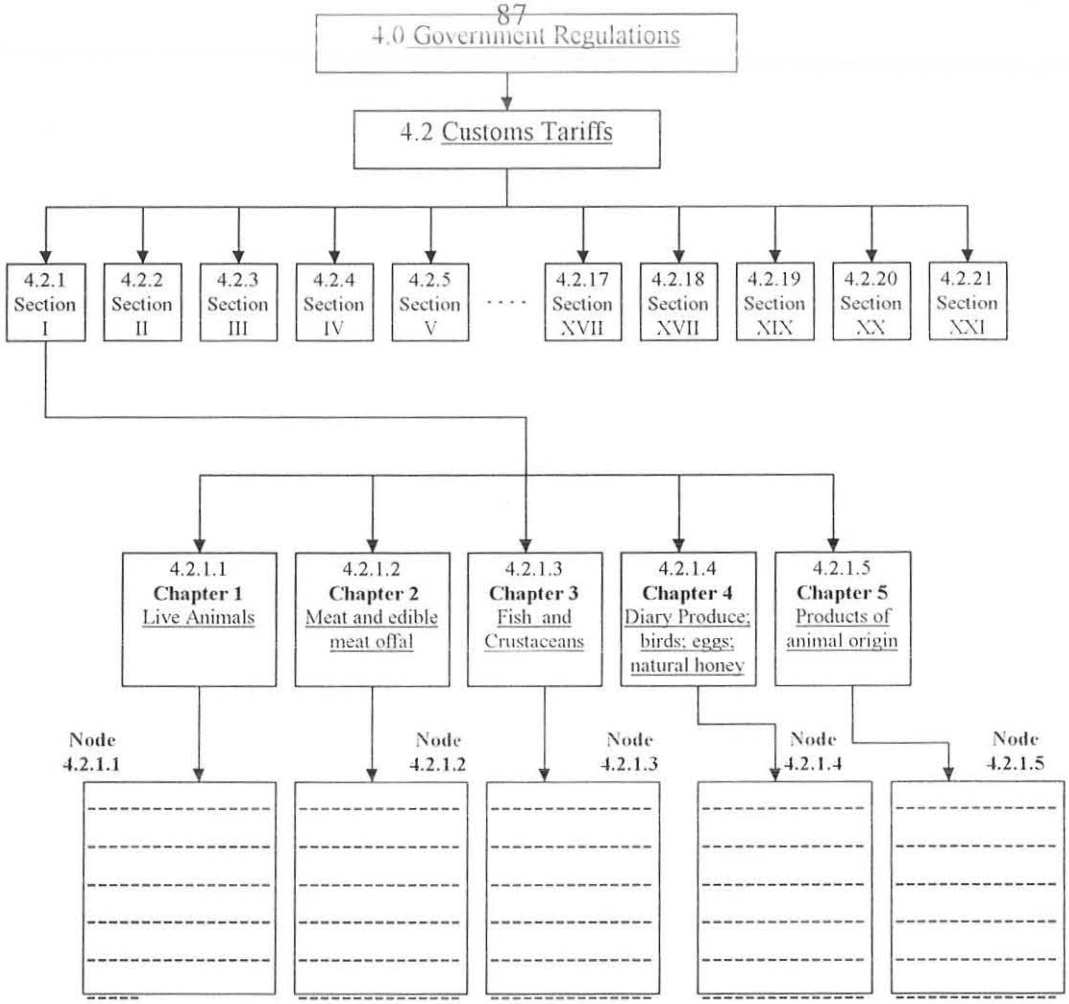


Figure 4.7 Hierarchical Structure Showing Import Information



Legend

Section I - Live Animals; Animal Products
Section II - Vegetable Products
Section III - Animal or Vegetable Fats and Oils and other Cleavage products; Prepared edible fats; Animal or vegetable waxes
Section IV - Prepared Food Stuffs; Beverages, Spirits and Vinegar; Tobacco and Manufactured Tobacco Substitutes
Section V - Mineral Products
Section VI - Products of the Chemical or Allied Industries
Section VII - Plastics and Articles Thereof; Rubber and Articles Thereof
Section VIII - Raw Hides and Skins, Leather, Foreskins and Articles Thereof; Saddlery and Harness; Travel Goods, handbags and similar containers; articles of animal gut (other than silk-worm gut).
Section IX - Wood and Articles of wood; Wood charcoal; Cork and Articles of Cork; Manufactures of straw, of esparto or of other plaiting materials; Basketware and wickerwork.
Section X - Pulp of wood or of other fibrous cellulosic material; Waste and Scrap of paper or paperboard; paper and paper board and articles thereof.
Section XI - Textiles and Textile Articles.
Section XII - Footwear, Headgear, Umbrellas, sun umbrellas, Walking Sticks, Seat-Sticks, Whips, Riding-Crops and parts thereof; Prepared feathers and Articles made therewith; Artificial flowers; articles of human hair.
Section XIII - Articles of Stone, Plaster, Cement, Asbestos, Mica or Similar materials; Ceramic Products; Glass and Glassware.
Section XIV - Natural or Cultured Pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; Imitation Jewelry; Coin
Section XV - Base metals and Articles of Base metal
Section XVI - Machinery and Mechanical Appliances; Electrical Equipment; Parts thereof; sound Recorders and Reproducers, Television image and sound recorders and reproducers, and parts and accessories of such articles.
Section XVII - Vehicles, Aircraft, Vessels and Associated Transport Equipment
Section XVIII - Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical or Surgical Instruments and Apparatus; Clocks and Watches; Musical Instruments; Parts and Accessories Thereof.
Section XIX - Arms and Ammunition; Parts and Accessories Thereof.
Section XX - Miscellaneous Manufactured Articles.
Section XXI - Works of art, Collectors' Pieces and Antiques.

Figure 4.8 Hierarchical Structure showing customs tariff information.

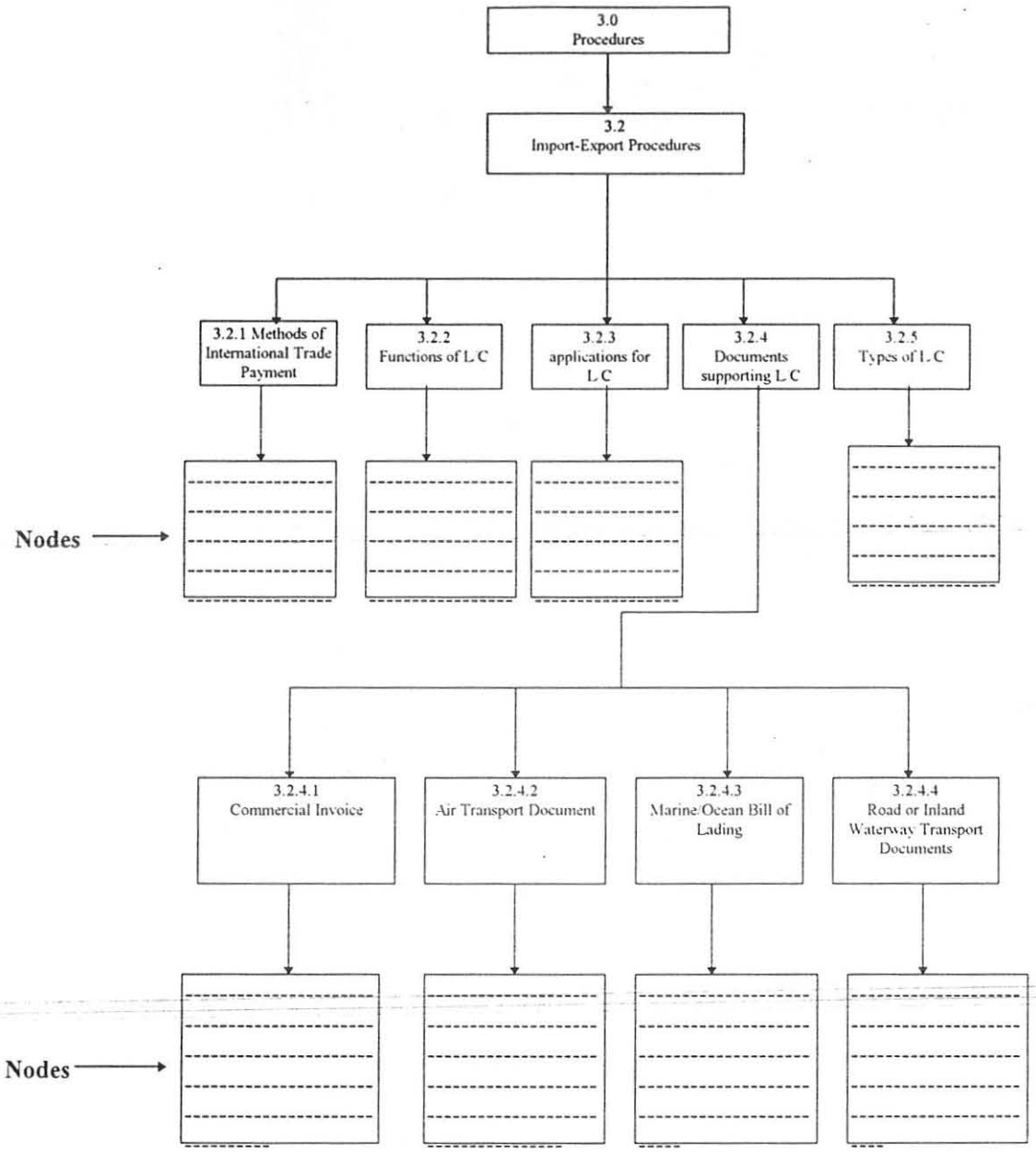


Figure 4.9 Hierarchical Structure showing Import-Export Procedures

The hypertext database is basically hierarchical in structure. But since Import, Export, Customs Tariffs and Import-Export procedures are related to each other, there are some links which connect one from the other in a network structure as can be seen in Figure 4.10 below.

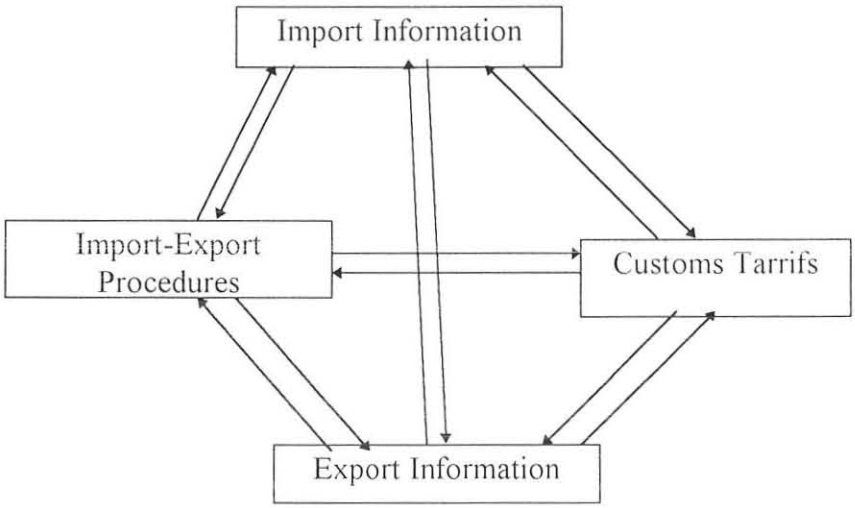


Figure 4.10 Network structure showing the links among foreign trade related information

4.5.2 Expert Interface Design

There can be many access paths to the hypertext database. The user can navigate the hypertext simply by clicking on an appropriate hypertext links or can use the expert interface facility just to display only the needed information. For the expert interface to the hypertext database, rules can be embedded into the database and when one wants to use this facility, he/she will be presented with a set of questions and the user is expected to choose one of the options depending on his/her choice until he reaches the node containing the requested information. Therefore, a production rule can be generated for each hierarchical structure. The rules for foreign trade related information is summarized below using pseudocode.

4.5.2.1 Export

4.5.2.1.1 Export by commodity type

Rule 1

If Inquiry is about foreign trade and if it is export and if it is by commodity type and if live animals then
link to node 7.2.1.1

end.

Rule 2

If Inquiry is about foreign trade and if it is export and if it is by commodity type and if Butter and other fats and oils then
link to node 7.2.1.2

end.

Rule 3

If Inquiry is about foreign trade and if it is export and if it is by commodity type and if Vegetables then
link to node 7.2.1.3

end.

Rule 4

If Inquiry is about foreign trade and if it is export and if it is by commodity type and if Coffee then
link to node 7.2.1.4 ← **the node shown in Figure 4.6**

end.

etc.

4.5.2.1.2 Export by country

Rule 1

If Inquiry is about foreign trade and if it is export and if it is by country and if Djibouti then
link to node 7.2.2.1 ← **the node shown in Figure 4.6**

end.

Rule 2

If Inquiry is about foreign trade and if it is export and if it is by country and if Gambia then
link to node 7.2.2.2

end.

Rule 3

If Inquiry is about foreign trade and if it is export and if it is by country and if Kenya then
link to node 7.2.2.3

end.

Rule 4

If Inquiry is about foreign trade and if it is export and if it is by country and if Lesotho then
link to node 7.2.2.4

end.

etc.

4.5.2.2 Commercial Representatives

Rule 1

If Inquiry is about foreign trade and if it is Commercial Counselors abroad then
link to node 7.3 ← **the node shwon in displayed in Figure 4.6**

end.

4.5.2.3 Import

4.5.2.3.1 Import by Commodity type

Rule 1

If Inquiry is about foreign trade and if it is Import and if it is by commodity type and if milk and cream. not concentrated then
link to node 7.1.1.1

end.

Rule 2

If Inquiry is about foreign trade and if it is Import and if it is by commodity type and if Butter and other fats and oils from milk then

link to node 7.211.2

end.

Rule 3

If Inquiry is about foreign trade and if it is Import and if it is by commodity type and if cheese and curd then

link to node 7.1.1.3

end.

Rule 4

If Inquiry is about foreign trade and if it is Import and if it is by commodity type and if Wheat and Meslin then

link to node 7.1.1.5 ←——— **the node shown in Figure 4.7**

end.

etc.

4.5.2.3.2 Import by Country

Rule 1

If Inquiry is about foreign trade and if it is Import and if it is by Country and if Djibouti then

link to node 7.1.2.1

end.

Rule 2

If Inquiry is about foreign trade and if it is Import and if it is by Country and if Gambia then

link to node 7.1.2.2

end.

Rule 3

If Inquiry is about foreign trade and if it is Import and if it is by Country and if Kenya then

link to node 7.1.2.3

end.

Rule 4

If Inquiry is about foreign trade and if it is Import and if it is by Country and if Lesotho

link to node 7.1.2.4

end.

etc.

The Structure chart for Import and Export is given in Figure 4.11.

4.5.2.4 Customs Tariffs

Rule 1

If Inquiry is about Government Regulations and if its Customs Tariffs and if Live Animals: Animal products and if live animals then

link to node 4.2.1.1

end.

Rule 2

If Inquiry is about Government Regulations and if its Customs Tariffs and if Live Animals: Animal Products and if Meat and edible meat offal then

link to node 4.2.1.2

end.

Rule 3

If Inquiry is about Government Regulations and if its Customs Tariffs and if Live Animals: Animal Products and if Fish and Crustaceans then

link to node 4.2.1.3

end.

Rule 4
If Inquiry is about Government Regulations and if its Customs Tariffs and if Live Animals; Animal Products and if Diary Produce; birds, eggs; natural honey then
link to node 4.2.1.4
end.
Rule 5
If Inquiry is about Government Regulations and if its Customs Tariffs and if Live Animals; Animal Products and if Products of Animal Origin
link to node 4.2.1.5
end.

etc.

4.5.2.5 Import-Export Procedures

Rule 1
If Inquiry is about Procedures and if it is Import-Export Procedures and if Methods of International Trade Payment then
link to node 3.2.1
end.
Rule 2
If Inquiry is about Procedures and if it is Import-Export Procedures and if Functions of L/C then
link to node 3.2.2
end.
Rule 3
If Inquiry is about Procedures and if it is Import-Export Procedures and if Applications for L/C then
link to node 3.2.3
end.
Rule 4
If Inquiry is about Procedures and if it is Import-Export Procedures if it is Documents Supporting L/C and if Commercial Invoice then
link to node 3.2.4.1
end.
Rule 5
If Inquiry is about Procedures and if it is Import-Export Procedures if it is Documents Supporting L/C and if Air Transport Document then
link to node 3.2.4.2
end.
Rule 6
If Inquiry is about Procedures and if it is Import-Export Procedures if it is Documents Supporting L/C and if Marine/Ocean Bill of Lading then
link to node 3.2.4.3
end.
Rule 7
If Inquiry is about Procedures and if it is Import-Export Procedures if it is Documents Supporting L/C and if Road or Inland Waterway Transport Documents then
link to node 3.2.4.4
end.

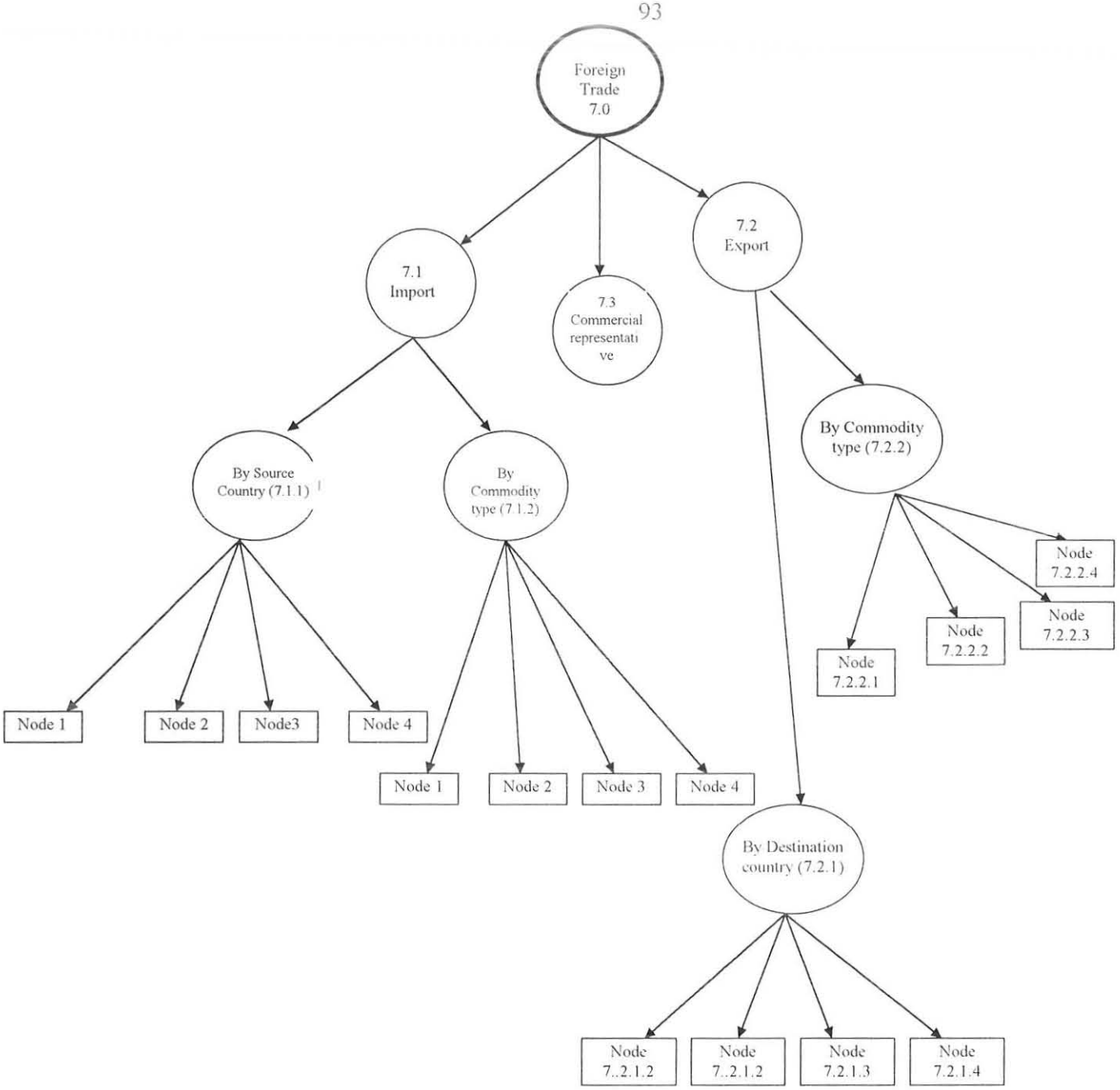


Figure 4.11 Structure chart for Import-Export Information

Two of the most important features of an expert system, i.e., the ability of the system to explain its line of reasoning of a conclusion, and informing the user why a particular fact is needed, were designed and developed in the prototype system. For the 'HOW' explanation, the steps taken to arrive at a specific node were traced and recorded in list for later display

to a user if requested. For the 'WHY' explanation, for each case a separate topic was included with it and displayed to users whenever requested.

The information displayed at each node could be saved in a file or printed on paper in addition to being displayed on the screen. Moreover, the 'HOW' and 'WHY' explanation windows are displayed on their respective window on screen, and could be printed on paper.

4.5.3 Hardware and Software Selection

The various software tools available for the development of an expert system and hypertext were discussed in Chapter 2.

Therefore, choosing the appropriate development tool that suits the given application is vital. There are various issues to be considered in choosing an authoring system. some of the issues include (Seyer 1991):

- The availability of a run-time engine of the program so that the developed system can be distributed widely;
- The ease with which one can include graphics nodes;
- The hardware required of the authoring system;
- The ability of the authoring system to capture trails taken by users;
- Whether the authoring system supports end-user scripting and how powerful are the scripting commands;
- The fastness of the system;
- The facility available for supporting ASCII files or easy importing of ASCII files.

There are various development tools which combine aspects of expert systems and hypertext. These include Neuron Data's Nexpert Object which allows the association of expert systems with HyperCard stacks; Texas Instruments HyperTrans which performs, using AI techniques, an analysis of documentation and suggests the most appropriate hypertext links to create; Hyperbase, from cogent Software Ltd., which permits the development of intelligently adaptive documents; 1st Class HT, from 1st Class expert systems which has been used to develop diagnostic systems which can access maintenance documentation online; and KnowledgePro for windows, from Knowledge Garden, Inc. which features support for decision trees and hypertext.

KnowledgePro, which is discussed in Chapter 2, besides being the only available authoring tool at the School, has various features that made it the ideal software tool for the development of the prototype system.

CHAPTER 5

PROTOTYPE DEVELOPMENT

For the purpose of developing the prototype, data was collected from different sources. Data on imports (commodity type and country of source), exports(commodity type and country of destination) and customs tariffs were obtained from the Customs Authority while data on commercial counselors abroad is obtained from the Trade directory of the Addis Ababa Chamber of Commerce published in 1994 and data on import-export procedures was obtained from the documents of the Addis Ababa Chamber of Commerce.

5.1 CODING AND DOCUMENTATION

Two files have been created for the prototype system. The BUSIHYP.KB contains the source code for accessing the hypertext both through the hypertext link and the expert interface (guided tour) and the BUSINESS.TXT is the linear file which contains the nodes which in turn contains the actual data to be retrieved when the user uses any of the two access methods.

The program file, BUSIHYP.KB, is a knowledge base that creates a hypertext file handler. It allows to create text files which contain paragraphs of text linked together by hypertext and can also be used to lead a novice user to the appropriate information. Selecting READ opens the hypertext file, BUSINESS.TXT. When the file is opened the subject at the top of the file is displayed. This is usually an index or a table of contents which lets the user access the other subjects in the file. Each indexed item is actually a hypertext phrase. In this program hypertext appears green on color monitors and underlined on mono monitors.

The source code BUSIHYP.KB is commented to explain how it is used to read hypertext files. The codes are modular in that a code to perform a specific task is defined on its own as a topic so that it can be modified easily. The use of the topic MARK is basic to the design of the program. When a hypertext phrase is selected, it can be explicitly linked to a topic with the same name as the phrase or, if it doesn't find a topic with the same name it will call the special topic MARK, passing the text of the phrase as a parameter. In MARK, we read the hypertext file starting at the location where we find the hypertext phrase preceded by double slashes until the next set of double slashes is encountered. We keep track of which subjects have been read in the topic LIST. This lets us back over the subject we've already viewed. Previously over 150 rules were used. But using the procedural programming capabilities of Knowledge Pro, it was reduced drastically to a small number of codes. In other words, an alternative to the rule-based programming approach was used to reduce the rule base.

Each subject in the hypertext file, BUSINESS.TXT, is identified by a subject title preceded by a double slash. The title is written on to the title bar of the window but is not displayed on the main screen. All spaces and line feeds remain as typed into the file. Any words surrounded by the characters #m are identified as hypertext.

Modifying or adding data to both of the files is very simple. If new data is to be added to the text file , then the data will be appended delimited by the hypertext delimiters. To add a new code or to modify the existing codes, it is just typing the codes in the appropriate topic.

5.2 DEMONSTRATION OF THE PROTOTYPE

The result of this study is a prototype system that demonstrates the application of expert interfaces to hypertext databases developed based on the information requirements of the Addis Ababa Business Community.

At the very beginning when the program starts the welcome screen shown in Figure 5.1 is displayed and an option is presented to the user. If the user clicks the Continue button then the second screen shown in figure 5.2 asking for the user to choose either the expert interface mode or just the hypertext mode is displayed and describing what each of the options mean. If the user clicks on the hypertext mode, he will be presented with the table of contents screen shown in figure 5.3. If the user chooses the expert interface mode, then he will be presented with a series of questions until he reaches the desired node containing the requested information. After reaching the required node the user can use the hypertext link to traverse links freely depending on his/her choice.

At the level down from the main contents screen, there are heading screens for each section, which have a simple layout. At the next level down the screens in most sections have a clear title, a row of buttons at the top of the screen for navigation, and items to select in the middle of the screen.

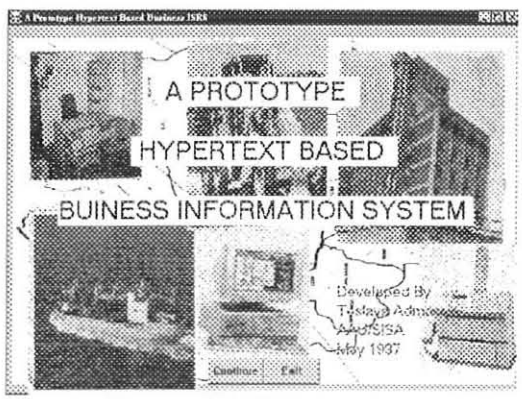


Figure 5.1 Opening Screen

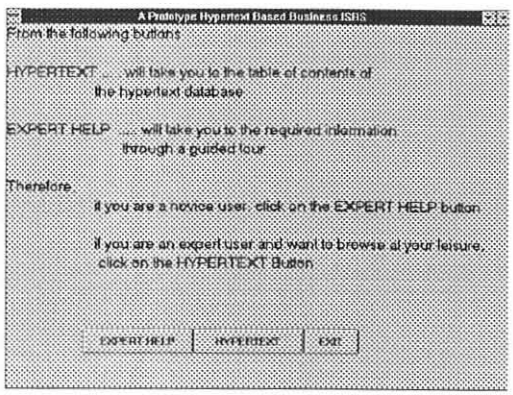


Figure 5.2 Second Screen

Once the user is on the table of contents screen, he can just point and click the mouse or press TAB or SHIFT TAB to move to the cursor and ENTER to select the hypertext. If, for instance, the user clicks on foreign trade, he will be presented with the next level menu in the hierarchy along with links to other related topics as can be seen in Figure 5.4. Again if the user clicks on export, then the next level hypertext menu will be displayed. On selecting 'by country of destination', the last hypertext link displaying the countries to which Ethiopia exports will be displayed and on clicking for instance Djibouti, the data showing the commodities exported, kilos and values in dollars will be displayed.

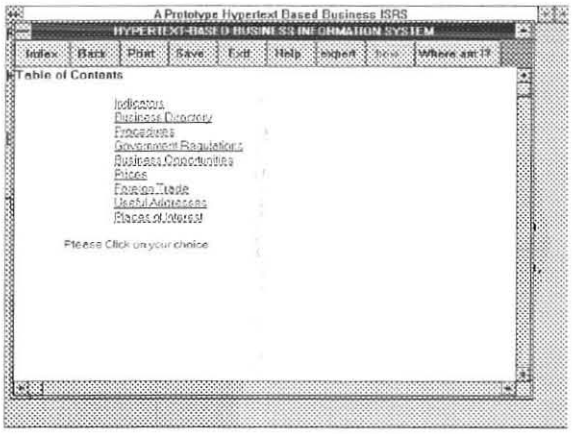


Figure 5.3 Table of Contents Screen

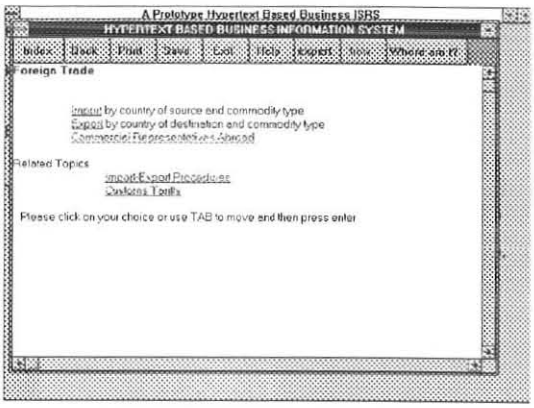


Figure 5.4 Foreign Trade Screen

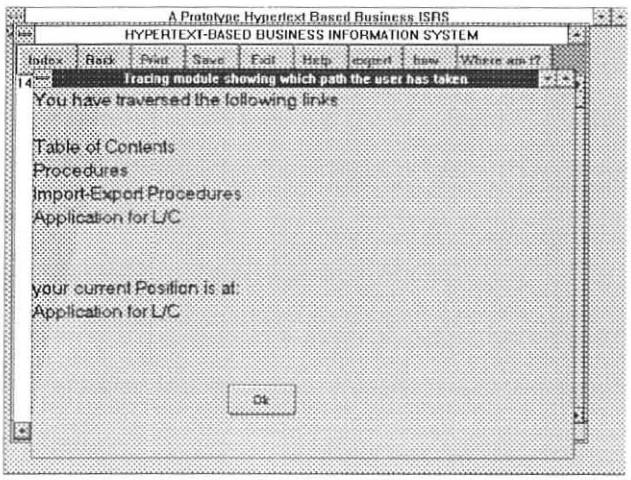


Figure 5.5 A screen showing traversed links

5.2.1 Backtracking

Backtracking facility is one of the most important navigation facilities, especially for novice users. Users frequently relied on backtrack to save them when they are in any kind of situation which they could not handle. Because of this, a Back button is always available in the system to take users back in the hypertext where they have jumped from.

The system has an unlimited backtrack capability within any one session, meaning, that sufficiently many repeated clicks on the Back button will take one back to the Table of Contents screen shown in Figure 5.3. The system also provides a direct hypertext jump to it from anywhere by clicking on the Index button.

The backtracking facility in this system is strictly path following meaning that nodes are revisited in exactly the reverse order in which the user originally visited them. This is implemented as a list, and every time a link is traversed, it is added to the list. In addition to the backtracking facility, to minimize the problem of 'lost in hyperspace' a Where am I? button is added and when clicked, it shows the path the user has taken in reaching at the current location in the order in which he traversed the link and identifies the current location (Figure 5.5). When this button displays the path the user has taken, it is also possible to jump to a specific traversed link or node since the lists displayed are hypertext buttons. The program re-establishes a completely identical screen layout when returning to a previous state after a backtrack operation. This makes it easier to recognize the location one returns and thus simplifies the understanding of the navigational dimensions of the hyperspace.

5.2.2 Output Options

At any point on the screen, whether the user is on a node or a link, he can have two sets of options for output, namely printing and saving, in addition to displaying the result on the screen.

Clicking the Print button enables the user to print the displayed text to a printer attached to the computer he is using. On the other hand, if he wants the output to be saved to a file the user can click on the Save button. He will be provided with a prompt to type a file name. The displayed text will be saved as a text file and can be retrieved and edited by using any text editor

5.2.3 Expert Interface

At any point in traversing the hypertext link, the user can click on Expert button to initiate a dialog. He will be presented with sequences of questions and answers one after the other as can be seen in figure 5.6 until the user reached the desired node containing the required information.

If after reaching the desired node, the user wants to know how he reached there, he can click on the How button and get the appropriate explanation how he reached at the current node.

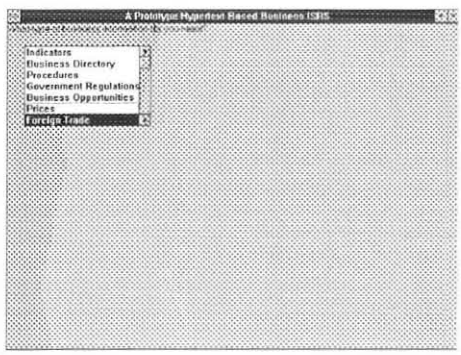


Figure 5.6 First Screen of the dialogue

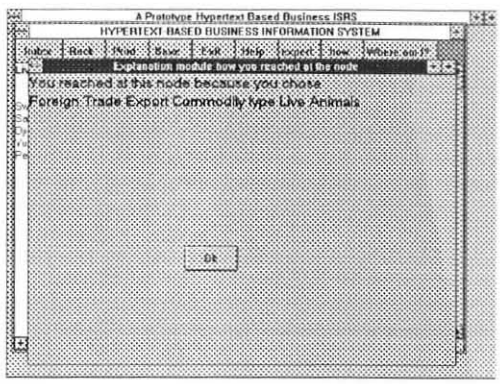


Figure 5.7 Screen showing how a user reached a specific node

If the user accessed the database through the hypertext, then the How button will be disabled and displayed as dimmed until the Expert button is activated. After using the expert interface and reaching the desired node containing the requested information, the user can browse through the hypertext and can use any of the buttons including printing, saving and backtracking facilities to traverse links at the user's pace.

5.2.4 Exiting and Getting Help

At any point, by clicking on the Help button, the user can get general information about the system. If the user wants to exit from the program and return to the windows program, he can click on Exit button from any location.

5.3 TESTING

Hardman (1989) suggested that general characteristics of an 'ideal' hypertext system could be one :

- that could be used by readers with no explanation before hand;
- that did not hinder readers by requiring them to learn superfluous details about their working environment; and
- whose structure and presentation would aid a reader's task.

Therefore, it is possible to test a hypertext based information system against these characteristics of hypertext systems.

Through testing, a user can test a system's competence in its domain of expertise and determine whether it produces meaningful results. Users also evaluate their interaction with the system - its facilities for assisting them in using the system, methods for input of

knowledge and output of results, and speed of response. All these evaluations help the user decide what capabilities are useful, what others are required and/or desired, and which can be ignored. This feedback in turn allows the system builders to provide capabilities commensurate with the needs of potential users.

There are two types of testing, namely, field testing and laboratory testing. The main difference between field testing and laboratory testing is that field testing involves the use of the system for real-world reason (not because the experimenter has setup the system for them to try) to solve self-defined tasks (rather than tasks defined by the experimenter). Since one of the main ideas behind hypertext is to empower users to navigate an information space according to their own individual wishes and at their own speed, it is important to look at people using hypertext in their own natural environments.

Because of time limitations and the incompleteness of the prototype system, it was not possible to test the prototype system. But an attempt was made to get feedback from the Addis Ababa Chamber of Commerce and 4 business people (2 Importers and 2 Exporters) who have responded to the information requirement questionnaire as well as colleagues who are engaged in trade related activities.

It is hard to gauge what readers' strategies would have been if the prototype system has been complete. The Chamber people indicated that though a facility for self-directed browsing was valued, a facility for direct questioning was considered to be much more important. They suggested that the purpose of an information resource is to make information accessible, rather than buried in a find-out-yourself encyclopedia. The trade

expert preferred the Table of Contents Screen instead of the guided tour as it enables him to choose related items of information which he hasn't thought of seeing it before.

The business people had no experience with Knowledge Pro or other hypertext systems except that two of them have used the help facilities of Microsoft Word and Excel which has a hypertext facility.

All of them were asked to look for information on 'Coffee Export in 1996' using both of the access methods for the hypertext database. Almost all of them have tried to locate the information with varying degrees of accuracy. They were also asked to go back to the Table of Contents screen as well as to the previous screen. All of them recognized the **BACK** button to go one screen back but had difficulty to go to the Table of Contents screen. One of the businessman was smart enough to use the **HELP** button to get an understanding of what each of the buttons at the top of the screen is and performed well. Two of the business people were able to get into the Table of contents screen after many tries on the other buttons. They explained that the **INDEX** button was not easily understandable to mean to take to the Table of contents screen. None of them tried to use the **HOW** and the **WHERE AM I** buttons. But later on the purpose of the two buttons were explained to them and they found out their importance in keeping track of their link traversal and their line of reasoning.

Readers tended to go back to the main contents screen for one of two reasons; either they had just completed a task and were going to start a new one, or they had become confused by a task and were going back to the beginning.

Three readers attempted to click on a text in a list but clicked on the inactive background instead. One reader realized what had happened, but the other two did not.

All of them have tried to use the expert interface to locate the required information. All of them underlined its importance for pinpointing the required information particularly when someone is in a hurry, but preferred the hypertext Table of Contents screen to get the required information at the user's pace. This is because when a link is traversed, other hypertext links which have some relation with the current link will be displayed and the user will jump to other information instead of the required information. In my opinion this will aggravate the 'lost in hyperspace' problem in hypertext. During testing, the online help facility for the expert mode was not developed and the users found it a little bit difficult to use without help. But this will be improved when the online help facility is available.

The observations were not carried out with the intention of gathering statistically significant results, but rather to gain a feeling that what actions readers were able to carry out with the ease and what aspects of the hypertext hindered them.

In general, it can be concluded that users can not always be assumed to read through an entire hypertext, but their ability to find that (potentially small) part of the information which is of interest to them is at the very heart of the usability of hypertext.

5.4 IMPLEMENTATION ISSUES

The prototype system is developed using Knowledge Pro for windows version 2.51 and runs in the microsoft windows operating system. It was developed on a 486 processor and 12MB of computer memory. It was also tried and found out that it can run on 486

processor and 4MB computer memory but not tested on lower capacity computers. Therefore, the minimum systems requirement could not be identified.

KPWIN GOLD or Borland C++ is needed to make a distribution disk which does not require a Knowledge Pro environment. But the School does not have either of these products. So, the prototype system needs Knowledge Pro to run in the background.

When all the data for all the nodes is entered into the text file, the file will grow in size and the access time will increase. Eventually, hypertext response time will slow down. But Knowledge Pro has an indexing facility to improve performance drastically even if the file is very large. Indexing as used by Knowledge Pro involves reading a file once and generating a list of where certain information is located in the file which is called an index. The index is based on the location of certain words in the text file, or in the structure of the file itself. Instead of sequentially searching the file for the desired information, a search can be made through the index, which is a subset of the information in the file. The index tells where in the file the complete information is. This allows us to move the file pointer directly to the information and read it. The index is created by taking advantage of the hypertext file structure in Knowledge Pro in which sections of the hypertext information are labeled .

Since the size of the text file in this prototype system is not large, the index facility is not utilized. But for the future expansion of the prototype the use of index will improve performance.

After fully developing and testing the system, it is to be installed, maintained and updated at the Addis Ababa Chamber of Commerce (AACC). As can be seen in Chapter 3, the AACC has shown high interest in the prototype system and has also the technical capacity

both in terms of hardware and skilled manpower. For arousing the business community's interest in the system, the AACC can deliver the service free of charge for some time and then can introduce appropriate service charges as they are even contemplating to introduce service charges to the information service they are providing to the business community. On the other hand, most of the businessmen have also indicated, in the survey result, that they will pay if they get the information they need. After finding the required information, it can be delivered to them in the form of hard copy or soft copy depending on the choice of the users.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Through this research project, an attempt was made to explore the possibilities of using expert interfaces to hypertext database by developing a prototype system.

There are a number of possibilities for integrating hypertext and expert systems. Expert systems problems that relate to explanation facilities, user experience, expertise and needs, inferencing and dialogue control, and also hypertext navigation problems might be reduced or overcome through the integration of the two types of systems. Such integration might occur through the use of hypertext as an interface for expert systems, expert interfaces for hypertext systems or by building an expert system within a hypertext environment.

For developing the prototype system as a basis for exploring the possibilities of using expert interfaces to hypertext database, a case study of the Addis Ababa Business Community was conducted and their information requirements were determined by the survey method using stratified random sampling.

Survey results show that 78.52% of the business community in Addis Ababa were not satisfied with the available information. This result is found to be statistically significant at any acceptable significance level ($\chi^2_{(1)}$=87.8370, p=0.0).

It was also found out that most of the respondents use computers for word-processing which indicates that computers are not used for storage and retrieval of business information. The business community has also recognized the absence of an organized and

integrated online information service to cater for their needs as 64.5% of the respondents attributed the problem of inadequate information to the absence of an organized and integrated information service.

Further more, 98.7% of the respondents have a plan to introduce or further develop the use of IT, and 69.7% of the respondents agreed to pay for the information they will be getting. This implies that the business community has recognized the global trend in taking advantage of the advances in IT as a major factor in their business activities although they are not currently making use of it because of the absence of an integrated and organized information service or low level of technical capacity.

After determining the information requirements, knowledge for the prototype system was acquired from human experts through interview and from printed documents. The knowledge base was designed in such a way that it can be easily upgraded without any fundamental change in the design. If more categories of inquiries were to be incorporated into the system, more rules would be incorporated into the interface. If more information is to be added to the knowledge base, it can easily be appended. The knowledge base was developed using the hierarchical hypertext structure.

The use of models for developing the prototype has helped discipline the authoring activity, by encouraging the development of the hypertext in a structured fashion, so that its structure is designed before the actual text is actually filled into nodes. An attempt is also made to incorporate most of the human-computer interface design guidelines suggested by scholars in the field.

The developed prototype system could be used by end users to obtain the required items of information. Users are provided with a graphical user interface, buttons, windows, dialog boxes and list boxes, to accept input, to provide output, to give online assistance and explanation of system's reasoning and for providing location information. The user can have access to the system in two ways: One is through the Table of Contents Screen in which the user is presented with a Table of Contents of the available information; the other is through the use of the expert interface in which the user is requested to respond to sequences of questions until he reaches the desired node containing the requested information.

In general, the developed prototype system demonstrated that hypertext and expert systems technologies can be integrated by developing an expert interface to a hypertext database, and thus can help in automating online business information. Subsequently, this study shows that such an integrated system needs gathering of information from available information sources to develop the hypertext while knowledge acquisition process is to be based on an understanding of the user information requirements and their information seeking pattern.

KnowledgePro for windows is found to be suitable for the development of the prototype system. The early feedback obtained from users indicate that though a facility for self-directed browsing was valued, a facility for direct questioning was considered to be much more important.

6.2 RECOMMENDATIONS

6.2.1 For implementing the system

For successful implementation of the prototype system the following items need to be considered:

- The prototype system needs to be fully developed by incorporating all the data needed into the database and adding corresponding rules to the expert interface and incorporating links among the data.
- The system should be tested by users with real data and under conditions as similar as possible to the environment in which it will be embedded. The system should also incorporate changes as a result of user tests. The test results along with the test data should also be properly documented.
- A range of documentation must be delivered and approved. This includes the complete set of specification documents produced during the development of the project, as well as documentation explaining the features of the new information system to its users and guiding them in how to use it.
- Operating and organizational procedures must be prepared and inspected.
- Adequate maintenance resources must be in place. A help desk may be required for providing support to the users when they are faced with problems.

In the course of the interview, the AACC has also indicated that it is planning to setup their own network for providing information to the business community. If this idea materializes, then it is recommended to provide access to this system through the network to the business community. But no further study has been done along this line.

6.2.2 Implications for similar systems

This study, being a case study, can be easily extended to other domains with minor modifications of the code and the database file. Knowledge Pro for windows is found to be extremely suitable for developing the prototype system. It has many developed sample applications which can easily be incorporated with minor modifications. Therefore, Knowledge Pro is also recommended for developing other similar systems for other application areas.

For developing similar systems in other application areas gathering of information from available information sources and knowledge acquisition based on an understanding of the user information requirements and their information seeking pattern need to be conducted. In addition, knowledge about the domain area is found to be important to determine the relationship between items of information.

6.2.3 For further study

Due to lack of time, a search facility is not included in the prototype system. So, in addition to the two access methods that we have for the database, i.e. through the hypertext for navigation at the users pace, and through the expert interface to pinpoint the required information, an additional third method using searching can be beneficial for the users. So, further research along this line can be conducted. After developing the search facility, proper testing should also be conducted.

After fully developing the prototype system, the Addis Ababa Chamber of Commerce can create a web page on the internet containing data most important to foreign investors like investment code, customs tariffs, and other similar items of information.

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APPENDIX I

QUESTIONNAIRE TO SURVEY BUSINESS INFORMATION REQUIREMENTS OF THE ADDIS ABABA BUSINESS COMMUNITY

Introduction

I am a graduate student of the School of Information Studies for Africa (SISA) at Addis Ababa University undertaking a research project as a requirement for completion of Master of Science Degree in Information Science. I am conducting the study on " EXPLORING THE POSSIBILITIES OF USING EXPERT INTERFACES TO HYPERTEXT DATABASES FOR BUSINESS INFORMATION STORAGE AND RETRIEVAL: A CASE STUDY OF THE ADDIS ABABA BUSINESS COMMUNITY"

The information you provide will help me in identifying the information needs of the business community and the information will be used in developing a prototype database which can be used by the business community after testing and validation. The information you provide will remain confidential and will not be used for any other purpose other than for research.

I would appreciate if you could take a few moments of your valuable time to answer the following questions. Thank you in advance in anticipation of your cooperation.

Instructions for filling the questionnaire

1. Use the spaces provided to write your answers to the questions. You may use additional papers.
2. Use 'X' to mark your answer in the box provided.
3. If ranks are asked, rank in order of priority staring from the most favorite one for you.
4. In case of Part III of the questionnaire, you can make use of the technical knowledge of your EDP staff.

Identification Information

1. Name of the organization _____
2. Address _____
3. Year of establishment _____

4. Type of organization :

[ ] Private company

[ ] Partnership

[ ] Public/Government organization

[ ] Other; Please specify _____

5. In which area of business are you engaged in ?

[ ] Agency

[ ] Import

[ ] Export

[ ] Manufacturing

[ ] Services

Information Requirement

6. Do you need information in your daily business activities ?

[ ] Yes [ ] No

7. If YES, in which area (s) ? Please rank in order of priority

[ ] foreign trade

[ ] international agreements on trade

[ ] economic and social indicators

[ ] company profiles of business organizations

[ ] customs procedures

[ ] banking procedures

[ ] company formation and registration procedures

[ ] business opportunities

[ ] commodity prices, exchange rates, interest rates

[ ] the new investment code

[ ] the new tax policies

[ ] the new foreign trade policies

[ ] the new urban land legislation

[ ] the new labor code

[ ] the new financial sector policies

[ ] the new customs tariffs

[ ] others; Please specify_____

8. For what purpose do you need information ?

[ ] economic analysis

[ ] financial management

[ ] planning

[ ] to be informed

[ ] others (Please specify)_____

9. From where do you get the information ?

[ ] Addis Ababa Chamber of Commerce

[ ] Ethiopian Chamber of Commerce

[ ] government offices

[ ] informal contact with people

[ ] mass media

[ ] Others; Please specify _____

10. What are the means and mechanisms through which you get information ?

[ ] personal contacts

[ ] membership

[ ] purchase

[ ] mutual cooperation

[ ] Others; Please specify _____

11. What type of information do you frequently use ?

[ ] statistical information

[ ] market information

[ ] bibliographic information

[ ] management information

[ ] others; Please specify _____

12. Are you satisfied with the available information?

[ ] Yes [ ] No

13. What do you think are the major problems in getting the right information?

[ ] absence of an organized information service

[ ] low level of recognition for role of information

[ ] inadequate financial capability

[ ] Other; please specify_____

14. What is your opinion about the information you get in relation to the following characteristics of information ? Please tick(√) in space provided.

	Very good	Good	average	Poor
Quantity				
Quality				
Upto-dateness				
Cost				
Coverage				

Use of Information Technology

15. Which Information Technology (IT) is your organization using in its day-to-day operation? (You can tick more than one)

    [ ] Computers [ ] Fax [ ] Telephone [ ] Telex

    [ ] E-Mail [ ] Others; Please specify _____

16. How did you get computer(s) and other IT you are using?

    [ ] Gift

    [ ] Purchased

    [ ] Others; Please specify _____

17. For what purpose do you use the computer(s), if there is/are any? (You can tick more than one)

    [ ] Word processing and Desktop Publishing

    [ ] Financial Analysis and Forecasting

    [ ] Statistical Analysis

    [ ] Records Management

    [ ] Others; Please Specify _____

18. Do you have any plan to introduce or further develop the use of IT in your business?

    [ ] Yes [ ] No

19. If you are able to get the information about the items in Question number 7 in digitized form (machine-readable), will you be able to use it?

    [ ] Yes [ ] No [ ] May be

20. If Yes, since costs are incurred in the production, processing, and dissemination of information, will you be willing to pay for the information you get in order to recover its cost?

    [ ] Yes [ ] No [ ] May be

\

21. How would you like to get the information?

[ ] hard copy (on paper) [ ] On floppy disk [ ] through E-mail

[ ] from central database [ ] Others; please specify _____

22. Do you have the technical capacity (trained manpower in IT) to make use of the developed system?

[ ] Yes [ ] No

23. Where do you want the business information system to be installed and maintained?

[ ] Addis Ababa Chamber of Commerce

[ ] Ethiopian Chamber of Commerce

[ ] Ministry of Trade

[ ] Other; Please specify _____

24. What is your general opinion about the use of Information Technology in facilitating your business?

_____

_____

_____

_____

APPENDIX II : INTERVIEW GUIDE

1. What are your activities?
2. Do you have any problems in providing information to the business community?
3. What do you think are the major constraints in getting business information?
    - Have you conducted any study regarding the information requirements of the business community?
    - Are there any ongoing projects and/or planned projects for solving the problem? Or are there any task force /committee setup for this purpose?
    - What are the measures taken to solve the problems, if any?
4. Are you willing to accept and maintain the proposed information system?
5. Do you have the technical capacity (both in terms of manpower and IT) to implement the prototype?
6. How are you providing information to the business community? Is it free or on cost basis?
7. What are your business plans in terms of providing the right information to the business community in the coming years?

APPENDIX III : PERSONS INTERVIEWED

1. Ato Shiferaw Bekele, Secretary General, Addis Ababa Chamber of Commerce.
2. Ato Hussien Shibeshi, Head, Trade Information Department, Addis Ababa Chamber of Commerce.
3. Ato Ahmed Addissie, Head, Information Service, Trade Information Department, Addis Ababa Chamber of Commerce.

APPENDIX IV : SAMPLE PROGRAM CODE

```
(*************************************************************************
* A hypertext based business information storage and retrieval system. The program has  *
*  also an expert system front-end to the database for facilitating the retrieval process.  *
*                                                                                *
*                          TESFAYE ADMASSIE                                      *
*                             MAY 1997                                           *
*                    SCHOOL OF INFORMATION STUDIES FOR AFRICA                    *
*                          ADDIS ABABA UNIVERITY                                 *
*************************************************************************)
fontdef().
title().

topic start.
        use_font(?bigFont).
        Text('#eFrom the following buttons').
        Text('#n#nHYPERTEXT ..... will take you to the table of contents of
                the hypertext database').
        Text('#n#nEXPERT HELP ..... will take you to the required information
                        through a guided tour').
        Text('#n#nTherefore,
                if you are a novice user, click on the EXPERT HELP button').
        Text('#n#n#t#tif you are an expert user and want to browse at your leisure,
                 click on the HYPERTEXT Button').
        e is button('EXPERT HELP',yes,15,25,20).
        n is button(HYPERTEXT,no,35,25,20).
        q is button(EXIT, quit,55,25,10).
        wait().
end.
(* ====================== for initiating the hypertext links=================*)
topic no.
   setup ().
   disable_window(?b8).
   file is 'business.txt'.
   getfile ().
end.

(*===========Reading the database file=========*)
topic getfile.
  set_focus (?w1).
  if ?file is []
     then exit ().
  message is read (?file,'//','//').
  close (?file).
  set_title (?wmain, 'HYPERTEXT-BASED BUSINESS INFORMATION SYSTEM').
  top is string_replace (first (?message),'//').
  list is [].
  mark (?top).
end.
```

```
(*================saving the displayed text=========*)
topic save.
    file=save_as('c:\thesis\out.txt').
    set_focus(?w1).
     data is get_text(?w1).
    write(?file, ?data).
end.

(*================Exiting module===============*)
topic Quit.
   exit_kp().
end. (* mQuit *)

(*=============Home module ================*)
topic Index.
 set_focus (?w1).
 if last (?list) <> ?top then mark (?top).
end.

(*=========== Backtracking module============*)
topic Back.
  set_focus (?w1).
  if list_length (?list) = 1
    then mark (?top)
  else
    list is sublist (?list, 1, list_length (?list) - 1) and
    item is last (?list) and
    list is sublist (?list, 1, list_length (?list) - 1) and
    (if ?item is help
       then help ()
       else mark (?item)).
    end. (* Back *)

(*===========Module for keeping track of traversed links and nodes ==========*)
topic position.
        w is window(OK,5,5,80,25,'Tracing module showing the path the user has taken',
[Siblings,thinframe,controlMenu,MaximizeBox,MinimizeBox,showChildren],,,lightgray).
        text('#e#tYou have traversed the following links#n').
        nlinks is sublist(?list,1,list_length(?list)-1).
        text(concat(#t, #m,?nlinks,#m)).
        text('#n#n#n#tYour Current Position is at:',concat(#t,last(?list))).
        b is button (OK,ok,30,20,10).
        show_window(?w).
        wait().

end.

(*=============Module for printing the diaplayed text=====================*)
topic PrintIt.
 set_focus (?w1).
 print (get_text ( ?w1)).
```

```
end.

(*====================the help module=======================*)
topic Help.
  set_focus (?w1).
  if last (?list) is 'Help'
    then exit ().
  list gets Help.
  set_text (?w1,'Help


        To select hypertext, point and click with the mouse or, use TAB
        and SHIFT TAB to move the cursor among hypertext items and press
        ENTER to select the item.

        To go back to the previous screen, select BACK.
        To return to the Table of Contents screen, select INDEX.
        To print the current item, select PRINT.
        To save the current item, select SAVE.
        To use the guided tour  for reaching to the desired information, select EXPERT.
        After using EXPERT, to see the line of reasoning, select HOW.
        To know your current position, select  WHERE AM I?
        To exit from the program and return to windows, select  EXIT.').

 set_active_window (?w1).


end. (*Help*)

(*========================= MARK ============================== *)

topic  mark (item).
   set_active_window(?wMain).
   list gets?item.
   displayText is read (?file, concat ('//',?item) ,'//') .
   if ?displayText is number_to_char (26)
     then displayText is '

  There is no information for this item.'.
   set_text (?w1,[#rd, ?item,?displayText] ).
   set_file_pos (?file,0,beginning).
end. (*mark*)


(* ==================== SELECT FONTS ============================ *)

topic b.
 use_font (?boldFont).
end.

topic d.
```

```
  use_font (?mainFont).
end.

topic l.
        use_font(bigFont).
end.
(* ============================ SETUP ============================ *)

topic setup.
  wMain is window (Finish,2,2,85,27, ,[popupwindow, thickFrame,TitleBar, ControlMenu,
MaximizeBox], , , , ).
  wB is window ( , 1,1,100,2, ,[child, visible, siblings, showChildren], ?wmain, , gray).
  b1 is button (Index,index,1,1,9).
  b2 is button (Back,back,9,1,9).
  b3 is button (Print,printit,17,1,9).
  b4 is button (Save,save,25,1,9).
  b5 is button (Exit,quit,33,1,9).
  b6 is button (Help,help,41,1,9).
  b7 is button (Expert,yes,49,1,9).
  b8 is button (How,how,57,1,9).
  b9 is button ('Where am I?',position,65,1,15).
  w1 is window ( , 1,3, element ( window_info (?wMain), 10), element ( window_info
(?wMain), 11)-2, , [child, siblings, horzScroll, vertScroll,showChildren, visible] ,?wmain).
  show_window (?wmain).
  list is []. (* keeps track of what you've looked at so far *)
end.
(* ======================== Font Definition ========================*)
topic fontdef.
        mainFont is create_char_font ( [1,1,400,'F','F','F',0,1,34,'Helv']).
        hyperFont is create_char_font ( [1,1,400,'F','T','F',0,1,34,'Helv']).
        boldFont is create_char_font ( [1,1,700,'F','F','F',0,1,34,'Helv']).
        bigFont is create_char_font ( [1.5,1.2857,400,'F','F','F',0,1,34,'Helv']).
        vbigFont is create_char_font([-2,1.2857,400,'F','F','F',0,1,34,'Helv']).
        font is create_char_font ( [-2.3125,0,400,'f','f','f',0,1,82,'Braggadocio'] ).
        rgb is 0.
        use_font (?mainFont).
        if last (system_info ()) > 2
           then :color is green2
           else :color is black.
        hyper_display (?color,,?hyperFont).
end.
(*=======================Explanation module for the interface============*)
topic how.
        w is window(,5,5,80,25,'Explanation module how you reached at the node',
[Siblings,thinframe,controlMenu,MaximizeBox,MinimizeBox,showChildren],,,lightgray).
        use_font(?bigFont).
        text('#eYou reached at this node because you chose#n').
        text(?why).
        use_font(?mainFont).
        b is button (OK,ok,30,15,10).
        show_window(?w).
```

```
        wait().


end.
(*================================*)
topic ok.
        close_window(?w).

end.
(*=====================================*)
topic cshelp.
        set_event_topic(chelp, sys_char_event).
        topic chelp(info).
                if ?info is F9
                        then help1 is read ('context.txt').
                        text (?help1).
        end.
end.
(*==========AN ALTERNATIVE TO RULE-BASED EXPERT INTERFACE=====*)
topic yes.
        cshelp ().
        use_font(?bigFont).
        wt is window(,1,1,92,30,'A Prototype Hypertext Based Business
ISRS',[Siblings,thinframe,controlMenu,MaximizeBox,MinimizeBox,showChildren],,,lightgr
ay).
        show_window(?wt).
        ask('#eWhat type of business information do you need?,#n Please double-click on
your choice ---------- F9 for help',businf,[Indicators,'Business
Directory',Procedures,'Government Regulations','Business Opportunities',Prices,'Foreign
Trade','Useful Addresses','Places of Interest']).
        do(?businf).
        topic 'Foreign Trade'.
                ask('#eWhich type of foreign trade information do you need?, #nPlease
Double-Click on your Choice',ftrade,[Export,Import,'Commercial Representatives
Abroad']).
                do(?ftrade).
                topic Export.
                        ask('#eBy which category?, #nPlease Double Click on your
choice',category,['Commodity type','Country of Destination']).
                        do(?category).
                        topic 'Commodity type'.
                                ask('#eWhich Commodity type?,#nPlease double click on
your choice',comtype,['Live Animals','Butter and other Fats and
Oils',Vegetables,Coffee,Pepper, 'BuckWheat, Millet and Canary','Oil seeds','Natural
gums','Vegetable Waxes','Bread,Pastry, Cakes and Biscuits','Wine of Fresh
Gape','Cement','Raw hides and skines','Leather of Bovine or equine animals','Sheep or Lamb
Skin','Woven Fabrics',Carpets,Footwear]).
                                filesetup().
                                why is [?businf,?ftrade,?category,?comtype].
                                mark(?comtype).
                        end.
```

```
                topic 'Country of Destination'.                                  Customs
                        ask('#eExport to which country?,#nPlease Double Click on
your choice',countrydes,[Djibouti,Gambia,Lesotho,'South
Africa',Egypt,Zambia,Austria,'Belguim-
Lux',Czechoslovakia,Denmark,Finland,France,Germany,Greece,Italy,Netherlands,Norway,S
pain,Sweden,Switzerland,'United Knogdom',Russia,Canada,'United
States',India,Indonesia,Israel,Japan,Jordan,'South Korea',Malaysia,'Persina Gulf
States','Saudi Arabia',Singapore,Yemen]).                                        :d
                        filesetup().
                        why is [?businf,?ftrade,?category,?countrydes].
                        mark(?countrydes).
                end.                                                             p,['Live
        end.
        Topic Import.
                ask('#eBy which category?,#nPlease Double Click on your choice
',category,['Commodity type','Country of Source']).
                do(?category).
                topic 'Commodity type'.
                        ask('#eWhich Commodity type?,#nPlease Double Click on
your choice',comtype,['Milk and cream, not concentrated','Butter and other fats and oils
from milk','Cheese and Crud','Tea,whether or not flavoured','Wheat and
Meslin',Rice,Yeast,Medicaments,Fertilizers,'Paints and
Varnishes',Perfumes,Soap,Matches,'Photographic films in rolls','Photographic
paper',Insecticides,Tyres,'Carbon Paper','Men"s or Boy"s suits',Millstones]).   ation and
                        filesetup().
                        why is [?businf,?ftrade,?category,?comtype].
                        mark(?comtype).
                end.
                topic 'Country of Source'.
                        ask('#eImport from which country?,#nPlease Double Click on
your choice',countrysou,[Djibouti,Gambia,Kenya,Lesotho,Nigeria,'South
Africa',Egypt,Senegal,Somalia, Zimbabwe,Sudan, Swaziland, Tanzania,
Zambia,Austria,'Belguim-
Lux',Czechoslovakia,Denmark,Finland,France,Germany,Greece,hungary,
Ireland,Italy,Netherlands,Norway,Spain,Sweden,Switzerland,'United
Knogdom',Russia,Brazil,Canada,Cuba,'United States',China, 'Hong
Kong',India,Indonesia,Israel,Japan,Jordan,'South Korea',Malaysia,'Persina Gulf
States','Saudi Arabia',Singapore,Yemen]).                                       ==========*)
                        filesetup().
                        why is [?businf,?ftrade,?category,?countrysou].
                        mark(?countrysou).
                end.
        end.
        Topic 'Commercial Representatives Abroad'.
                filesetup().
                why is [?businf,?ftrade].
                mark(?ftrade).
        end.                                                                     =*)
end.
Topic 'Government Regulations'.
```

DECLARATION

The thesis is my original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

Tesfaye Admassie
May 16, 1997

The thesis has been submitted for examination with our approval as university advisors.

Dr. G.G. Chowdhury
May 16, 1997

Ato Sisay Fissaha
May 16, 1997