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Object-oriented Planning and Policy Database Development: A Case Study of the Ministry of Economic Development and Cooperation

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OBJECT-ORIENTED PLANNING AND POLICY DATABASE DEVELOPMENT: A CASE STUDY OF THE MINISTRY OF ECONOMIC DEVELOPMENT AND CORPORATION

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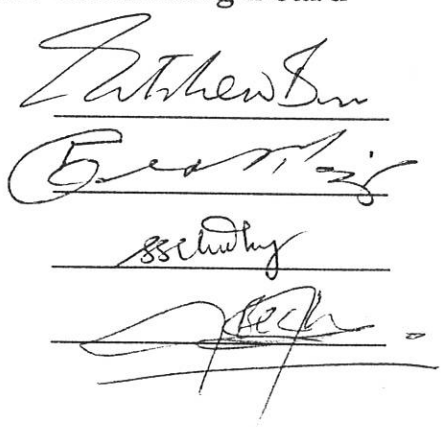

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ABSTRACT

Currently, Ethiopia is undertaking major reforms in its economic system through the introduction of a market-based economic policy. Among the effects of these are the increase in the volume of trade and international relations and a shift in the role of the government in controlling the economy from micro-level to macro-level. The macro-level management (in particular, the formulation of tangible policies and plans to manage/control the macro-economic activities), in turn, requires more than any thing else timely and complete information on socio-economic as well as spatial variables at various levels. However, problems in accessing even available information for the purpose indicated have been repeatedly cited at the Ministry of Economic Development and Cooperation (the government organ in charge in this respect).

This study, therefore, was undertaken to establish the information requirements and assess the major problems of accessing available information at the ministry, with the view of exploring the application of the features and capabilities provided by object-oriented techniques, in tackling the information access problems.

Experts at the ministry were surveyed. On the basis of data gathered during the survey, organization-level information requirements are identified; inventory of existing capabilities is made; the information provision problems are analyzed.

Development of an integrated database system (with "multimedia" features, i.e., that supports text and image), is identified as one of the requirements in tackling the existing problem. An attempt is also made to summarize the limitation of conventional approaches to implement such database, as well as demonstration of the application of object-oriented development techniques (as an appropriate alternative) database through prototyping. Further, recommendations are made for consideration by the ministry, to fully benefit from the solution suggested by way of identifying major activities to be carried out to develop the prototype database into a fully operational (mature) database.

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1. INTRODUCTION

1.1. Background

The constantly changing trend in information technology is rapidly introducing new concepts and means in information retrieval systems. Conventional information retrieval systems built on the basis of traditional approaches for textual information handling are no longer the preferred means for information handling practices in such dynamic areas of economic planning and policy analysis whose information requirements are not only complex in nature but constantly changing. Object-oriented approaches are among the new techniques that are coming into the scene with features and capabilities that enhance the performance of conventional storage and retrieval techniques to meet the challenges in such areas.

> Object-orientation is "an approach to systems development that proposes the use of system "objects" to build new systems and rebuild old ones" (Weinberg, et al, 1989). It tries to model and represent the real world in terms of objects which are easier to visualize and understand.

Since development planning and policy analysis in any economic system involves activities that are deemed state responsibilities, the greater the number of activities the more complex the macro-economic decision making procedures become. For such a complex decision making process, therefore, information on various socio-economic aspects is required. The information required, especially, at the national level, includes large volumes of data on the physical, social, economic and ecologic systems (Taddesse, 1988). The types of information

involved, come in numeric, text (long text and variable length text), image and graphics forms.

Use of object-oriented technologies in the design of modern information storage and retrieval system has been increasing and seen as a better means that deserves attention. Currently, there is an upward trend in the interest for the object-oriented approach as a way for overcoming drawbacks in traditional data models (Clementini and Felice, 1994). Because the object-oriented approach tries to model the real world as closely as possible, databases built on the basis of this approach are reported to avoid system complexities and have greater efficiency. The capability to model the real world in a closer way has the advantage of representing and manipulating links and relationships among entities in a direct way.

The object-oriented approach has been praised also for its handling of complex types of information such as set and tuple valued with greater efficiency and effectiveness. "Complex objects can be represented in various ways in the sense of a structural object-orientation." This feature combined with other aspects has been proven to handle better information types such as geographic, environmental and engineering (Gunther and Lambarts, 1994). It is this capability that makes it an appropriate approach in the management of planning information where such data types are required.

1.2. Statement of the Problem

Recently, Ethiopia has been undertaking major reforms in its economic system through the introduction of market-based economic policy. Among the effects of this are increase in the

volume of trade and international relations and a shift in the role of the government in controlling the economy from micro-level to the macro-level.

As indicated earlier, there is no doubt that information is indispensable to the formulation of tangible policies and plans to manage/control the macro-economic activities. Huge amount and complex types of information are demanded for purposes of plan formulation and policy analysis.

In the Ethiopian economic management situation there is substantial evidence (Taddesse, 1988) that there has been a persistent problem of accessing available information. Information on socio-economic as well as spatial variables has been difficult to access to a degree required for planning purposes. There is a sub-optimal utilization of information generated from various sources. Among the major factors, cited by workers in this area (Zhou, 1992), contributing to this problem are the absence of proper organization of the available information and a suitable mechanism for timely delivery to the user.

That use of information technology (IT) can improve the accessibility of information required in the planning, management and productivity of all types of economic development activities is not disputed. Use of properly designed IT-based information systems can greatly enhance policy analysis and macro-economic management by allowing a computerized capital project financing, disbursement tracking, physical progress and technical assistance monitoring of projects, monitoring of foreign exchange commitments, tailoring budget production to policy analysis, provision of multi-sectoral socio-economic information, etc. (Hanna, 1991).

At the Ministry of Economic Development and Cooperation (MEDaC) even if the role that IT can play in the provision of information has been, it could be said, well recognized and practical measures have been taken to acquire a fairly large number of micros with relatively newer technology, the level of utilization is very low. Almost all of the personal computers (PCs) that are currently available are loaded with software that is meant for low level routine/clerical operations such as word processing and spreadsheet, and statistical (econometric) analysis to a lesser extent in unorganized manner.

Although attempts were made to set up an information center and install a rudimentary Local Area Network (LAN) to connect the PCs with the aim of upgrading the level of utilization, the support provided is far from that needed. The use of the PCs is still limited to stand alone clerical functions. Information systems that address specific user needs at planning and policy analysis level are absent. So far, no user study has been undertaken to address the issue.

Thus, information mainly for the technical experts, middle level management and the higher level management is difficult to get at a required level and within a required time. Obviously this will have a negative impact on the management of the economy as a whole as activities in planning and policy analysis are highly dependent on information. Thus there is a need to seek ways to alleviate these problems.

The ministry owns relatively better IT facility in relation to similar local institutions. Considering this and the change taking place in the area of IT improvement, it is projected that an information storage and retrieval system that will provide multimedia facilities will impove the situation being investigated. Thus, the system by providing services for handling

of image documents and text documents along with simple structured data in an integrated manner, will greatly enhance the access to available information.

To this end, this study tried to assess existing problems and requirements so as to explore the possibility of benefiting from the advantages offered by object-oriented technology in database building to minimize the prevailing problems. In particular, it tried to look into the hypothesis that ***reported information access problems were not significant against there were serious problems in accessing information at the Ministry of Economic Development and Cooperation with a view to tackle the significant problems based on the object-oriented methodology***.

To summarize, the specific problems on the basis of which this study is initiated are:

- there are persistent problems of information access at the Ministry of Economic Development and Cooperation;
- policy and planning systems need to have databases that incorporate numeric, text, image and graphics;
- the current applications to database design are not able to accommodate this multimedia type of information;
- a need for database services that would come to the aid of the middle level professional and management as well as the upper management in providing required information at each level;
- a need for exploiting the advantages offered by object-oriented technology that would enhance the design and development of databases.

1.3. Justification

Application of IT in economic development management is not something that can be undermined in today's competitive world. It has an immense power in transforming activities which would bring a positive impact in an organization's performance or a country's socio-economic status. It is "the driving force for a new techno-economic paradigm with far reaching effects" for all types of economic activities (Hanna, 1991). As information for planning and policy analysis includes cartographic, geologic and other with image content, a need for an appropriate information retrieval system to handle textual and image information is apparent.

As most of currently available retrieval systems are based on traditional database technology which are for the most part made up of text, they have limitations in handling complex data types such as images, long text and variable length text as a single unit. "Applications that involve complex data and operations are not served well by conventional data models and DBMS" (Hurson and Pakzad, 1993) an argument that may go well for database systems intended to serve in areas of planning where images are greatly involved.

The traditional database technology does not provide the fundamental components to support integrated applications that use multimedia data types such as long texts, image, voice data (Khoshafian, 1993). Their applications tend to have structured data records each record usually being assigned a few bytes of memory (Gunther and Lambarts, 1994). Relational systems which are well known for their simplicity and mathematical foundation require that data be at least in first normal form which leads to an awkward decomposition of data and thus poor performance (Hurson and Pakzad, 1993). Therefore, their application

in designing an information retrieval system which can also handle geographic data would have severe problems which would call for an alternative.

Recent development in the technologies such as multimedia and object-orientation are bringing about dramatic changes in the way we store and retrieve (access) information. The capabilities of object-oriented systems to deal with non-homogeneous data have made them suitable for multimedia data types. This feature, especially in handling variable length and long strings, and complex objects (possibly composite objects) makes them more preferable to other conventional systems in areas where such type of data are dealt with. Therefore, information in documents in a form of graphics/image and simple structured forms can be managed easily with such systems. This is more difficult to do with conventional systems because of their inherent drawbacks to provide mechanisms for integrating such information types into a single system.

Hence, in order to build a database that can handle an integrated database in a multimedia environment, adapting object-oriented technology is considered a better choice. In view of the foregoing arguments the thesis tries to explore the features of object-oriented database technology praised elsewhere in modeling databases for handling textual and image information in an integrated manner, and by making use of locally (at the ministry) accessible technologies .

1.4. Objectives of the Study

General Objective:

The general objective of this study is to determine existing information access problems and requirements with a view to explore the features that an object-oriented method provides in designing and developing a database which would contribute towards the attempt to improve the access of information at the Ministry of Economic Development and Cooperation.

Specific objectives:

In order to meet the general objective stated above the specific objectives outlined below have been formulated.

1. To asses/analyze the information requirement and information access problem of the planners and policy analysts;
2. To explore the limitations of the application of conventional approaches to the design and development of information systems at this level;
3. To apply an object-oriented approach to the design and development of the prototype database for economic planning and policy information retrieval;
4. To explore the implementation requirements and constraints of the developed prototype into a full/matured application system.

1.5. Method

The method of conducting this study consisted of first reviewing the information requirement at MEDaC, followed by designing an integrated database with multimedia features as one proposed solution to meet the information requirements. At a third stage,

an attempt was made to demonstrate an aspect of the database system proposed using existing technological facilities at the ministry.

To determine the information requirements, a survey was conducted in addition to the reviewing of official documents and related literature. A questionnaire was used during the course of the survey as a means to collect data on major requirements and problems faced, together with planned discussions on certain issues that required further information with selected members of the ministry. Simple random sampling was applied in selecting the respondents at the ministry, and thus, randomization was ensured when selecting respondents by the use of random numbers. The sample size was made to include 30% of the population, thus, out of the total size of 170 professionals engaged in planning and policy analysis activity (the target population) 51 were selected. Though it was possible to go for complete enumeration of the population, sampling was preferred because

- there was a need to reduce costs of materials and processing due to budget constraints;
- processing time would have taken longer;
- based on the pilot survey, it was assumed that information obtained from this many respondents would be enough.

A questionnaire, which included 36 questions divided into five sections, was prepared for the final administration (Appendix 1). Before coming up with the final questionnaire, a pilot survey was conducted to test validity of questions and to see unattended areas. The five sections included questions on information requirements, information presentation formats, problems related to information access and information technology (computer) facilities. There was a 94% response rate, i.e., out of the 51 people who had received the

questionnaire 48 responded. Statistical techniques of qualitative data analysis (Chi-square analysis) were employed to come up with inference statements in respect of problems reported, where appropriate. SPSS 6.1.3 for Windows statistical analysis software was used in analyzing the collected data.

While the object-oriented method based on Lorenz(1993) and Khoshafian(1993) were used for the purpose of designing the proposed database, prototyping approach was employed to demonstrate the development of the project monitoring management module using dBASE 5.0 for windows

1.6. Scope and Limitations

Although the study tried to assess general information requirements at the ministry, it did select only the industrial project for prototyping and demonstration due to the vastness of the ministry and the shortage of time within which the prototype was developed. Individual departmental information needs also have not been addressed in detail.

Sample size determination for the survey was more subjective because of two reasons:

i) readily available estimate of the parameters to be measured was not available;

ii) the population to be sampled was relatively smaller for the probability sampling formula to be used.

A case study approach has been adopted to demonstrate the application of object-oriented principles for designing a database that will address information requirements at planning and policy analysis level using existing facilities.

The development of the prototype has not been done in a truly object-oriented DBMS environment because of the unavailability of such software locally. dBASE 5.0 for Windows is primarily a relational system although it provides features of object-orientation for data manipulation in the volatile memory and interfacing routines. For instance, the selected software does not provide facilities for persistent classes.

For reasons of reducing the size of the project to a manageable proportion, keeping in view the resources available, the study did not provide a detailed design of a fully integrated database, nor was it necessary at this stage.

1.7. Organization of the Thesis

The thesis is organized into five chapters. The first chapter is the introduction which contains the statement of the problem, justification, objectives, method, scope and limitations, and, of course this section. The second chapter presents the existing situation at MEDaC, introduces what planning is, country profile about Ethiopia, the current organ(MEDaC) responsible for planning and policy analysis, outlines user information requirements at the ministry and presents problem analysis. The third chapter is a literature survey of object-oriented methodology used in the database design of the prototyping. Chapter four presents the database design and exploratory prototype. Chapter five is left for conclusion and recommendations.

2. The Existing Situation: a survey

Planning is an activity whereby a certain organ (could be central government or regional) attempts to lay down what it will do or might do in the future. It is an act of making decisions in advance on what to do, when to do and by whom to do based on past events (historical facts), existing resource base and an assessment of the future. Economic planning at national level is a process of deciding how the factors of production of a country shall be allocated among different sectors, thereby deciding how much of all kinds of goods and services shall be produced in the ensuing period.

Economic planning at national level is needed because labor and productive resources are scarce relative to the demands up on them. If there were enough productive capacity to provide everything desired, there would be no need for planning. Therefore, economic planning represents an effort to coordinate economic decision, the allocation of factors of production among different sectors to produce the necessary quantities of goods and services, over the years in order to give direction to and accelerate a country's development. As such it is involved in the setting up of priorities, determining objectives, setting goals and targets, charting policies and strategies, etc.

There are many different types of plans depending on the nature of planning goals, the scope of planning activity, the spatial level of planning activity, the length of plan period or the political system and ownership pattern. Thus, preparing a plan takes such given situation into account, is usually based upon principles and objectives which guide decision making on particular matters, i.e., policy.

The remainder of this chapter attempts to provide an assessment of the existing situation at MEDaC as a prelude to the proposed database solution in the next chapter. Background information on MEDaC is provided in terms of establishment, objective and organizational setup. This is followed by a review (on the basis of the survey) of organizational level information requirements, existing level of support and analysis of problems in the existing system, respectively.

2.1. Background

2.1.1. Country Profile

Ethiopia has a total land area of 1,130,000 square kilometers[1]. The country is divided into 9 regions and two metropolitan administrations. The central government is a federation of the 9 regions. The total population for the 1994 projection was 54,539,000 with annual growth rate of 2.78%(CSA, 1995). Gross domestic product for the year 1994/95 was estimated at 12644.34 million birr and was growing at an annual growth rate of 5.4% . Percapita income for the same year was estimated at 223 birr[2].

Ethiopia is one of the poorest and least developed countries in Africa. Its economy is highly dependent on subsistence agriculture. About 80% of the total employment is in the agricultural sector. Agriculture contributes about 42% of the GDP and 90% of exports[3]. The manufacturing sector is heavily dependent on inputs from the agricultural sector.

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[1] Department of Regional Planning, Ministry of Economic Development and Cooperation
[2] National Accounts Team, Ministry of Economic Development and Cooperation
[3] National Accounts Team, Ministry of Economic Development and Cooperation

2.1.2. The Ministry of Economic Development and Cooperation (MEDaC)

Establishment

The history of economic development planning in Ethiopia can be classified into three categories on the basis of the type of the political system the country was having and thus the type of economic policy followed. The first category includes the period from 1957 to 1974(the year the emperor was overthrown) during which a series of three five year development plans were prepared. Of course, the first planning organ, the Planning Council, was established in 1954 under order no 15/1954 (Negarit Gazeta, 14th year No. 3). The three five year plans were: The First Five Year Plan(1957 - 61) (Imperial Ethiopian Government, 1957), The Second Five Year Plan (1963 - 1967) (Planning Board, 1963) and The Third Five Year Plan (drafted in 1968-69) (Planning Commission, 1968). Planning was done to direct government investment activities, and foster the private sector participate in the development process in an environment of a mixed economy type whereby both public and private ownership were encouraged.

The second category was the time when the military government was in power(1974 - 1991) and was characterized by the central command economic system with strict control of the economy by the government. During this time the central planning authority was strengthened and took various names indicating the high priority for central planning in 1977, 1978 and 1984 being named as Central Planning Commission(Negarit Gazeta, 36th year No. 29), National Revolutionary Development Campaign and Central Planning Supreme Council (Negarit Gazeta, 38th year No 4) and Office of the National Committee for Central Planning (Negarit Gazeta, 43rd year No 13), respectively.

The third part of the planning history period started in 1991 when the current government took power. According to the policies drafted by the government, market economic principles have been followed (Transitional Government of Ethiopia, 1991), and in line with this the planning

ministry has been reorganized, and in 1996 again without any significant divergence from preceding policies (i.e., during the transitional period) the government reorganized (renamed) the Planning Ministry as Economic Development and Cooperation Ministry with broader mandates, i.e., with additions of coordinating foreign assistance and loan mobilization to its previous mandates.

Duties and Responsibilities

The Ministry of Economic Development and Cooperation was established in 1995 (reorganized as a successor to the previous ministry) and has the following duties and responsibilities (Negarit Gazeta, proclamation No. 4/1995):

- *"initiate policy proposals that help to define the country's long-term development perspective and, on the basis of same, to set development priorities and strategy;*
- *prepare and, upon approval, follow up the implementation of long, medium and short-term development plans that are based on the country's development strategy and to be executed by the Federal Government;*
- *prepare the population policy of the country; and, upon approval, follow up its execution;*
- *in cooperation with the concerned organs, cause the study and preparation of and review projects based on the long, medium and short-term plans and to be executed by the Federal Government;*
- *prepare annual development program and supporting capital budget proposal upon analyzing development programs and supporting capital budget proposals received from Federal Government organs; present said annual development program and supporting capital budget proposal to the Ministry of Finance for*

consolidation into the annual Federal Government budget and upon approval, follow up the implementation of same;

- *identify investment areas on indicative plans to assist the private sector in making investment decisions; in cooperation with the appropriate organs, initiate policy proposals with a view to encouraging and promoting the private sector;*
- *undertake economic studies and research and prepare plan methodology and general macro economic and social parameters and guidelines that enable the preparation of the country's long, medium and short-term development plans;*
- *cause the carrying out in mapping, statistical and other development information, in its own field;*
- *prepare plan preparation and presentation guidelines; ensure the distribution in due time of same to concerned organs;*
- *formulate strategies with a view to increasing the type and volume of foreign development aid and loans; negotiate and sign aid and loan agreements and, in cooperation with the concerned organs, follow up their implementation;*
- *evaluate the execution of development plans and submit annual report to the Council of Ministers" (Federal Negarit Gazeta, first year, No 4/1995).*

Organizational Setup

To discharge the above mentioned duties and responsibilities, the ministry is currently organized as shown in figure 2.1 below. There are 407 personnel in the 11 departments and 4 supporting service units, out of which 170 are professionals engaged directly in planning and policy analysis, the target population this study selected.

The ministry has been divided into two major divisions along functional lines. Departments of Macro Planning and Policy Analysis, Development Finance, Regional Development Planning, Development Projects deal with macro aspects, i.e., like policy analysis and national policy frame-work, national accounts, analysis of national economic indicators, grand budget ceiling setting, project preparation, setting parameters and criteria at a macro level, economic model analysis, etc., come under the Office of the Vice Minister for Macro-Economic Development. On the other hand, departments of Agriculture, Industry and Trade, Development Infrastructure, Mining and Energy, Bilateral Cooperation, Multilateral Cooperation, and Human Resources and Social Development deal with specific sectoral issues, and come under the Office of the Vice Minister for Sectoral Economic Development and Cooperation. They set sectoral plan objectives, strategies, investment ceilings, production and service control figures, sectoral policy, etc. Among them departments of Bilateral and Multilateral Cooperation, however, do have different functions as they are engaged in coordinating foreign resource mobilization.

Supporting units with in the ministry provide services of various kinds to enable other departments discharge their duties. The Administration and Finance Service is responsible for administrative and financial matters within the ministry. The information and Conference Service is a public relations unit and together with Audit and Legal Services is directly accountable to the minister. The two other services, Library and Documentation Service and Computer Service do have responsibilities for storing and providing information, and the Computer Service in addition provides maintenance service for micro-computers and their accessories.

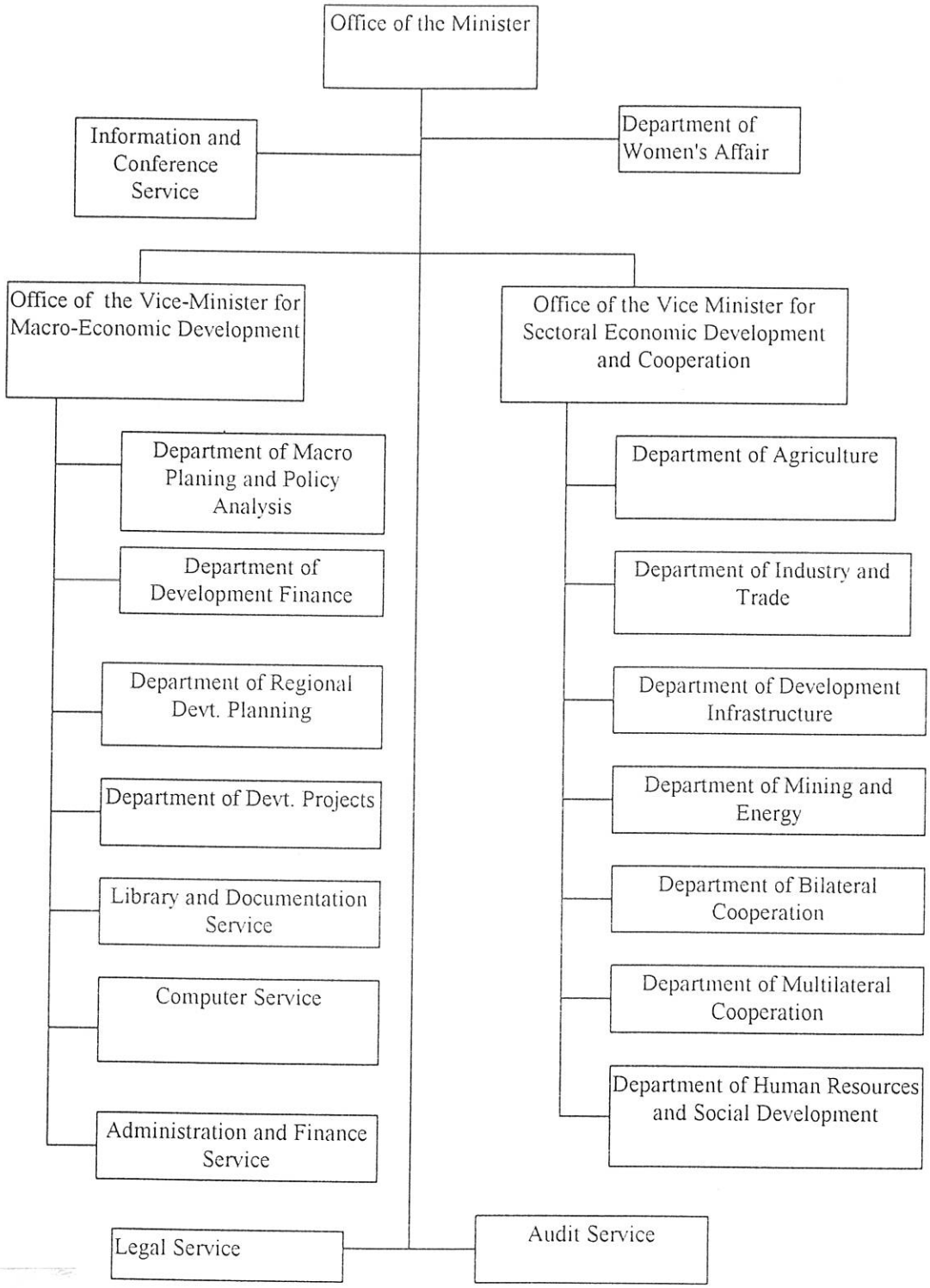

Figure 1.1 Organizational Structure of the Ministry of Economic Development and Cooperation

2.2. Information Requirements

2.2.1. The Planning Process

The process of planning involves a number of steps and activities which are to be performed by the planning organs. In any plan preparation, the following general activities are done.

- Reviewing the past performances and existing situation.
- Setting objectives, targets and strategies.
- Setting resource limits within which the plan is to be realized.

After these activities are completed, details are worked out in line with the objectives and resource limits.

Keeping this in view, the Ministry of Economic Development and Cooperation, in line with its duties and responsibilities,

- prepares long-term plan framework;
- prepares medium and short-term plans on the basis of the long-term framework;

to meet the country's development needs.

In particular, the planning process at MEDaC involves the following activities.

- investigation of the economy's past performance and existing situation;
- revising the long-term (strategic) plan and the medium-term plans
- preparing annual programs.

The process includes the determination of capital outlay settings within which details of plans are prepared.

For instance, regarding individual project preparation within the framework of the medium or long-term plans, the following steps are employed.

- According to its duties and responsibilities, a project initiation is caused by the ministry in cooperation with concerned organs;
- The ministry reviews and approves project proposals in line with the country's development plan framework and the annual program settings; if not satisfied, asks for further studies and clarification;
- Includes the project within the annual program framework if approved;
- Asks the implementing agency for an implementation plan for the project;
- Monitors the progress of the implementation of the project on the basis of the implementation plan.
- prepares project monitoring reports monthly, quarterly, bi-annually and annually as the case may be.

The above processes have been indicated in a more general way and at organizational level. When going deeper one gets further break downs of the process into specific areas. For each specific area, as indicated in the organizational structure, there is a department responsible to take care of the planning process in the respective area. For instance, the Industry and Trade Department has the following, among others, main duties based on the general frame-work of the national plan.

- prepare long, medium and short term plans regarding the sector;
- set annual capital budget for the annual programs of the sector;
- propose policy options which it believes add up to the sector's development;
- regarding the development of the sector, propose project initiation ideas, cause the study of projects, evaluate/review project proposals and approves them;
- sets criteria and parameters that are used in preparing plans for the sector;
- prepare reports of various kinds.

In order to effectively discharge the above duties, the department requires information on the manufacturing, small scale industries, the trade sector and the macro-economic situation. It also requires information on the progress of existing project implementations, new project proposals, government regulations, international situations, and bilateral and multilateral cooperation, etc., concerning the sector.

Sources of the indicated information are: other ministries, the Central Statistical Authority, consultants, contractors, regional offices, international organizations, mass media, documentation centers and libraries in the form of documents, newspapers, bulletins, lists/tables of figures, images, memos, letters, etc.

2.2.2. Organizational Level Information Requirements

The survey indicated that information on each of the following subject areas is required for planning and policy analysis at MEDaC.

- Agriculture
- Manufacturing
- Mining
- Finance
- Project Monitoring
- Climate
- Macro-economic indicators
- Education
- Health
- Foreign Assistance and Debt Situation
- Bilateral and Multilateral Agreements
- National and Regional Budget Allocation and Implementation
- Human Geography
- Location
- Population Dynamics
- Environment
- Infrastructure such as

* buildings
* roads
* telecommunication
* air transport

As can be seen these are broad general categories of information required at organization - wide level, not at departmental level nor application level. More specific detailed information required in respect of each category is presented in chapter 3 of this report.

2.2.3. Sources and Formats of Information

The format of data required include tables containing quantitative indicators, report documents such as feasibility reports, agreement documents and status reports, pictures/images/graphs included in textual documents or alone like cartographic ones. Data based on time domain (time-series) and cross-sectional are demanded for various purposes. While aggregation level varies according to demands, generally information/data by spatial aggregation, by indicator type, by project, by household are required.

The information needed can be categorized into four broad use areas: planning, foreign debt and assistance management (foreign resource mobilization), policy analysis, and project implementation monitoring and evaluation. Although the categorization seems to make distinct classification of information types into these categories, there is an overlap of needs, i.e., the same information may be required in the three areas.

The bulk of the information used at the ministry is obtained from outside the office. According to the survey, the following sources are identified.

Domestic Sources

- Central government ministries and other agencies, the main supplier being Central Statistical Authority
- Regional government offices
- Non-governmental aid agencies
- Private organizations engaged in commercial activities

Foreign

- Multilateral organizations such as the World Bank and other UN agencies
- International Publications such as journals

Much of the information received from outside is in a form of documents containing descriptive text and quantitative figures. In certain cases documents may include charts, maps, designs or plans, i.e., there are image contents for some documents. There are also documents which are almost exclusively dedicated to tables containing facts and figures like the annual sample surveys coming from the Central Statistical Authority. At times information is also collected without receiving formal documents. In such cases quantitative figures are obtained from different sources for various purposes.

2.3. Existing Level of Support

2.3.1. Departmental Systems

All departments own micro-computers which are used for secretarial purposes, spreadsheet handling, records management, financial analysis and statistical analysis. However, well

organized storage, retrieval as well as processing are lacking. In case of manual systems, there are storages of employee records which are well organized.

2.3.2. Central Systems

To meet its need for information required for planning and policy analysis, the ministry depends on its library and documentation unit. It has also created an information unit (the Computer Service) within its organizational setup that deals with modern information activities. The unit has been entrusted to do among others the following main activities (among other things):

- information systems development;
- developing and maintaining databases for purposes of information provision;
- system maintenance.

2.3.3. Hardware and Software Facilities

The ministry has acquired personal computers and accessories with various makes, models and computing capacities in order to enhance its overall activities. Since the arrival of the first computers in 1987[4], many more have been purchased and made available to users at various times. According to information obtained from an inventory of existing hardware and software, the following list of hardware and software is available.

I. Hardware[5] and Operating Software

1. Micro Computers available

- Intel 80386 with 16, 20 and 25 MhZ clock speed 23 in number
- Intel 80486 with 25, 33 and 66 MhZ clock speed 23 in number

[4] The source is an internal document describing the purchase of computers
[5] Does not include micros prior to intel386 models

- Pentium with 90, 100, 133 and 166 MhZ clock speed 16 in number

The micros are located in the various departmental and service units within the ministry.

2. Printers available

- Dot Matrix Printers 42 in number distributed all over the departments and services.
- Laser Jet (HP-LaserJet III, HP-LaserJet IV /4 plus and HP-LaserJet 5) 12 in number. Their distribution is one at the Computer Center, at the minister's and the two vice ministers' offices 1 for each, the rest distributed to 7 departments and the Administration and Finance Service.

3. Operating Software

- DOS 5.0 and 6.2;
- Windows 3.1, 3.11 and Windows95 (available at the Departments of Agriculture and Bilateral Cooperation)
- Database Management - dBASE 1.5 and 2.0 for DOS

II. Other Software Packages

- Word Processors - WordPerfect 5.1 for DOS, WordPerfect 5.2 for Windows, Word 2.0, 6.0 and 7.0 for Windows (Word 7.0 available at the Bilateral Cooperation and Women's' Affairs departments)
- Spreadsheet - Lotus 3.4, Excel 4.0 and 5.0 for Windows
- General Statistical Software - SPSS 6.1.3 for Windows available at the Department of Agriculture.

- Econometric and Time series Analysis Software - TSP, GAMS, used for econometric model building and time series data analysis at the Macro Planning and Policy Analysis Department.
- Project Management Software - COMFARIII, used for economic feasibility analysis of a project and found at the Computer Center and the Department of Development Projects.
- Graphics - Harvard Graphics 3.0 for DOS available at the Computer Center.

As the above lists show, there is a wide range of software list, and computer hardware with varying models and capacities. The use of these hardware and software also varies. Application of them include office management, statistical compilation (analysis), budget preparation and monitoring, as a storage for data/information and others. The results of the survey showed that out of those who use computers and who responded to the question (Q33 in the questionnaire), 26 were using them for word processing, 9 were using them for financial analysis and forecasting, 12 were using them for statistical analysis, 11 were using them for records management, 16 were using them for various tables handling. Even though comparison on absolute terms is not a way of getting more reliable picture, one can say based on the mere high discrepancies of the absolute figures that more of the existing computer resource is used for word processing.

The level of application, when seen from the point of view of the decision hierarchy may be classified as conventional data processing, control level and strategic level. Application of the computer resource may also be classified according to these levels. At lower levels, i.e., routine data processing activities, use of computers is minimal as most of routine activities with transaction nature, i.e., those activities related to internal financial administration,

inventory control and transport, are carried out, in most cases, manually. It can be said that most use of computers is directed to office management and to a lesser extent for activities directly or indirectly related to the needs of experts, middle level managers(control level) and top level managers (strategic level). To this effect computers are used for national budget compilation, preparation of agreement documents, statistical analysis and project monitoring works

Regarding the coordination or integration of the different hardware and software as well as application areas, one can say that there is no integration at all. The departments, even an individual user, operate or use computer resources independently without any knowledge of what happening within the office. Whatever is done or produced there seems/is no standard that governs it.

2.4. Analysis of Problems of the Existing System

In order to go for the analysis and subsequent inference, there is a need to formulate the hypothesis in advance. Thus, in a more general way the null hypothesis that ***reported information access problems were not significant*** were tested against ***there were serious problems in accessing information at the Ministry of Economic Development and Cooperation***.

The analysis of responses regarding existing problems was divided into access to existing information, accuracy, availability, conformance to demand, consistency, timeliness and adequacy of internal information services. Chi-square tests have been applied to verify response differences among (between) categories or groups. Theoretical values for Chi-

square at 5% significance level for 3 and 1 degrees of freedom are 7.81 and 3.84, respectively.

Before going into the analysis, a brief introduction of Chi-square is felt important. We may use Chi-square in testing to see if a sample distribution sufficiently conforms to some theoretical distribution, to decide whether or not the sample has been drawn from a population having the specified distribution, and to see if there is a significant difference in the frequency with which several categories of observation. This is an extension of the tests of proportions where only two categories of observation could be dealt with (Yeomans, 1979). Therefore, the use of Chi-square in this study is to see if there is a difference between different categories. The formula for Chi-square is given by

$$\text{Chi-square} = \sum(O-E)^2/E$$

Where, O = observed frequency

E = expected frequency

Access to existing information. The responses to question 13 ("How do you rate the accessibility of the available information?") are summarized in Table 2.1 below. From the summary one can say there was access problem to already available information. 59.6% of the total respondents who answered the question chose the category "poorly accessible". In order to analyze further, the respondents who gave answer to the question were divided into two groups: those who responded as "inaccessible" or "poorly accessible" under the first group and those who responded as "moderately accessible" or " accessible" under another group. Then a Chi-square test was applied for differences of group proportions. The results are displayed in Table 2.2.

Table 2.1. A Summary of responses to information access ratings

Rating		Frequency	Percent
inaccessible	(1)	3	6.4
poorly accessible	(2)	28	59.6
moderately accessible	(3)	12	25.5
accessible	(4)	4	8.5

Table 2.2. Chi-square Analysis for information access ratings in two broad categories

Category	Cases observed	Expected	Residual
First (Group 0)	31	23.5	7.5
Second (Group 1)	16	23.5	-7.5
Total	47		

Chi-square	D.F.	
4.79	1	Significant at 5%.

The value of Chi-square (4.79) indicates that group proportions were not equal. Proportion of the first group exceeded proportion of the second group as the absolute magnitude of the first group is greater. This shows that access to existing information has difficulties. The reasons indicated by the respondents for such a problem are shown in Table 2.3 below.

Table 2.3. Causes to information access problems as indicated by respondents

Reason	Number of markings for each reason
1. lack of proper utilization of information technology	23
2. absence of tracer slip or file movement register	3
3. absence of retrieval tools such as accession register and	2

Reason	Number of markings for each reason
location register	
4. absence of finding aids such as lists, indexes and other guides	5
5. inadequacy of reprographic/micrographic facilities	2
6. lack of properly trained manpower in the area of information services	9
7. Other	
• absence of willingness to share information among the professionals	1
• lack of awareness of what information is available	1
• absence of an organized system	1
• lack of cooperation of the external information sources	1
• too much emphasis on delivering information only to the top management	1

Lack of proper utilization of information technology has got more marks in absolute terms, and it seems that much of the respondents are in favour of proper application of information technology to overcome access to existing information.

Information availability. When the responses for information availability have been examined, many of the respondents (50% of those who answered the question) marked the rating "fair" (Table 2.4). Here also to see whether there is any significant variation among the responses, Chi-square test was run and indicated that variation among the ratings was significant at 5% level (Table 2.5). Categorizing the responses given as below average and above average, two groups were formed, the first group comprising of "poor" or "fair" ratings and the second group including the other two ratings. A Chi-square test (Table 2.5) result at 5% level again showed a significant variation between the groups. It can be concluded, therefore, that the first group dominates as obviously its frequency is greater than the second group.

Table 2.4 A Summary of Responses to Information Availability

Rating		Frequency	Percent
poor	(1)	11	22.9
fair	(2)	24	50.0
good	(3)	10	20.8
very good	(4)	3	6.3

Table 2.5 A Chi-square Analysis of Responses for Information Availability

Category	Cases observed	Expected	Residual
First (Group 0)	35	24.0	11.0
Second (Group 1)	13	24.0	-11.0
Total	48		

Chi-square	D.F.	
10.08	1	Significant at 5%.

According to a summary of causes to the problem, "absence of an organized system such as central database services" and "poor communication with other offices" were identified as major causes that affected information availability. "Low level of recognition for the role of information" have also some weights although the comparison is in absolute terms.

Table 2.6 Reasons Cited by Respondents

Reason	Number of Markings
1. absence of an organized system such as central database services	26
2. low level of utilization of information technology	13

Reason	Number of Markings
3. poor communication with other offices	18
4. low level of recognition for the role of information	13
5. difficulty in searching and locating because of the manual nature of the information service	10
6. Other	
• absence of willingness to share information among the professionals	1
• no concrete strategy for information provision	1
• information is seen as personal property	1
• lack of cooperation of the external information sources	1
• negligence of the suppliers of information	1

Accuracy of information. Regarding "accuracy" of information, Table 2.7 shows that the major proportion of the respondents (53.2%) marked their responses as "moderately accurate" out of those who answered the question. Dividing the respondents into two groups, i.e., between those who considered the problem as serious ("inaccurate" or "poorly accurate") and those who considered it as mild or non-existent ("moderately accurate" and "accurate"), a Chi-square test indicated significance at 5% level reminding the problem was not serious or not worrying.

Table 2.7 A Summary of Responses for Information Accuracy

Rating		Frequency	Percent
inaccurate	(1)	2	4.3
poorly accurate	(2)	14	29.8
moderately accurate	(3)	25	53.2
accurate	(4)	6	12.8

Table 2.8 A Chi-square Analysis of Responses for Information Accuracy

Category	Cases observed	Expected	Residual
First (Group 0)	16	23.5	7.5
Second (Group 1)	31	23.5	-7.5
Total	47		

Chi-square	D.F.	
4.79	1	Significant at 5%.

Consistency of information. Problem of inconsistencies of information have not been exaggerated. The results were summarized in Table 2.10. To check if there were variations in the number of responses, a Chi-square test was done and indicated that there was a variation among the four categories of responses. Further analysis was done by regrouping the four categories into two groups. The first group included responses of "inconsistent" and "poorly consistent" ratings. The second group included "moderately consistent" and "consistent" ratings (see Table 2.11). The Chi-square result indicates that there was no significant difference between the two groups at 5% level. Thus, it is hard to say whether the problem was really worrying as the result is inconclusive.

Table 2.9 A Summary of Responses for Information Consistency

Rating		Frequency	Expected	Residual
inconsistent	(1)	2	11.75	-9.75
poorly consistent	(2)	19	11.75	7.25
moderately consistent	(3)	19	11.75	7.25
consistent	(4)	7	11.75	-4.75
Total		47		

Chi-square	D.F.	
18.96	3	Significant at 5%

Table 2.10 A Two Group Chi-square Analysis of Responses for Information Consistency

Category	Cases observed	Expected	Residual
First (Group 0)	21	23.5	7.5
Second (Group 1)	26	23.5	-7.5
Total	47		

Chi-square	D.F.	
0.53	1	Not significant at 5%.

Timeliness of information. Problem of timeliness of information was another aspect which attracted attention. As Table 2.12 shows 47.9% of the respondents answered the question "How do you rate the timeliness of the information you are getting?" as "fair". A two step Chi-square test also supported the claim that the information provided was not in most cases timely. The first Chi-square test was conducted at 5% level to see if there were any differences among the respondents' attitude. Then, after observing such a difference, the four categories were regrouped into two groups. The first group including those responses of "poor" and "fair", while the second group including the responses "good" and "very

good". It is logical to create such grouping as it indicates below average and above average. Based on this grouping a Chi-square test at 5% level (Table 2.13) indicated significant difference, the weight tilting to the first group. Hence, it can be concluded that there was a problem of getting timely information.

Table 2.11 A Summary of Responses for Timeliness of Information

Rating		Frequency	Percent	Expected frequency	Residual
poor	(1)	11	22.9	11.75	-0.75
fair	(2)	23	47.9	11.75	11.25
good	(3)	12	25.0	11.75	0.25
very good	(4)	1	2.1	11.75	-10.75
Total		47	100.00		

Chi-square	D.F.	
20.66	3	Significant at 5% level

Table 2.12 A Two Group Chi-square Analysis

Category	Cases observed	Expected	Residual
First (Group 0)	34	23.5	10.5
Second (Group 1)	13	23.5	-10.5
Total	47		

Chi-square	D.F.	
9.38	1	Significant at 5%.

Reasons summarized in Table 2.14 indicate the major causes of untimely information are "absence of an organized/integrated system", "poor delivery system linked with external sources", and "low level of application of information technology.

Table 2.13 A Summary of Reasons Indicated by Respondents

Reason	Number of markings for each reason
1. absence of an organized/integrated system	26
2. low level of utilization of information technology	13
3. poor delivery system linked with external sources	17
4. Other	
• inadequate effort to collect and analyze data on time on the part of information sources	1
• institutional factors and capacity gap	1
• unorganized nature of external information sources	2

Completeness of information. In an attempt to see whether the information received by the professionals was complete, the question "How do you rate the completeness of the information provided to you?" was included in the questionnaire. The responses to each rating are summarized in Table 2.15 below. The percentage distribution shows that more respondents marked ratings as "poor" or "fair" (altogether 68%). The Chi-square test, making a two group analysis, favors the argument that the completeness of the information provided was below average.

Table 2.14 A Summary of Responses for Information Completeness

Rating		Frequency	Percent
poor	(1)	8	17
fair	(2)	24	51.1
good	(3)	13	27.7
very good	(4)	2	4.3

Table 2.15 A Two Group Chi-square Analysis of Responses

Category	Cases observed	Expected	Residual
First (Group 0)	32	23.5	8.5
Second (Group 1)	15	23.5	-8.5
Total	47		

Chi-square	D.F.	
6.15	1	Significant at 5%.

Low rating of the completeness of information received was ascribed to reasons listed in Table 2.16. "Absence of an organized system" is the most important factor followed by "low level of application of information technology" rank high in absolute terms in contributing to the low rating.

Table 2.16 A Summary of Causes

Reason	Number of markings for each reason
1. absence of an organized/integrated system	25
2. low level of application of information technology	14
3. Other	

Reason	Number of markings for each reason
• inadequate assessment of the information need	2
• suppliers' capacity limitation	1
• poor reporting ways	2

Addressing information demands. Whether the respondents were satisfied by the information they were receiving was one of the problem areas looked into. To this end, a question "Do you think that the information you receive addresses your needs, i.e., conforms to your demands?" was included in the questionnaire. A summary of responses for the ratings indicated as shown in Table 2.17, the major proportion of the respondents (85.1%) marked the rating "yes, but partly".

Table 2.17 A Summary of Responses for Information Demand

Rating		Frequency	Percent
No	(1)	3	6.4
Yes, but partly	(2)	40	85.1
Yes	(3)	4	8.5
Total		47	

Adequacy of internal information services. The situation for the adequacy of information services at the respondents work place is summarized in Table 2.18. From the table it can be seen that the response for "inadequate" is far greater (70.1% out of those who responded to the question). The Chi-square test also testifies the same.

Table 2.18 A Summary of Adequacy of Internal Information Services

Category	Cases observed	Expected	Residual
inadequate	34	23.5	7.5
adequate	9	23.5	-7.5
Total	43		

Chi-square	D.F.	
14.53	1	Significant at 5%.

Opinions of the respondents as to what should be done to minimize the inadequacy of the existing level of support provided by the information services vary. According to the ideas compiled, the main suggested solutions have been jotted down below to improve existing level of support. They are

- introduction of networking
- creation of central databases
- upgrading of the existing information technology level
- upgrading of the skill level of existing information professionals and
- strengthening of the library and publishing (under the Administration and Finance Service) units.

Need and importance of internal information services. Three questions (27, 28 and 29) were included in the questionnaire to see the need and importance of information services within the ministry. Questions 27 and 28 were assigned ratings and question 29 was left open to the respondent to write what he/she felt. Tables 2.19 and 2.20 summarize the responses for the two questions.

Table 2.19 A Summary of the Usefulness of Internal Information Services

Rating		Frequency	Percent
not useful	(1)	2	4.5
less useful	(2)	11	25.0
useful	(3)	23	52.3
very useful	(4)	8	18.2
Total		44	100.0

Table 2.20 A Summary of Responses for Integrated Central Database

Rating		Frequency	Percent
seldom required	(1)	1	2.2
some times required	(2)	1	2.2
essential	(3)	43	95.6
Total		45	100.0

The respondents' reaction to what they thought about the establishment of an integrated database was that they were in strong favor of it. 95.6% (Table 2.20) of those responded to the question identified it as "essential". Also, opinions regarding what improvements over the existing level of service could be obtained by introducing the integrated central database are reported as

- improvements of accuracy of, timeliness of, and access to information;
- reduction of information search effort and time as well as cost;
- increase of the efficiency of information services;
- quick dissemination of information.

2.5. Existing Problem Summary and Discussion of Results

The analysis of the survey showed that problems were abundant in accessing required information for planning and policy analysis at the Ministry of Economic Development and Cooperation. Major problems were noted in accessing existing information, making information available, acquiring complete information, and having information timely. The major causes which were common to (or deemed significant to) the identified problems were summarized in table 2.21.

Among the causes cited by respondents, "lack of proper utilization of information technology" and "absence of an organized/integrated system such as integrated database services" were more frequent and common to most of the problems. The analysis results favor the argument that existing information technology facilities have not been properly utilized for providing information at planning and policy level. Furthermore, absence of an integrated database system has contributed to problems related to information access. The responses summarized in Table 2.20 testify a great demand for an integrated system such as an organized database for storage and retrieval of information required by planners and policy analysts.

Opinions of the respondents suggest that existence of an integrated database service can improve existing level of information access by reducing search efforts and time. It can also improve accuracy and timeliness by reducing too much intermediate processes for recompiling and the time required for information to reach the user. Overall, it can upgrade the efficiency of the existing information service.

Table 2.21 A Summary of Significant Problems and Major Causes

Cause	Problem			
	access to existing information	availability of information	completeness of information	timeliness of information
Lack of proper utilization of information technology	23	13	14	13
Lack of properly trained manpower in the area of information services	9	–	–	–
Absence of an organized/integrated system	–	26	25	26
Poor communication with other offices	–	18	–	17
Low level of recognition for the role of information	–	13	–	–

3. Object-oriented Approaches and Object-oriented Databases - An Overview

In this study the object-oriented approach was considered as a means to design the proposed database solution. To this end, an attempt is made in this chapter to introduce the basic concepts and principles that underlie the object-oriented approach.

The term **'object'** appeared in various fields of computer science in the early 1970s to refer to notions that were different in their appearance yet mutually related. These notions were used to manage complexity of software systems. Objects represent components of a modularly decomposed system (Booch, 1994).

The object-oriented approach has evolved into its present status over a long period of time. The concept first was used in programming languages, and gradually has become adopted in areas of analysis and design. Since its early appearance much literature has been produced in all the three areas (i.e., systems analysis, systems design and programming) although literature on the programming part has the lion's share. In terms of standardization and stability, object oriented programming is more standardized and stabilized than object-oriented analysis and object-oriented design due, mainly, to its longer time stay and maturity.

3.1. Basic Concepts and Principles

Object-oriented technology revolves around a central concept that is the idea of 'object'. Objects are entities that encompass the properties of procedures and data. According to Booch(1994), "an object has state, behavior, and identity; the structure and behavior of similar objects are defined in their common and behavior of similar objects are interchangeable". Thus, the basic concepts associated with an object are described as follows:

- a **state** of an object includes the properties (static and dynamic) of the object;

- **behavior** of an object is related to its dynamic aspects whereby its actions and reactions result in changes of its state. In other words, the state shows the commutative results of its behavior; and the behavior of an object depends on its state and the operation performed upon it;

- "**identity** is that property of an object that distinguishes each object from all others" (Khoshafian, 1993);

- "a **class** is an implementation of an object type. It has a data structure and methods that specify the operations which may be used with that data structure" (Martin, 1993). It represents a set of objects with common structure and behavior. It serves as a template from which objects with uniform structure and behavior are created;

- an individual object is an **instance** of a class.

The object-oriented paradigm advocates that a system may be best modeled by the objects that constitute the system and the class relationships that exist between the objects. The whole universe consists of objects that interact with one another. The underlying principle suggests object independence (Losee, 1990). The objects within the system make interactions through their interfaces. They may be independent from each other or one object may reside within another object.

Different authors on object-oriented approach do have differing views regarding what the major elements of an object-orientation are, apart from the main concept of object. Some of the views can be cited. Deng and Fuhr (1995) explain that "the object-oriented approach

to information system development is built upon three basic ideas: objects, messages and classes". Khoshafian (1993) stresses that the fundamental aspects of object-oriented paradigm are abstract data types, inheritance, and object identity. Booch (1994) asserts that the major elements of an object model are abstraction, encapsulation, modularity and hierarchy. Eckert and Golder (1994) have presented objects, classes and inheritance as three conceptual steps of object-orientation in the traditional view, but have presented another view by Blair. In their article the view of Blair was summarized as the very essence of object-orientation can be captured by the ideas of encapsulation, classification, flexible sharing and interpretation.

Although the various writers have differing views as to what the core ideas that explain the essence of object orientation are, in this thesis focus is made onto the conceptual framework explained by Booch (1994) as his ideas are more elaborate and tend to incorporate the others to a greater extent.

Two categories of elements of an object model are identified according to Booch. Major elements and minor elements. The term 'major' describes those elements which are essential for the model to be object-oriented, namely, abstraction, encapsulation, modularity and hierarchy. On the other hand, the term 'minor' refers to those elements which are useful but not essential, in particular typing, concurrency and persistence. (Booch, 1994). A brief review of each of these elements is felt in order.

Major Elements

Abstraction is a mechanism used to describe some of a systems details while suppressing others. It is used to form a higher level construct. it is "the principle of defining a data type

in terms of the operations that apply to objects of the type, with the constraint that the values of such objects can be modified and observed only by the use of the separations" (Coad and Yourdon, 1991). In a similar way "an abstraction denotes the essential characteristics of an object that distinguish it from all other kinds of objects and thus provide crisply defined conceptual boundaries, relative to the perspective of the viewer" (Booch, 1994)

Abstraction has different kinds. They are (Booch, 1994):

entity abstraction: an object that represents the problem domain or solution-domain entity

action abstraction: an object that provides a generalized set of operations which perform the same kind of function

virtual machine abstraction: an object that groups together all operations that are used by some upper level control, or operations that all use some level set of operating

coincidental abstraction: an object that groups a set of operations that have no relationships to each other.

Encapsulation is the grouping together of various properties associated with an identifiable entity (the object) to which access is restricted by a well-defined interface (Eckert and Golder, 1994). Encapsulation is achieved through information hiding, a process of hiding all the secrets of an object which do not contribute to its essential characteristics.

Modularity refers to decomposition of a system into manageable units. It is defined as "the property of a system that has been decomposed into a set of cohesive and loosely coupled modules (Booch, 1994).

Common elements of different types, where a type is a set of objects and a set of operations on the objects, can be abstracted to form **hierarchies** (Khoshatian, 1993). Thus, a hierarchy refers to such order of abstractions.

Hierarchies are expressed in the form of inheritance (single or multiple) and aggregation. Where **aggregates** are abstract entities that contain heterogeneous components, **inheritance** is "a mechanism for expressing similarity among classes, simplifying definition of classes similar to once previously defined. It portrays generalization and specialization, making common attributes and services explicit within a class hierarchy or lattice" (Coad and Yourdon, 1991). As such it is the most important and essential part of object-oriented feature. It defines relationships among classes where one class inherits or shares the structure and behavior of another class. It can have two forms: single inheritance and multiple inheritance. In single inheritance one class shares the structure and behavior of one super class whereas multiple inheritance allows a single class to inherit or share structure and behavior of more than one class, i.e., multiple classes.

Minor Elements

Typing is related to the description of a set of objects with the same representation. It is defined as "the enforcement of the class of an object, such that objects of different types may not be interchanged, or at the most, they may be interchanged only in very restricted ways" (Booch, 1994). The concept derives from the theories of abstract data types.

Abstract data types extend the notion of a data type by hiding the implementation of the user-defined operations ("message") associated with the data type (Khoshafian, 1993).

Cuncurrency deals with problems wherein an automated system may have to take care of different events simultaneously. Its definition is given as "the property that distinguishes an active object from one that is not active" (Booch, 1994).

Persistence is the property that an object outlives a program execution, i.e., an object continues to exist after its creator ceases to exist.

3.2. Object-oriented Data Models viz. Conventional Data Models

Database management systems came after file management systems, where a program or different programs are developed for each different application, and each application has its view of data[6], in chronological order. Much work has been done in developing and improving database management systems so as to make them more flexible and suiting to various data type requirements. Currently, most operational database management systems are the hierarchical model, the network model, and the relational model.

The **hierarchical data model** was created earlier than the network and relational model, and database management systems based on hierarchical model were the earliest to appear on the market. The model allows a record[7] type to be involved in only one relationship[8] as

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[6] Information processing in such an environment suffers from data redundancy, data integrity problems, limited data sharing, data availability constraints, and difficulty in management control.

[7] A data field (data element) is an attribute that characterizes an entity, and a data **record** is formed by a collection of values taken by related fields or data elements. A collection of the data records form a data file.

[8] A relationship is an association that link entities. Basically, it is a special kind of entity.

a child. The persistent database is represented as a collection of trees where each node of the tree represents a set of records of the same type (Khoshafian, 1993).

The **network data model** followed the Database Task Group's (DBTG) work in 1969 (Khoshafian, 1993). Network data models are based on graphs and tables. The model allows a one-to-many relationships among record types it consists of. It also allows a record type to be involved in more than one relationship. The network model, thus consists of a collection of records which are connected with each other through links.

The above data models suffer from problems, mainly, reorganization of databases. Reorganization is very difficult due to the fact that physical and logical models are so closely associated it, therefore, prohibits data independence. Moreover, since access to records is through navigation it requires traversing along the tree roots before reaching the required node containing the record.

In an attempt to solve problems of database based on the above two models (bring more flexibility to databases), **relational data model** was introduced in 1970 (Khoshafian, 1993). Relational database management systems are very popular in terms of use because they enabled faster application development and easier application maintenance, relational data base models are fully independent of the processes. Relational database structure consists of relations or tables. Each relation or table is organized in to rows (tuples) and columns with each column having a type that represents a set of allowable values (domain). Unlike the hierarchical and network system, relational databases are declarative, i.e., they avoid the specification of how to access server data. Data independence is preserved.

Newly arising demands in database management systems resulted in the emergence of **object-oriented databases**. Although the traditional database technologies have stayed long in the service, they are not meeting new requirements, mainly in handling complex data. Object-oriented databases support diverse data types rather than only the simple tables, columns, and rows of relational databases.

In a relational model, records of a given type are identical in structure. They must contain the same field and a field must draw its value from the same type in each record. Relational systems establish connections between entities logically through attribute values. At a minimum one address translation has to be performed from a key value to the location of a tuple (Bhalla, 1991). Therefore, although the relational model has a strong mathematical base on which it is founded and relatively superior to hierarchical and network models in supporting the notion of physical and logical data independence (Khoshafian, 1993), it suffers a lot when it is intended for complex data types.

For network and hierarchical databases, the access mode basically, as already mentioned, is navigational. The navigation is to a larger extent based on the way data are organized in the underlying system. Because of this characteristic data independence is not preserved and any reorganization of the underlying data may mean rewriting of the application program (Khoshafian, 1993). Although they support a one-to-many relationship which is similar to set-valued attribute of complex object models, they lack the flexibility even the relational system provides.

As already discussed in the preceding paragraphs, conventional database systems support homogenous collections of simple entities that are characterized by a small number of types,

each with a large number of instances. They lack the capability to deal with complex objects with different data types such as variable length and long strings, images or pictures as a single unit.

Although the concept object-oriented database still requires stable and standard definition, there is a consensus starting to build. Object-oriented databases combine object-orientation with database functionalities, i.e., persistence, concurrency, transaction management, recovery, querying, versioning, integrity, security and performance (Khoshafian, 1993). Object-oriented data models originated from the tradition of semantic data modeling. In addition to the basic concepts of object-orientation described in section 3.1, it supports features which are more advanced: version control that captures the record of evolution for data objects, equivalence object whereby an object having different representations that are equivalent (Hurson et al, 1993). Hence, object-oriented databases are a combination of the two concepts: object-orientation and databases.

An object-oriented data model supports structural object-orientation and behavioral object-orientation. Structural object-orientation allows the construction of composite objects (also known as complex objects), i.e., attributes of a tuple do not have to be atomic (which is the case in relational models), and behavioral object-orientation, allows user-defined types and definition of operators that act on these types (Gunther and Lamberts, 1994). The object-oriented data model, therefore, provides the capability to handle complex data.

Object-oriented databases have many advantages over the conventional systems in dealing with complex data. An object-oriented database system can support modeling of the complexity and variations that occur in the real world better than the conventional database

systems. Newly arising requirements for which traditional database technology has been found to be inadequate are (Bhalla, 1991)

a) "office information management systems;

b) computer-aided design;

c) distributed heterogeneous database management systems (DBMS), connecting existing DBMS; and

d) knowledge base management systems and other artificial intelligence (AI) applications."

Moreover, application areas of geographic and environmental fields require data management which is different than traditional business applications where data records tend to be more structured, and conventional database systems, especially the relational model, meet them very well. Relational data models are table oriented, and thus, fit to business requirements (Gunther and Lamberts, 1994). However, since they require data to be at least in first normal form[9], representation of multi-valued or set-valued attributes can not be accommodated. Besides, "the relational model does not explicitly include semantics as part of the data representation." Interpretation of data semantics is left to the application programs (Hurson and Pakzad, 1993). Another deficiency of a relational system is that it requires the creation of relationship relations for modeling many-to-many relations. This produces many relations which have to be joined by queries. The hierarchy supertype-subtype that is supported under object-oriented data models is not available within the relational model. Object oriented databases, in general, (Bhalla, 1991)

- allow variations in structuring objects to enable arbitrary data items as values which is not allowed in case of relational systems. The domain of an attribute is a type or a sub-type of it;

[9] In a relational database relations (tables) are defined over simple domains that contain atomic values. A relation is in first normal form if and only if it satisfies the constraint that it contains atomic values only.

- support data types such as variable-length and long text, image or graphics by providing the required operations for such data types;
- objects refer to sub-objects by identity not by key values, thus avoiding one level of mapping;

What is more,

- join operations in relational systems are not required for re-assembling sub-components of an entity since complex entities can be directly represented in object-oriented systems;
- a change in the value of an object is seen by all objects that refer to it, whereas in relational systems a change in the key value of an entity is not propagated to other tuples that refer it;
- database operations in an object-oriented model can be stored within the database. This ensures the existence of a single copy of each operation, and database access can be restricted through these operations. Thus, it reduces intentional corruption of data by programs. An operation can also be shared by many different applications.

3.3. Examples of Object-oriented Database Systems

Research efforts have been going on for quite a length of time to create object-oriented database management systems. There are systems that have been commercialized and those that are still at experimental level. Examples in this area are: Orion, Iris, GemStone, Ontos/Vbase, Versant and ObjectStore (Hurson and Pakzad, 1993).

Orion developed by MCC is intended for applications in CAD/CAM, artificial intelligence, and office information system domains. It supports multimedia information management. It also supports object data model features, and advanced functions of composite objects, version control schema evolution, query management and transaction management. However, it was at experimental level as of 1993 and was available on a limited basis (Hurson and Pakzad, 1993).

The **iris** data model from Hewlet Packard is based on three constructs: objects, types and functions (Bhalla, 1991). It was implemented using C and Lisp programming languages in combination. It was at experimental stage as of February, 1993 (Hurson and Pakzad, 1993).

GemStone was developed by Servio Logic and has been designed to support applications that include CAD, hypermedia, knowledge bases, and office information systems. It is commercialized system (Hurson and Pakzad, 1993).

Ontos was developed by Ontologic and has been targeted for applications CAD/CAM, CASE, documentation, hypermedia, and office automation. It is based on C++, i.e., its Data Definition Language and Data Manipulation Language are C++. It runs in a client/server environment. Databases can be accessed using either C++ or SQL interface. It is commercially available (Huemer et al, 1995).

ObjectStore developed by Object Design Inc. is another object-oriented database management system which is available commercially and was intended to serve application areas of CAD, CASE, computer-aided publishing, and image-and multimedia based office

information applications. It can be accessed by a DML based on C++. It runs in a client/server environment (Huemer et al, 1995).

There are also object-oriented database management systems which are extensions of relational systems. Among them **Postgress** and **Starburst** can be cited as examples (Bhalla, 1991).

3.4. The Development Process of an Object-Oriented Information System

The object-oriented system tries to model the real world as closely as possible. The problem domain is analyzed from the point of view of objects (real or abstract) that constitute the application domain. In order to model the real world as directly as possible, object-oriented methodology employ phased approaches, although the processes within phases may overlap and may be iterative. Lorenz(1993) identifies four phases: business phase, analysis phase, design and test phase, and packaging phase. With the exception of the first and last phases the middle two (i.e., analyze, design and test) phases being iterative. Martin (1993) refers to the whole development process "Object-oriented Information Engineering". The aim of Object-oriented Information Engineering is to build a system by applying "Object Structure Analysis" and "Object Behavior Analysis" at various stages of development. The phases that are included in this classification are Enterprise Modeling, Business Area Analysis, System Design and Construction. Booch(1994) labels the whole process as "the macro process" and classifies the stages into conceptualization, analysis, design, evolution and maintenance. Leaving out 'maintenance' which is a post delivery evolution, the stages identified by Booch up to delivery are again four. Although there are variations in naming and some conceptual contents, the aims of each phase in one type of

classification more or less addresses the same issues as a parallel phase in another classification.

The Business Phase

The first phase involves an initial survey of user requirements. It is at this level that high - level requirement specification is completed. It is done once, and includes (Lorenz, 1993)

- identification and documentation of types of users;
- contacting users who will involve themselves in the development process;
- identification and documentation of initial user requirements.

In the process of documenting user requirements, the analyst focuses on the functionalities of the system, the paradigm (type of interaction-of-execution model the system provides), the environment (systems and platforms that support the system) and the interfaces (Khoshafian, 1993).

The Analysis Phase

"Analysis is the process of breaking down a complex problem in to its component parts, examining those parts and reconstituting them into a more efficient, effective whole" (Modell, 1988). Thus, this phase is concerned with decomposing the application area into its components and understanding it. It focuses on learning the problem and the user's needs, identifying all possible constraints on a solution, and organizing the over abundance of assembled information.

The output of this phase is the object model of the application area. It provides a detailed description of the system using the symbolism and methodology of the object-oriented design, and later will be incorporated into the object-oriented design of the system.

Existing analysis methods generally lack uniformity and standardization. Fairly abundant methods of analysis have been proposed and published by different authorities in the field. Many books introducing new object-oriented analysis (OOA) methods are being published at an accelerating pace, but most of the methods they describe are quite immature both theoretically and empirically. Their theoretical underpinnings are usually weakly documented (Iivari, 1995). Hence, choosing which one to use becomes difficult and confusing. The notations and documentation tools also vary greatly complicating the situation further.

Even if the matter of choosing a method is complicated due to the reasons explained above, certain methods have been selected for this study. The methods used in this work, mostly for reasons of simplicity and familiarity, are those suggested by Lorenz (1993) uses a simplified strategy (method) for analyzing and extracting requirement and Khoshafian(1993) adds database concepts which the study focuses on.

The Design Phase

This phase provides detailed specifications for the classes of the problem/product domain. Design is commenced as soon as some reasonably complete model of the system is obtained. Design, as in the case of analysis, is also concerned with two aspects: static and dynamic.

The static aspects deal with the definition of classes, their attributes, their relationships, the static behavior of their instances, etc. On the other hand dynamic aspects are those which constitute the behavior of the objects during the operation of the system, that is, state transition, data flow diagrams, and dynamic relationships between objects (Khoshafian, 1993).

Like the analysis, design still lacks uniformity and standardization. Methods suggested by a number of works are available (Deng and Fuhr, 1995). Which one to choose among the existing methods depends on personal experience and familiarity due to absence of standards and evaluation criteria. In this study, and for the same reasons expressed earlier, the methods proposed by Lorenz (1993), and Khoshafian (1993) (for database aspects) are followed by choosing among them the one preferable to the others for a specific purpose in the prototyping.

The Construction Phase

Construction is the transformation of design features in to selected language code. It also includes final testing, documentation of final architecture, documentation of user manuals, etc.

4. Proposed Database Solution

As indicated in chapter 3, an information storage and retrieval database for planning and policy analysis is required. An object-oriented database has been suggested as a better alternative to existing conventional database technologies. Therefore, a database based on the object-oriented technology has been designed for the situation under investigation in this study. Methods followed and design outputs have been shown in subsequent sections.

4.1. General

As already discussed in chapter 2 of this report, existing level of information service within the MEDaC is inadequate. There are problems in using available hardware and software to enhance/strengthen the service provided. Application of systems analysis and design methods in organizing proper information systems (sub-systems) is missing.

Among the specific areas that need to be addressed in tackling the problems are:

- introduction of networking;
- creation of central databases;
- upgrading of the existing level of information technology;
- upgrading of the information professionals' skill level and;
- strengthening of the library and the publication units are cited as major ones

However, most of the above areas of concern are long-term undertaking requiring extra resources to look into in detail. Keeping in view the existing information technology and

manpower resource, it is felt that problems related to access to existing information can be minimized by introducing an integrated database solution.

Further, since the information required varies with type and format, a database capable of handling the variety of types and formats in this respect is indispensable. As information contained in documents, images/pictures/graphs, tabular, etc. is needed, it is proposed to adopt an object-oriented database due, mainly, to the advantages/benefits presented in the previous chapter.

The proposed object-oriented information storage and retrieval database, the Planning and Policy Database (PPAD), will have the advantages, among others,

- of minimizing existing information search efforts;
- of providing users with well organized and summarized information;
- of providing users with information in a variety of formats and types;
- of providing information on many disciplines and sectors in an integrated manner.

The proposal is also considered appropriate in view of the existing hardware facilities (i.e., all the respondents responded that their departments own computers. Also out of the total respondents 58% replied that they use computers which shows the number of computer users is not something to be underestimated).

The remainder of this chapter will present the database design for the purpose of storage and retrieval of planning and policy information, and using object-oriented approaches.

4.2. Design Method

The method used in this study is largely dependent on Lorenz's (1993) proposal. The development strategies and tools for documentation have been adapted to a greater extent from the same book. However, consultation regarding database concepts have been made to Khoshafian (1993).

In particular, the following strategies are employed in each of the phases.

Analysis Phase

⇒ Write use-cases: writing what is heard of the users saying the system should do in descriptive text scenarios.

⇒ Verify use-cases with users

⇒ Extract and document requirements from use-cases

⇒ Extract nouns from use-cases

⇒ Identify and document application classes from the noun list

⇒ Walk through use-cases, using the identified application classes

⇒ Prototype use-cases

⇒ Verify prototype with user

⇒ Update use-cases and requirements as needed

⇒ Iterate the preceding steps for areas that don't have solid requirements

Design and Test Phase

⇒ Review the analysis-phase deliverables

⇒ Document the target language, hardware and software platforms

⇒ Search the reuse library for applicable off-the-shelf components

⇒ Look for overlap of responsibilities, similarity of types of objects

⇒ Draw collaboration diagrams

⇒ Draw message flow diagrams

⇒ Walk through the design diagrams and documentation

- **Implementation Phase (Construction)**

⇒ Implement subsystems

⇒ Iterate subsystem development until requirements are met

⇒ System test the complete system

The following graphics symbols are used for documentation purposes.

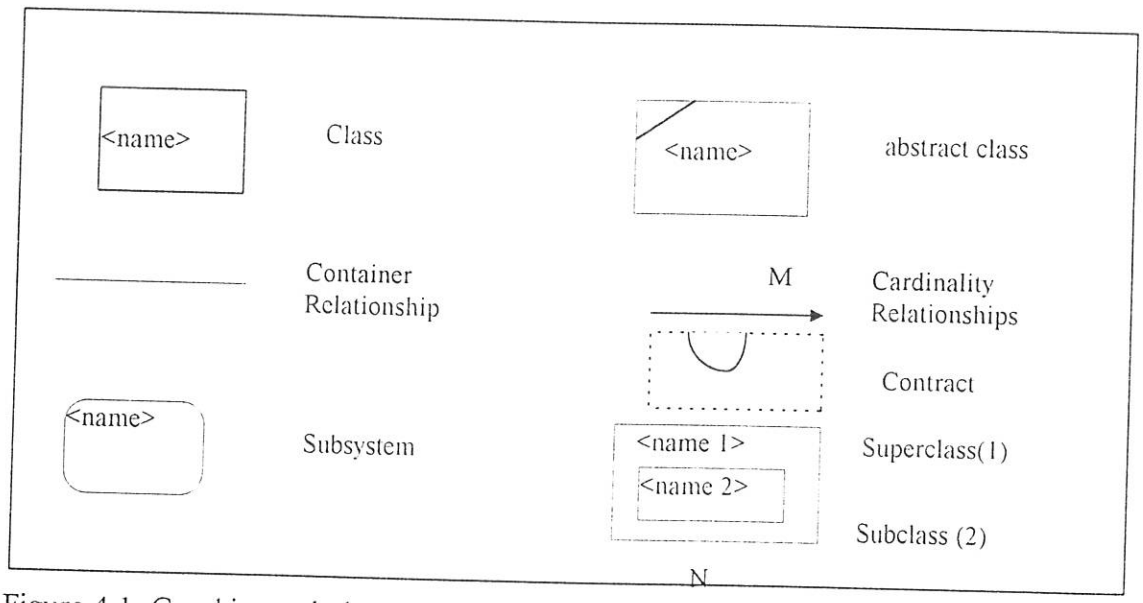


Figure 4.1 Graphic symbols used in the documentation process

The results obtained after applying the strategies adopted on the case area (i.e., MEDaC) are summarized under subsequent sections in the order suggested by the strategy.

4.3. Requirements Specification

4.3.1. Basic Requirements

According to the results obtained from the survey conducted, document analyzed, and discussions made with experts at the MEDaC the major requirements of users may be summarized as under.

- Information by spatial aggregation, i.e., by country, region, zone and woreda level is stored and made available to users.
- Information by project and enterprise classification is stored and retrieved.
- Within a spatial or political division information is classified by sector. The sectors are macro-economy, geography, population, education, health, agriculture, and infrastructure.
- A map of a spatial entity is made available to users.
- The system handles information in documents: feasibility reports, evaluation reports, annual budget report, progress reports, research reports, agreement documents, etc.
- Architectural designs, images and charts are taken care of and provided by the system.
- Rural-urban classification is to be included.

4.3.2. Interfacing Requirements

- The system is expected to print information displayed on request.
- Information entry or editing is performed by authorized personnel only.
- The user accesses the system through a menu driven interface.
- Provisions for security for classified documents/information should be available.

- Search, copy and browsing features are provided when a document related to a project or a spatial entity is opened.
- Interfacing features with text, image and table outputs is required for importing information in digital form.

4.4. A Catalogue of the Classes

On the basis of the requirements identified and following verification with users, the following persistent and interface classes have been identified

Spatial entity	Macro-economy
Country	Geography
Region	Population
Zone	Telecommunication
Woreda	Power
Project	Transport
Map	Water
Document	Agriculture
Design	Education
Implementation Plan	Health
	User

Interfacing Classes

input	Window
output	Menu

Printer File

Import

4.5. Sub-systems

Subsystem identification according to Lorenz(1993) is done on the basis of functional cohesion boundaries or coupling between classes. Thus, the subsystems in this work have been identified along major functionality rather than class collaborations as the system is complex and identification of class collaborations exhaustively at this time would take longer time.

1. The Socio-economic Profile Sub-system	
Description - coordinate the activities related to persistent classes or database	
Contract	**Responsible Class**
[1] Maintain Spatial entity	Spatial entity

2. The Project Monitoring Sub-system	
Description: coordinate the activities related to project information	
Contract	**Responsible Class**
[2] Maintain project	Project

3. The Interface Sub-system	
Description - coordinate the input-output activities from and to users.	
Contract	**Responsible class**
Getinput	input
Put output to user	output

4.6. Contracts

The major contracts, the server classes and their clients within the system are listed as in the following.

4.6.1. Maintain spatial entity

Description: provides basic functions to create, edit, delete, and store information on spatial entity

Server: Spatial entity

Clients: Window, Menu

4.6.2. Maintain project

Description: provides functions which are basic to maintaining project monitoring information

Server: Project

Clients: Window, Menu

4.6.3. Maintain profile

Description: handle and maintain socio-economic profile

Server: Profile

Clients: Spatial entity, Country, Region, Zone, Wereda

4.6.4. Maintain and associate map

Description: Save and display corresponding map to a spatial entity

Server: Map

Clients: Spatial entity, Country, Region, Zone, Woreda

4.6.5. Maintain and associate design

Description: save and display a design corresponding to a project

Server: Design

Clients: Project (all sub-classes), Profile and its subclasses

4.6.6. Maintain and associate document

Description: handles documents related to a project by providing basic functions for text manipulation

Server: Document

Clients: Project and its sub-classes

4.6.7. Verify type of user (password)

Description: provides basic functions for identifying the user whether she/he can have add/edit rights

Server: User

Clients: Input

4.6.8. Get input

Description: handles input from the user

Server: Input

Clients: Project, Spatial entity

4.6.9. Put output to user

Description: provides output functions

Server: Output

Clients: Spatial entity and subclasses, Project and subclasses

4.7. Cardinality Relationship

The cardinality relationship for the different entities or classes within the system is shown in figure 4.2 on the next page. Spatial entity refers to a spatially delineated area such as country, region, zone or woreda. The class Map creates objects containing maps for a

given spatial entity. Project refers to a new or ongoing project and serves a super class to different project types. Profile refers to general information at different levels. Classes Document and Design serve for creating objects of textual and architectural drawing.

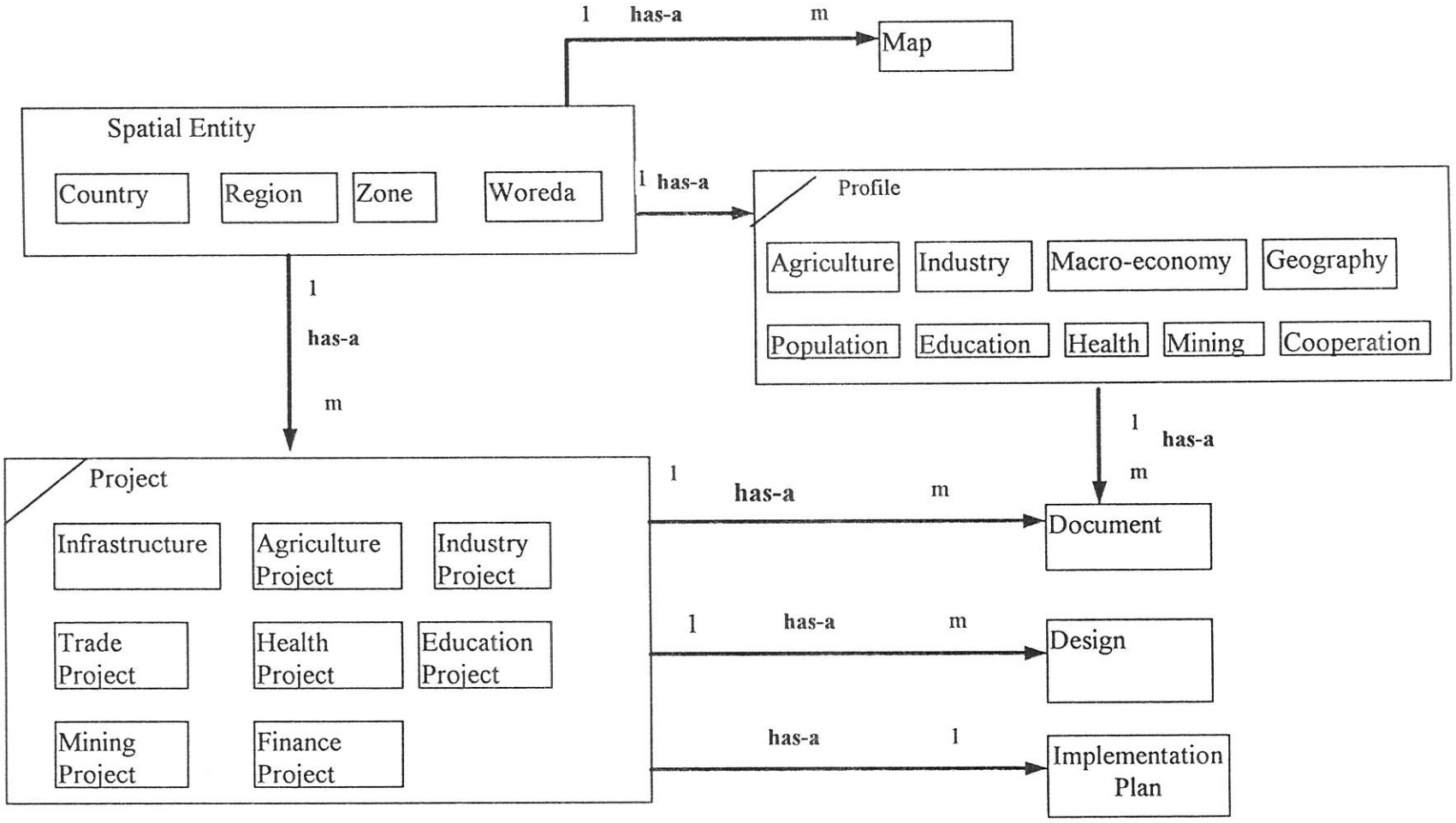
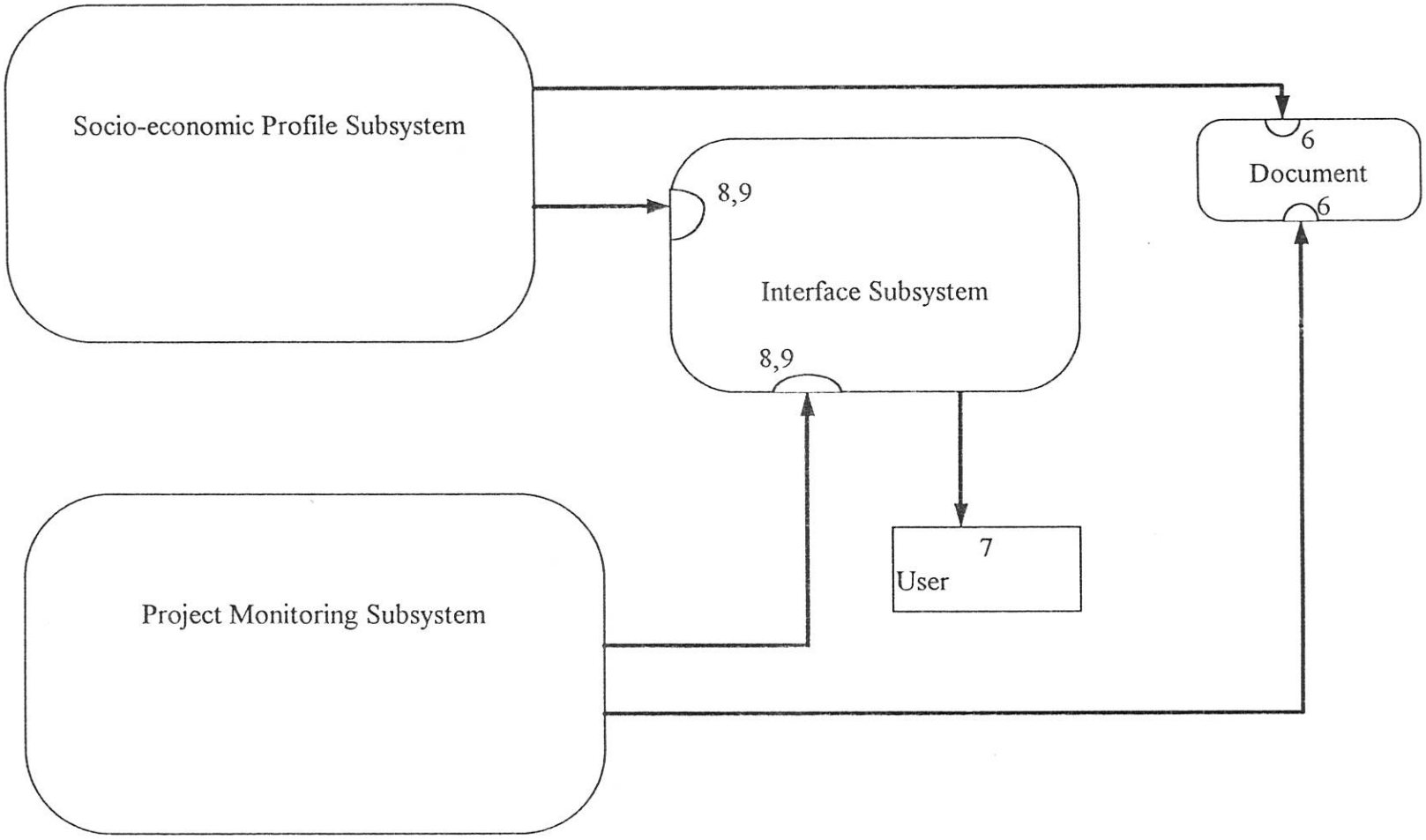


Figure 4.2 Cardinality Relationships Among Classes

4.8. Collaboration Diagrams

Figure 4.3 Collaboration Diagrams Among the Subsystems - numbers indicate contracts provided by a subsystem or a class



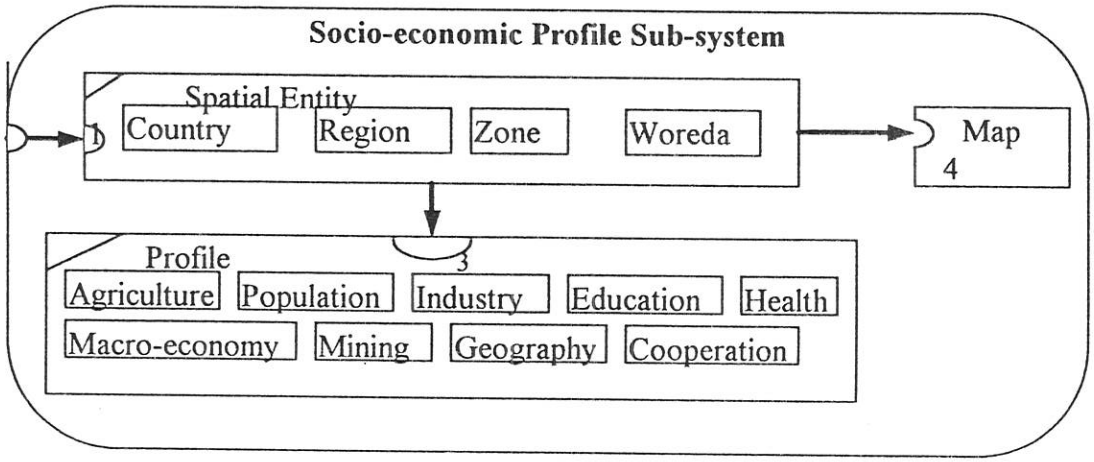


Figure 4.4 Collaboration within Socio-economic Sub-system

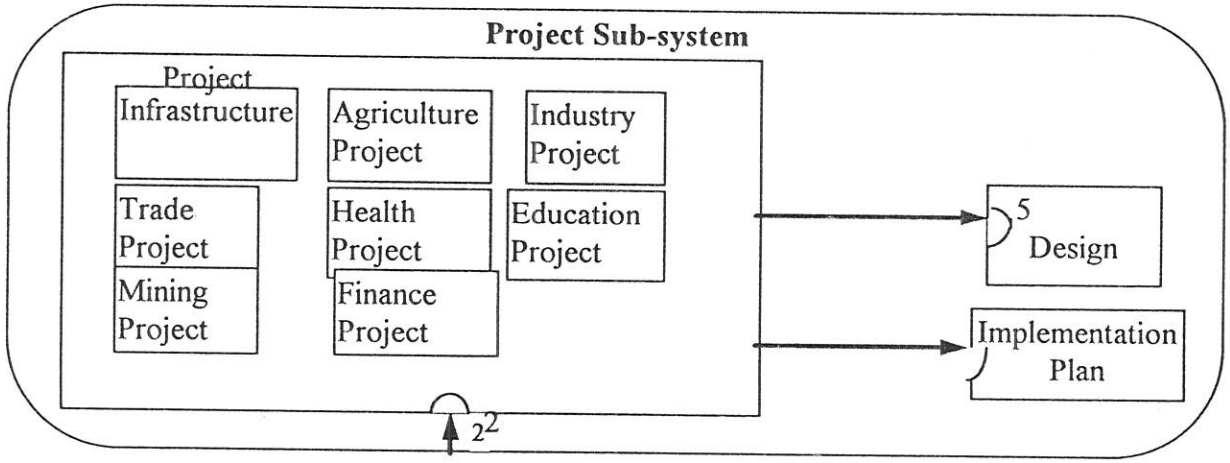


Figure 4.5 Collaboration within Project Monitoring Sub-system

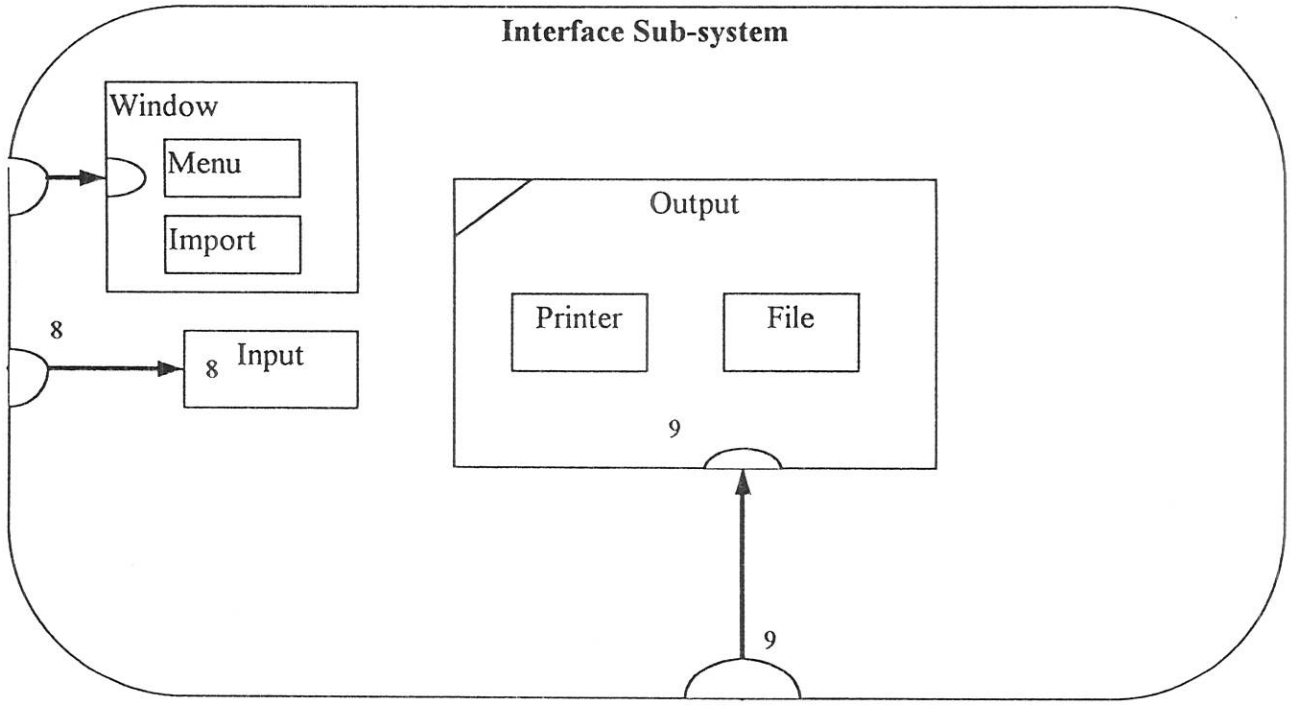


Figure 4.6 Collaboration within Interface Sub-system

4.9. Class Hierarchies

Figures 4.7, 4.8 and 4.9 show inheritance hierarchies. This is not a complete list of inheritance relationship. Further subclassing may be required for some classes. For instance classes marked with "+" sign require further subclassing as a "Power project" may have subclasses of "Transmission", "Generation" and "Distribution".

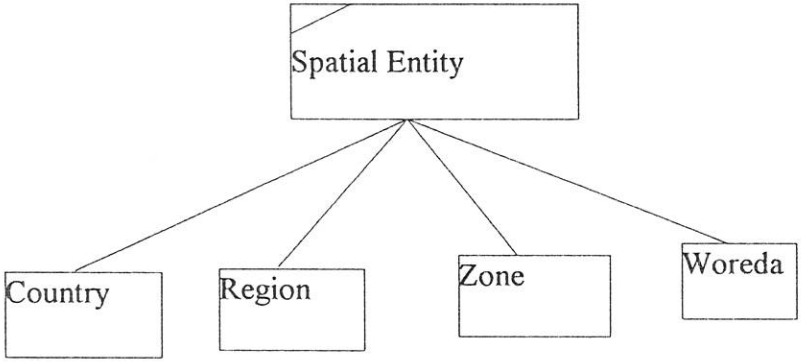


Figure 4.7 Inheritance hierarchies of a Spatial Entity Superclass

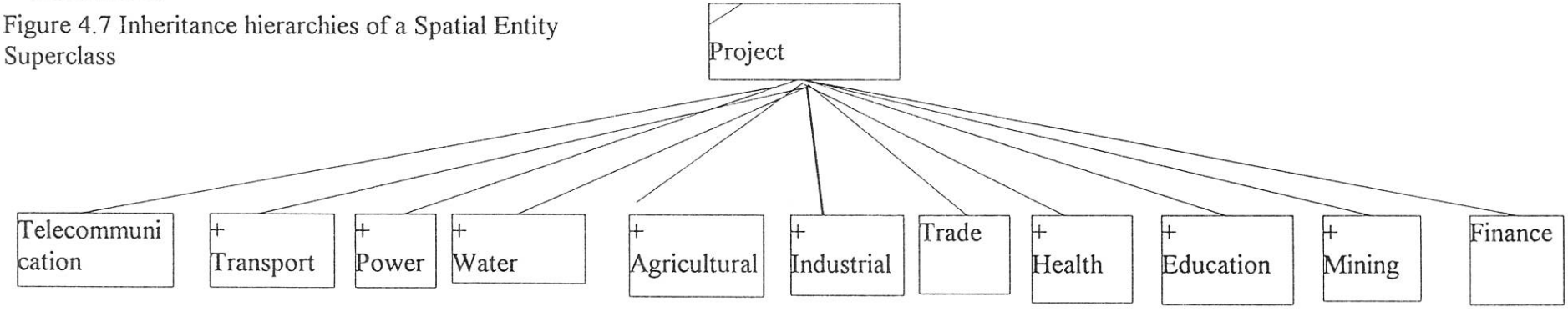


Figure 4.8 Inheritance hierarchies of a Project Superclass - "+" indicates that further subclassing is required

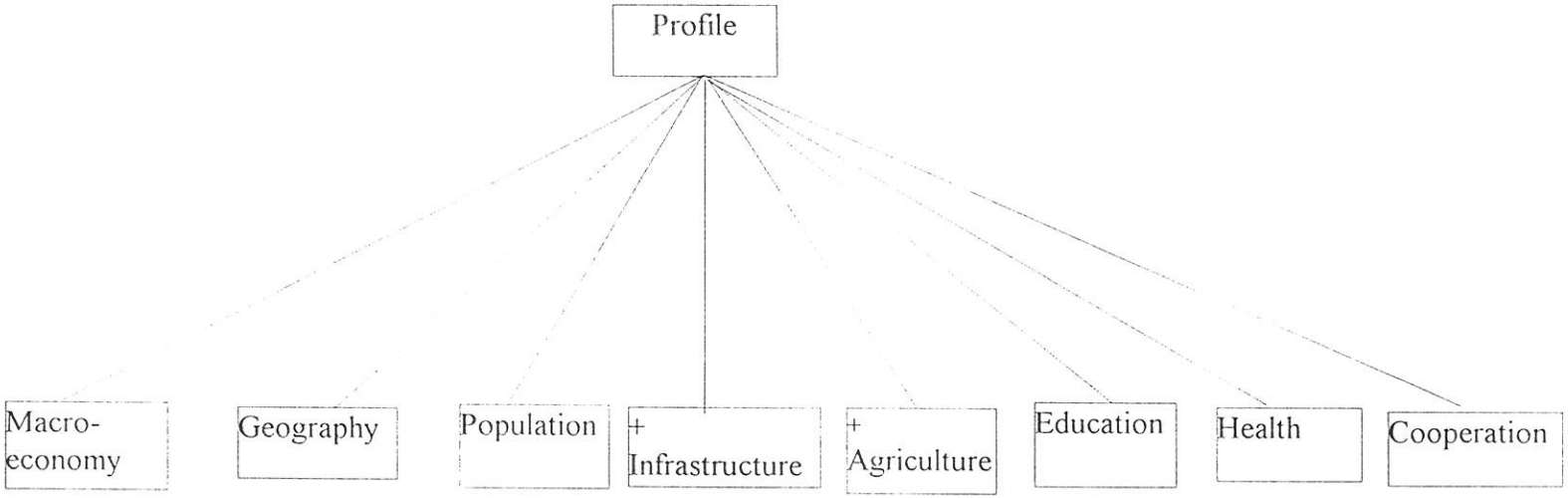


Figure 4.9 Inheritance hierarchies of a Profile Superclass - "+" indicates that further subclassing is required

4.10. Class Definitions

The classes defined in this section included only those methods which are more general, public and basic. Repetition of methods between a superclass and a sub-class indicates that they have to be redefined, i.e., they are virtual. Attribute and contract definitions are also not complete and exhaustive. As to the interfacing classes, their definition was not done at this stage since the main emphasis was on the basic classes. Their definition can be done in the process of further refinements at a later stage.

Spatial entity (persistent and abstract class)	
Description - The spatial entity class is an abstract class which provides common attributes and services to all types of spatial objects.	
SuperClasses - none	
Subclasses - country, region, zone, woreda	
Maintain spatial entity is implemented by the following public methods	
a. Createsp	
b. Savesp	
c. Modifysp	
d. Showsp	
e. deletesp	
Responsibility	**Description**
a. Createsp	creates a new spatial entity
b. Savesp	saves a modified spatial entity object
c. Modifysp	allows editing of a spatial entity object
d. Showsp	allows the display of a spatial entity object
e. deletesp	deletes an already created spatial entity
Data	**Description**
name	the classification name of the entity
level	the level hierarchic division (national, region, zone, woreda)

Country

Description: A class responsible for providing attributes and services to all types of country objects

Superclasses: Spatial Entity

Subclasses: none

Responsibility	**Description**
a. Savesp	saves object country
b. Modifysp	modifies object country
c. Showsp	displays object country

Data	**Description**
Capitalcity	Capital city of the country
noofregions	number of regions within a country

Region

Description: A class responsible for providing attributes and services to all types of region objects

Superclasses: Spatial Entity

Subclasses: none

Responsibility	**Description**
a. Savesp	saves object region
b. Modifysp	modifies object region
c. Showsp	displays object region

Data	**Description**
regtown	regional capital
noofzones	number of zones within a region
reglanguage	official language used in the region

Zone

Description: A class responsible for providing attributes and services to all types of zone objects

Superclasses: Spatial Entity

Subclasses: none

Responsibility	**Description**
a. Savesp	saves object zone
b. Modifysp	modifies object zone
c. Showsp	displays object zone

Data	**Description**
zonetown	zonal capital

Woreda

Description: A class responsible for providing attributes and services to all types of woreda objects

Superclasses: Spatial Entity

Subclasses: none

Responsibility	**Description**
a. Savesp	saves object woreda
b. Modifysp	modifies object woreda
c. Showsp	displays object woreda

Data	**Description**
woredatown	woreda town
noofkebles	number of kebeles available in the woreda

Project

Description: The Project class is an abstract class and provides common attributes and services to project type objects

Superclasses: none

Subclasses: Agricultural Project, Industrial Project, Trade Project, Health Project, Education Project, Mining Project, Finance Project

Contracts

Maintain Project *is* implemented by the following public methods.

a. Createproject
b. Saveproject
c. Createdocument
d. Calldocument
e. Createdocument
f. Calldesign
g. Selectproject
h. Showproject
i. Deleteproject

Responsibility	**Description**
Createproject	creates and inserts a new object in the database
Showproject	displays an already existing project object
Createdocument	sends message to the document class for creation of a document object
Calldocument	activates the object containing corresponding document to a project
Createdesign	sends message to the design class for creation of a design object
Calldesign	activates the object containing corresponding design to a project
Selectproject	a selector which type of project to use currently
Deleteproject	destroys a project object
Data	**Description**
Projectno	project identification number
Title	project title
Sector	sectoral classification of the project

Location	site where the project was/is established
Totalcost	total investment outlay allocated for the project
Source	financier of the project
Implementor	the implementing agency
Excuting	contractor or the excuting agency
Lifespan	duration within which the project is executed
progress	physical progress of the implementation of a project (%)
priority	priority given on certain conditions to the implementation of the project
projectstatus	the stage of project progress
disbursement	disbursed finance to date
startdate	date on which the implementation was started
problem	a list of problems, if any

Agricultural project

Description: Agricultural project class is responsible for providing common attributes and services to all types of agricultural projects

Superclasses: Project

Subclasses: none

Data	**Description**
totalprojectarea	total area coverage under the project
waterfeedingsystem	either irrigation or rainfed or in both ways
projectcategory	a research or development project
projecttype	crop, livestock, fishery, etc.

Industry project

Description: Maintains and provides information on all types of industrial projects

Superclasses: Project

Subclasses: none

Data	**Description**
plantcapacity	production capacity of the industrial plant when completed

Product	the type of product the factory produces when completed
Input	the type of input needed to produce the product

Trade project

Description: Maintains and provides information on all types of trade projects

Superclasses: project

Subclasses: none

Data	Description
category	what the category of the project within the trade sector is (domestic vs. foreign)
tradetype	goods marketing, services, etc.
target	intended part to address

Telecommunication

Description: The telecommunication class is responsible for maintaining information on telecommunications

Superclasses: Project

Subclasses: none

Data	Description
nooftargetcustomers	the intended number of customers to serve
type	microwave, open wire, cable or radio
terminalsites	locations for installing terminals
noofapparatus	number of telephone apparatus to be distributed to customers
nooflines	number of lines intended to install
feasibility	a feasibility report document

Water

Description: The water class maintains and provides information on water related projects

Superclasses: Project

Subclasses: none

Data	Description
coverage	total area the project is supposed to cover
beneficiary	who are to benefit from the project
class	is the project in the irrigation, potable water or river basin

Power

Description: This class provides and maintains information on all types of power projects

Superclasses: project

Subclasses: Generation, Transmission, Distribution*

Responsibility	Description
Data	**Description**
Projecttype	either a Generation, Transmission or Distribution project

*Subclasses have not been defined

Health Project

Description: The Health Projects class maintains and provides information on health projects

Superclasses: Project

Subclasses: none

Data	Description
noofbeneficiaries	number of intended beneficiaries
projecttype	expansion, new or upgrading
level	level of institution to be expanded or constructed newly or upgraded
projectstatus	a description of the stage of the project progress

Education Project

Description: This class is responsible for maintaining and providing information on education projects

Superclasses: Project

Subclasses: none

Data	Description
noofstudents	number of students to benefit from the project
projecttype	expansion, new or upgrading project
projectstatus	stage of the project progress

Mining Project

Description: The water class maintains and provides information on water related projects

Superclasses: Project

Subclasses: Regional Mapping, Geophysics, Hydrology, Mineral Exploration, Geothermal*

Data	Description
typeofwork	Regional Mapping, Geophysics, Hydrology, Mineral Exploration, Geothermal

*Suclasses have not been defined

Geography

Description: Provides information on the geography of a spatial entity

Superclasses: Profile

Subclasses: none

Data	Description
totalarea	total area of an entity
boundary	boundaries shared with other political divisions
coastline	total length of a coastline
territorial sea	maritime claims
environment	a document containing descriptions of the environment
latitude	latitudinal measure of a location
longitude	longitudinal measure of a location
rainfall	average annual rain fall
altitude	average altitude of a spatial entity
temperature	average annual temperature
landuse	description of land use pattern
map	map of an entity
nooftowns	number of towns with in a political or administrative division

Population

Description: Maintains and provides information on country or administrative unit objects

Superclasses: Profile

Subclasses: none

Data	Description
totalpopulation	total population of a country or an administrative unit
density	density of a population
urbanpopulation	total population for that division
growthrate	annual population growth rate
bithrate	annual birth rate
fertilityrate	total fertility rate
deathrate	annual death rate
underage15	percent of population under age 15
over65	percent of population over age 65
infmortality	infant mortality rate
lifeexpect	life expectancy at birth
migration	net migration (per 1000 population)
composition	Ethnic composition
religion	religious composition
languages	languages and their speakers compostion

Education

Description: The Education class maintains and provides information on education related projects

Superclasses: Profile

Subclasses: none

Data	Description
literacy	percentage of literate population
edexpenditure	educational expenditure (% of GNP)

edexpgov	educational expenditure (% of government expenditure)
participation	school participation rate
students	number of students currently attending school
teachers	number of teachers currently employed

Health

Description: The Health class maintains and provides information on health

Superclasses: Profile

Subclasses: none

Data	**Description**
mexpenditure	medical care expenditure (% of GNP)
hcare	health care (% with access)
hbeds	hospital beds (population/bed)
physicians	no of physicians
pcapita	physicians per 10000 persons
nurses	no of nurses
nursesp	nurses per capita (per 10000 persons)

Industry

Description: Maintains and provides information on industry.

Superclasses: Profile

Subclasses: none

Data	**Description**
productname	the product name produced
amount	total production produced with in a year

Agriculture

Description: Maintains and provides information on agriculture

Superclasses: Profile

Subclasses: none

Data	**Description**
lagriculture	land in agriculture
agpopulation	agricultural population density

totagpop	total agricultural workers
agimp	agricultural imports
agexp	agricultural exports
cereals	cereals produced
wheat	wheat produced
barley	barley produced
maiz	maiz produced
animals	total number of animals

Mining

Description: Maintains and provides informaition on mining.

Superclasses: Profile

Subclasses: none

Data	**Description**
location	where the mining(quarying) is taking place
type	mineral type being quaried

Cooperation

Description: Maintains and provides information on bilateral and multilateral agreements

Superclasses: Profile

Subclasses: none

Data	**Description**
dateofagreement	date on which the agreement was signed
partner	the partners who signed the agreement
purpose	a description why the agreement was signed

Profile

Description: A persistent and an abstract class provides common attributes and services to all types of proiles

Superclasses: none

Subclasses: Agriculture, Industry, Macro-economy, Geography, Population, Education, Health, Mining, Cooperaiton

Contracts

Maintain profile is implemented by the following methods

Selectprofile

Saveprofile

Showprofile

Editprofile

Responsibility	**Description**
Selectprofile	a method used to select a spatial entity's profile object
Saveprofile	a method used to save a spatial entity's profile
Showprofile	a method used to display a spatial entity's profile
Editprofile	a method used to edit a spatial entity's profile data

Data	**Description**
year	year for which information is registered

Map

Description: Maintains and provides map informaition of a spatial entity.

Superclasses: none

Subclasses: none

Contracts

Maintain and associate map is implemented by the following public methods

a. Createmap

b. Savemap

c. Showmap

d. Deletemap

Responsibility	**Description**
a. Createmap	inserts a new map
b. Savemap	saves a changed map
c. Showmap	displays a map
d. Deletemap	deletes a map object

Data	**Description**
name	name of the map

scale	scale on which the map is based
purpose	purpose for which the map was produced

Document

Description: Maintains and provides document attributes and services to project and profile objects.

Superclasses: none

Subclasses: none

Contracts

Maintain and associate document is implemented by the following public methods

a. Createdocument
b. Savedocument
c. Showdocument
d. Editdocument
e. deletedocument
f. search
g. copy

Responsibility	Description
a. Createdocument	creates and inserts a new document
b. Savedocument	saves a modified document
c. Showdocument	displays a document
d. Editdocument	modifies an already existing document
e. deletedocument	destroys a document object
f. search	provides a search based on terms
g. copy	provides copy facility for selected document parts

Data	Description
doctitle	the title of the document
usage	what the document is used
text	the body of the document

Design

Description: Provides design information and services to project objects

Superclasses: none

Subclasses: none

Responsibility	**Description**
a. Createdesign	inserts design of a project
b. Savedesign	saves a changed design
c. Showdesign	displays a design on a screen
d. deletedesign	destroys a design object

Data	**Description**
destitle	the title of the design
design	the body of the design

Implementation Plan

Description: Maintains and provides implementation plan attributes and services to project objects.

Superclasses: none

Subclasses: none

Contracts

Create and Provide Implantation Plan is implemented by the following public methods

a. CreateImplementationPlan

b. ShowImplementationPlan

c. EditImplementationPlan

d. DeleteImplementationPlan

e. CopyImplementationPlan

Responsibility	**Description**
a. CreateImplementationPlan	Creates a new implementation plan object
b. ShowImplementationPlan	displays existing implementation plan object
c. EditImplementationPlan	edits an implementation plan object already exists
d. DeleteImplementationPlan	deletes an already existing implementation plan
e. CopyImplementationPlan	produces a copy of existing implementation plan

Data	Description
implementationplantitle	the title of the implementation plan
duration	the time for which the plan is prepared

4.11. Construction of the Prototype

In dealing with the construction, a prototyping approach was adopted as detailed below.

4.11.1. Scope and Limitation

Prototyping has meanings differing with some degree. Hawryszkiewycz (1991) considers prototyping as a model of a proposed system. Clifton and Sutcliffe (1994) explain prototyping as "a collection of techniques for reducing misunderstandings and clarifying requirements." They identify different categories: non-working prototypes, partially working prototypes, bread board prototypes and others. Avgerou and Conford (1993) summarize the various definitions given to prototyping, in the context of a proposed system, as "*exploratory*, if used to clarify some ideas or some of the features of the system; *experimental*, if used to test new aspects of a system about which users or developers have not much experience; *incremental*, if used as a strategy leading from a rudimentary core system towards more complicated versions of it; or *evolutionary*, used as a strategy to cope effectively with a changing context."

The implementation in this case assumes the *exploratory* type. A prototype of the proposed planning and policy database was constructed as a means to explain how the design could be implemented. For reasons of reducing the magnitude of the attempt to a manageable size, the prototyping is restricted to the project subsystem with emphasis on industrial projects. The project case was selected not only because it features best as an object where there is a mix of all types of information (text, graphics, etc) but also it was felt this would be of general appeal to users (clearing demonstration) as currently much time of experts goes into searching information for the purpose of followup and evaluation of proposals.

The prototype database was implemented using dBASE for Windows 5.0. dBASE for Windows is primarily a relational database management system designed to run on personal computers. Although it provides object-oriented features for interfacing purposes, it does not provide any object-oriented facility for persistent class implementations. It has only features of object-orientation that can be used in the primary memory to ease interfacing, especially for use of graphics user interface such as forms and menus. It is selected in default of a better system locally. As such the system discribed below is an extremely simplistic and incomplete version of the actual implementation. It is merely intended to demonstrate the most basic features that dBASE allows.

4.11.2. The Prototype: an overview

What follows is a brief description of the prototype constructed. For detailed information regarding the source program, refer to Appendix 2. As indicated in the foregoing, dBASE 5.0 for Windows was used to implement the prototype. In order to bring the design into the dBASE environment, object to entity mappings and modifications to the object structure and behavior have been made. This is so because the system requires that data and procedures (methods) be separated so as to create tables for data to be stored and procedure files for procedures (functions) to manipulate the data. Therefore, for persistent objects tables have been created to store their attributes, and for procedures and capturing of events another set of files has been created. The latter are mostly associated with object definitions related to forms, i.e., for input - output purpose, used for interfacing and manipulation of tables.

The following tables have been created for the purpose.

Table 4.1 Created Tables along with Their Identifiers

Tables Created	**Identifier keys**
Project	projectno
Industry	projectno
Document	Projectno,docname
Design	Projectno,designname

The attributes of each table have been indicated in the following table.

Table 4.2

Table Name:

Project

Attribute	**Type**	**Size**	**Description**
projectno	Character	12	Project number
projecttit	Character	50	Project title
sector	Character	20	Sectoral classification of the project
location	Character	30	Site where the project was established
totalcost	Numeric	10	Total investment outlay allocated for the project
lifespan	Numeric	10	duration within which the project is executed
startdate	Date	8	The starting date of the project

Table 4.3

Name: industry

Attribute	**Type**	**Size**	**Description**
projectno	Character	12	
plantcapct	Character	15	The capacity of the plant would have
product	Character	20	The intended product to be produced
input	Character	50	The type of input to be used

Table 4.4
Name: **Document**

Attribute	Type	Size	Description
projectno	Character	12	
doctitle	Character	50	Title of the document
month	Character	10	Month in which the document was acquired/stored
text	Memo		The body of the document

Table 4.5
Table Name: **Design**

Attribute	Type	Size	Description
projectno	Character	12	
designtitl	Character	50	The title of the design
designdate	Date	8	The date when the design was created
design	Binary		The bitmap containing the design

Table 4.6
TableName: **ProjProg**

Attribute	Type	Size	Description
projectno	Character	12	
date	Date	8	Reporting date
disbursmnt	Numeric	10.2	Amount disbursed
projstatus	Character	50	Current progress status
problem	Character	100	Any problem reported
workdone	Character	10	Physical progress in %

Implementation was made to conform to the design as much as possible, especially, in using forms to show the features an object oriented methodology offers. Hence, a class called ***project*** was created to serve as a superclass, and a sub-class ***industry*** was made to inherit the properties of *project*. Classes *document* and *design* were created which provide textual and bitmap information. They are associated with the class project. Other interfacing classes, i.e., welcome, projectmenu, select, mysearch, mainmnu, welcomeform were also created for welcome screen, selection of control transfer, searching and main menu

purposes, respectively. Of course many built in classes have also been used. All the classes, however, are not persistent since the software does not provide the feature. They are used only in the volatile memory for manipulation of tables and interfacing. Table 4.10 shows the classes used/defined and the methods they contained.

Table 4.7 Classes Defined

Class Name	Description	Methods it contains	Description
Project	A class containing common attributes, methods and parts	open (constructor)	does initial parameter and environment settings, opens related tables
		calldesign	calls a method in the design class to display a related design
		createdesign	creates the design object
		createdocument	creates the document object
		calldocument	calls a method in the document class to diplay a related document
		selectaction	assigns control according to selection
		form_onclose (destructor)	closes tables and releases project object
*Select	A class used for a form containing project list	formonselection	assigns control according to selection of a project type
*Mysearch	A class used for search dialog box	onopen (constructor)	sets parameters, initiates a dialogbox
		onclose (destructor)	returns control to the calling program
		onselection	assigns control according to selection
*Mainmnu	Main menu class		
Industry	A class for a form used for displaying industrial project		inherits methods of the project class
*Welcome	A welcome form class	goontonext	calls the main menu
Projectmenu	A menu class for menu objects when a project information is displayed	search_onclick	launches search operation
		Designs_onclick	activates design display routines
		Documents_On click	activates document display routines
		exit_onclick (destructor)	terminates a session and releases the menu object
		help_onhelp	displays help
Document	A document class for displaying	showdocument	displays a document related to the current project

Class Name	Description	Methods it contains	Description
	documents and providing related services		
		open (constructor)	does parameter settings, and opens tables
		onclose (destructor)	does clearing activities
Design	A class for displaying designs and providing related services	showdesign	displays a design related to the current project
		open (constructor)	does parameter settings, and opens tables
		onclose (destructor)	clears the environment settings

*Not shown in the main design

The hierarchy of screens is organized in such a way that the first screen is the welcome screen, the second screen is the main menu screen, the third is a choice of options among the available list of project types although the prototype was restricted to the industrial project option, the fourth is the display screen with a request for an initial search. Other screen features have also been developed for text, design and implementation plan displays. Figures 4.10, 4.11, 4.12, and 4.13 indicate the hierarchies of the main screens, and Figures 4.14 and 4.15 show additional screens for document displays and design displays.

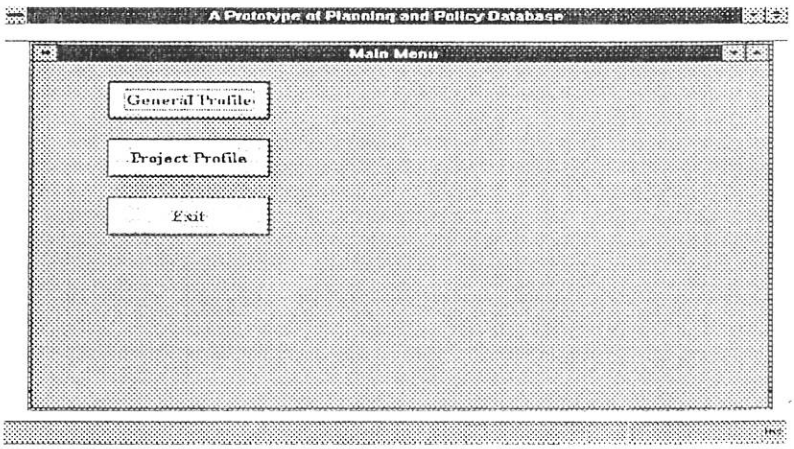


Figure 4.10 A menu screen after the welcome screen

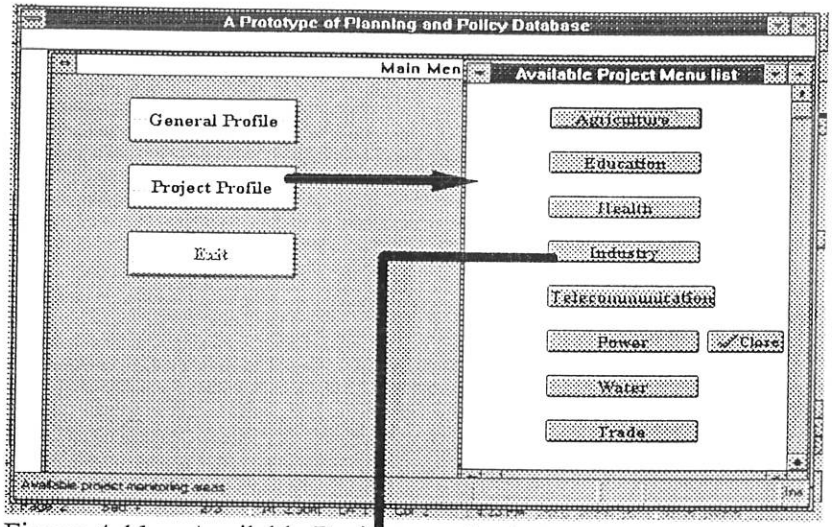


Figure 4.11. - Available Project monitoring areas

Arrow indicates Selection

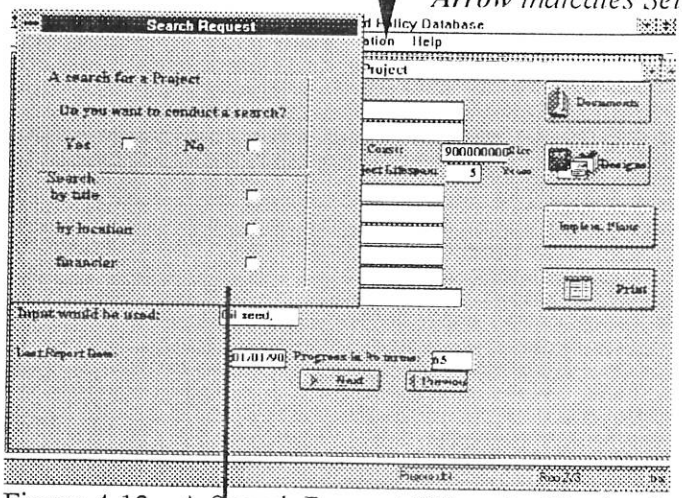


Figure 4.12 - A Search Request When the Display Screen Opens

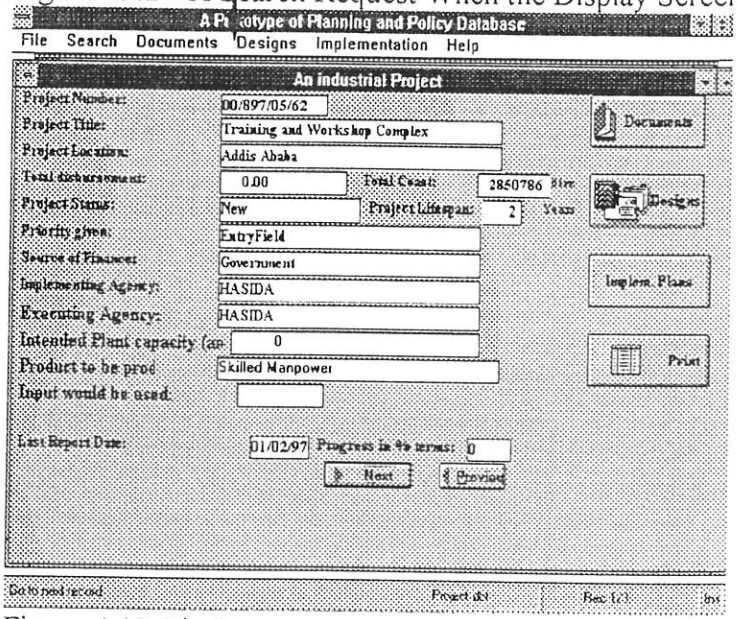


Figure 4.13 Display screen

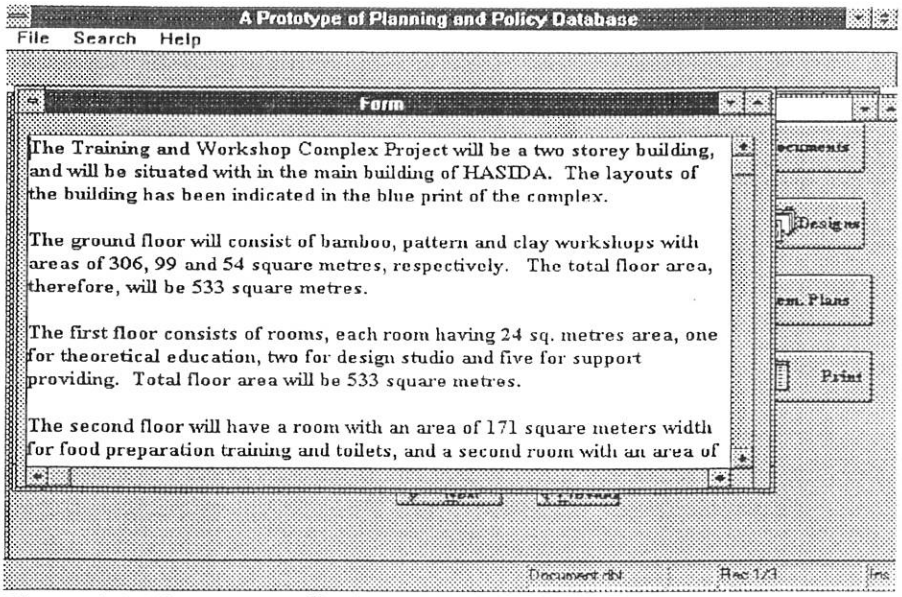


Figure 4.14 Document display

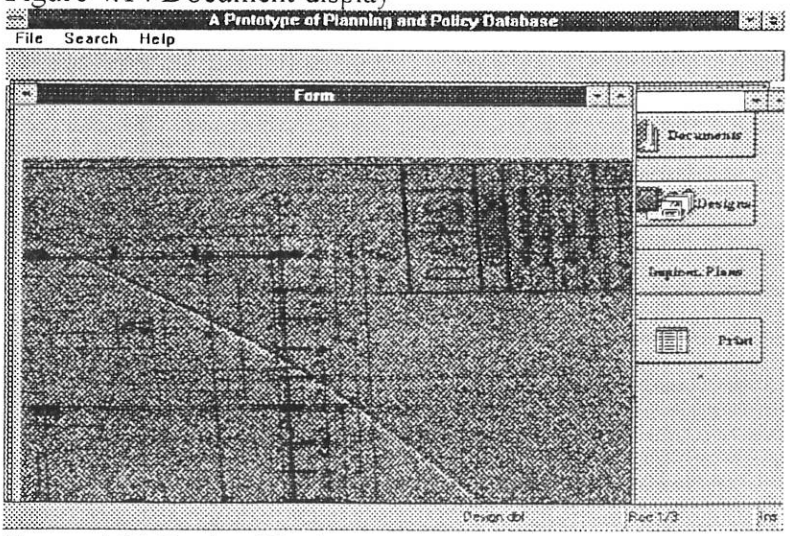


Figure 4.15 Design Display

4.11.3. General Remarks

The prototype constructed was presented to users for comment and review. Some of the comments made by users and my advisor, and which have already been incorporated in the prototype relate to organization of menu options, search request feature for information on a project and using push buttons for easy recognition and accessing documents, designs, implementation plans and printing in addition to the main menu.

Although users have appreciated what they have seen, they still wanted the system to include advanced features for handling formatted and long text in big documents, full-fledged search facility for terms within documents and copying a selected text. As the current database management system is more fitting to simple structured data than complex

data, features for manipulation and storage of complex data of the required type need a fullfledged object-oriented database management system. Also since access to objects (tuples) was based on value rather than object identity in the persistent storage, it has constraints of its own on accessing different objects as the user still has to define many key values, because relational systems impose normalization which leads to a break up of contents of an object into different tables. To this end, the required modification could not be made in the current version of the prototype.

5. Conclusion and Recommendations

5.1. Conclusion

This study was conducted to investigate the problem in accessing information at the MEDaC with the view to apply object-oriented database methodology in trying to help solve the problem. To this end, a survey was conducted to determine user information requirements and identify the problem within the existing system to meet the requirements.

The results of the analysis of problems in chapter two of the report indicate that accessing information at the Ministry of Economic Development and Cooperation has been a serious problem. According to the survey, the major causes of the problems may be attributed to: lack of proper utilization of information technology and the role it can play in supporting unstructured decision making, lack of properly trained manpower in the area of information services, absence of an integrated system, poor communication with other offices and low level of recognition for the role of information.

Although the availability of a fairly large number of micro-computers is indicative of the recognition (on the part of the ministry) of the role that IT can play in the provision of information, the level of utilization, according to the survey results, was below the desired level.

The survey also indicated that the key areas to look into in tackling the existing problems are: introduction of networking, creation of central databases, upgrading of the existing level of information technology, upgrading of the manpower skill level and strengthening of

the library and the publication units. Keeping in view the limitation on time and other resources required to address all the problem on the one hand and the existing hardware/software resource at the ministry and the developments taking place in object-oriented technology, on the other hand, the study considered the adoption of an integrated object-oriented database system, with multimedia features (i.e., that supports images and text), as one feasible solution in dealing with the access problems reported and ensuring proper utilization of existing hardware resources.

To this end, information said to be useful in the planning process were gathered from the experts through discussion and a survey questionnaire and a prototype database was designed. In the course of the design, attempts were made to demonstrate that features provided by object-orientation are more suitable to the demands of such a database than the conventional database features especially, in handling the desired data formats such as long and variable text, image/graphics and structured data in an integrated manner. The study has attempted to outline the basic classes and their relationships required in building the database. The implementation of the design using dBASE 5.0 for Windows and the industrial project subsystem, although limited, has demonstrated the features that an object-oriented database could provide in dealing with the complex requirements of information and data formats identified in the area of planning and policy analysis. It is hoped that this attempt demonstrates the principles of object-oriented databases that will achieve the functions needed to satisfy the requirement of users using existing facilities.

What is more, it is believed that the findings of this study as well as the proposals would serve as the starting point (basis) for any further work to establish a better system at MEDaC, especially, in view of the absence of any published formal report on the

information system in place. The basic development model adopted could also serve as a model for other similar undertakings.

5.2. Recommendations

As this undertaking was more considered as a research and training vehicle, the purpose was not to develop a full-fledged solution to the existing problems. As such, although several areas of improvements may be required for MEDaC to benefit freely from the proposed solution, there is no doubt that full development of an integrated database system as envisaged in the design part of this report will demonstrate a significant improvement in the work of the planning experts at the ministry. To this end, the following account is recommended for consideration.

1. Further problem analysis and requirements definition is recommended to establish a strong base for solutions.
2. The ministry if it has to go for a concrete solution, it should commit itself to provide support for further work in this direction.
3. Since any system development requires continuos iterations (in the terms of object-oriented methodology) before it is fully implemented, the design proposed still requires more refinements. Hence, it is recommended that continuos work be done to refine it further.
4. Appropriate database management system from the object-oriented family is required to fully utilize the features proposed, hence, it is recommended that the ministry should process the procurement of a fully object-oriented database management system.

5. In the current prototype design even if document handling features were included, they did not include features for hypertext searching. Hypertext or hypermedia capabilities when conducting a query would highly facilitate the process. Thus, it is recommended that future works based on this study address these issues as object-oriented features allow for such facilities.
6. Since working languages at the ministry and other government offices are both Amharic and English, incorporation of such multilingual feature be considered in the actual design of the operational database. Therefore, work towards establishing such an interface is recommended.
7. Multiple inheritance is one aspect that is to be looked into for improvements in the design. Therefore, attempts should be made for possibilities of applying it in the process of refining the design for future work.

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APPENDIX 1 - QUESTIONNAIRE USED FOR THE SURVEY

10 March, 1997

Dear sir/Madame,

A survey is being conducted to assess the existing level of information provision for economic planning and policy analysis within the Ministry of Economic Development and Cooperation, with a view of suggesting better ways of organization that increase the accessibility of available information. The work is being done in partial fulfillment for an M.Sc. I.S. degree in information studies.

I realize that you are very busy, but as you would appreciate, the success of my thesis depends on your cooperation. To this end, I am keen to receive your responses, so please make every effort to return the completed questionnaire at your earliest convenience, but no later than five days. All replies will be treated in strict confidence.

If you have any problem in completing the questionnaire, do not hesitate to contact me on 172 internal line.

Thank you in anticipation of your kind cooperation.

Hailie Mekonnen
School of Information Studies for Africa
Addis Ababa University

A SURVEY OF INFORMATION NEEDS AND PROBLEMS

Instruction for completing the questionnaire

Please, put 'x' mark on the space provided to indicate your response where applicable. In case where responses other than marks are required, please, write your responses in the spaces provided. You may use additional paper where the space provided is not enough.

Part I: Identification

1. Identification information
   Department Name: _____
   Profession: _____
   Position: _____
2. What are the specific activities you are currently engaged in? _____
   _____
   _____
   _____
   _____

Part II: Category of Information and Sources

Below are listed broad categories of information related to economic planning and policy analysis. Indicate the category of information you require to carry out the activities indicated in (2) by using the labels listed below.
(h=high priority; m=medium priority; l=low priority)

- **Economic**(Gross Domestic Product(GDP), Growth rate, Inflation rate...)

Geographic

- **Locational data** (latitude, longitude, direction...)
- **Climatic data** (rain fall, temperature...)
- **Resource data (Environmental data)** (Land use and/or coverage types, patterns, Soils...)
- **Human Geographic Data** (Population number and distribution, political maps (countries and distribution)...)
- **Population dynamics** (population growth, total births, birth rate...)

Infrastractural data

- **Building data**(type of building, architectural drawing...)
- **Road data** (type of road (primary, main road, feeder and rural road) ...)
- **Mass media information** (radio and television, press - no of editions (news paper/magazine)...)
- **Air transport**(no of airports, construction type...)
- **Telecommunication data** (no of apparatus (at regional, national level), no of customers (at regional, national level)...)
- **Agriculture data** (land in use, agricultural population density...)
- **Education data** (literacy rate, ages of compulsory education...)

- **Health data**(medical care expenditure, access to health care...)
- **Other, please specify** _____

_____

_____

4. At what level do you require information of the identified type?

- ☐ international
- ☐ continental
- ☐ national
- ☐ regional
- ☐ subregional
- ☐ woreda
- ☐ kebele
- ☐ enterprise
- ☐ project
- ☐ house hold
- ☐ individual

5. What sources do you use to meet your information requirements?

Internal Sources

- ☐ Library (documentation center)
- ☐ A central database
- ☐ From meetings, seminars, etc.

External Sources

- ☐ Media (Radio, TV, news paper,...)
- ☐ From meetings, seminars, etc.
- ☐ Reports and monographs
  - ☐ Government institutions
    - ☐ Federal institutions
    - ☐ regional institutions
  - ☐ NGOs
  - ☐ World Bank
  - ☐ UN agencies
  - ☐ Other, please, specify _____

_____

Part III: Information Types and Forms

6. Does the information you require includes image types (graphs, maps, etc.)?
   - ☐ Yes
   - ☐ No
7. If your response in (6) is "Yes", what kind?
   - ☐ pictures(photographic like satellite images)
   - ☐ cartographic types (maps, etc.)
   - ☐ engineering designs(plans,architectural drawings, etc.)
   - ☐ other, please, specify _____

_____

8. How do you store your information?
   - ☐ as a periodically consecutive information (as a time series data tables/documents)
   - ☐ as a one time (cross-sectional) information in a single file or folder regardless of time
   - ☐ other, please, specify _____

_____

9. How do you classify when you store it?
   - ☐ by type of indicators (information)
   - ☐ by spatial location (continent, national, region, zone, woreda)
   - ☐ other, please, specify _____
     _____

10. When you are provided with information, how do you get it?
   - ☐ hard copy(on paper)
   - ☐ on floppy disk
   - ☐ accessing from a central database
   - ☐ others, please, specify _____
     _____

Part IV Accessibility, availability and other factors related to information

11. How do you rate the **availability** of information at your workplace (institution)?
   - ☐ Very good
   - ☐ Good
   - ☐ Fair
   - ☐ Poor

12. If you have felt that **availability** of information is fair or poor, what do you think the reason(s) could be?
   - ☐ absence of an organized system such as absence of central database services and poor manual systems
   - ☐ low level of utilization of information technology
   - ☐ poor communication with other offices
   - ☐ low level of recognition for the role of information
   - ☐ difficulty in searching and locating because of the manual nature of the information service
   - ☐ other, please, specify_____
     _____

13. How do you rate the **accessibility** of the available information?
   - ☐ accessible
   - ☐ moderately accessible
   - ☐ poorly accessible
   - ☐ inaccessible

14. If your response for (12) is "poorly accessible" or "inaccessible", what in your opinion is (are) the possible cause(s)?
   - ☐ lack of proper utilization of information technology
   - ☐ absence of tracer slip or file movement register
   - ☐ absence of retrieval tools such as accession register and location register
   - ☐ absence of finding aids such as lists, indexes and other guides
   - ☐ inadequacy of reprographic/micrographic facilities
   - ☐ lack of properly trained manpower in the area of information services

- ☐ other, please, specify _____
  _____

15. How do you rate the **consistency** of the information you are receiving?
    - ☐ consistent
    - ☐ moderately consistent
    - ☐ poorly consistent
    - ☐ inconsistent
16. If your response in (15) is "inconsistent" or "poorly consistent", what do you think the reason(s) could be?
    - ☐ absence of an organized/integrated information system within the ministry
    - ☐ low level of application of information technology
    - ☐ depulicated external information sources
    - ☐ other, please, specify_____
      _____
17. How do you rate the **accuracy** of the information you are receiving?
    - ☐ accurate
    - ☐ moderately accurate
    - ☐ poorly accurate
    - ☐ inaccurate
18. If you feel that the information you get is "inaccurate" or "poorly accurate", what in your opinion the reason(s) could be?
    - ☐ absence of an organized/integrated information system
    - ☐ low level of application of information technology
    - ☐ unreliable external information sources
    - ☐ other, please, specify_____
      _____
19. How do you rate the **timeliness** of the information you are getting?
    - ☐ very good
    - ☐ good
    - ☐ fair
    - ☐ poor
20. If your response for (19) is "poor" or "fair", what in your opinion the reason(s) could be?
    - ☐ absence of an organized/integrated information system
    - ☐ low level of application of information technology
    - ☐ poor delivery system linked with external sources
    - ☐ other, please, specify_____
      _____
21. How do you rate the **completeness** of the information provided to you?
    - ☐ very good
    - ☐ good
    - ☐ fair
    - ☐ poor
22. If your response for (21) is "poor" or "fair", what in your opinion the reason(s) could be?
    - ☐ absence of an organized/integrated information system
    - ☐ low level of application of information technology
    - ☐ other, please, specify_____

23. Do you think that the information you receive addresses your needs, i.e., conforms to your demands?
    - ☐ Yes
    - ☐ Yes, but partly
    - ☐ No

24. Do you see problems in comprehending or understanding the information you receive because of complexity of presentation formats?
    - ☐ Yes
    - ☐ No

25. How do you rate the existing level of support provided by the information services?
    - ☐ adequate
    - ☐ inadequate

26. If your response in (25) is "inadequate", what course of action do you suggest to minimize, if not eliminate, the problems you are currently experiencing?

_____
_____
_____
_____

27. To what extent have the information sources/services from within been of use to you?
    - ☐ very useful
    - ☐ useful
    - ☐ less useful
    - ☐ not useful

28. Based on your experience with the existing information service, how do you express the need for integrated information from a central database?
    - ☐ essential
    - ☐ some times important
    - ☐ seldom required

29. Please, indicate how such service/facility improves the existing level of service.

_____
_____
_____
_____

Part V Computer facilities, their uses and outputs

30. Does your department or service has computers?
    - ☐ Yes
    - ☐ No

31. Where are they located?
    - ☐ at the desk of secretaries
    - ☐ at a central location (office) accessible for all staff members of the department
    - ☐ at your office
    - ☐ other, please, specify_____

_____

32. If your response for (30) is "Yes", do you use the computers in your daily activity?
    - ☐ Yes

- ☐ No

33. If your response for (32) is "Yes", for what purpose(s) do you use the computer?
    - ☐ word processing
    - ☐ financial analysis and forecasting
    - ☐ statistical analysis (including econometric and time series analysis)
    - ☐ records management
    - ☐ table handling
    - ☐ others, please specify _____
      _____

34. How do you present your out put?
    - ☐ in a form of summarized tables
    - ☐ in a form of short notes accompanied by detailed tables
    - ☐ in a form of a document that includes detailed verbal analysis
    - ☐ in a form of graphs, maps, designs alone
    - ☐ in a form of graphs, maps or/and designs included in verbally analytical documents
    - ☐ other; please, specify _____
      _____

35. Who are the users of your out put?
    - ☐ your colleagues with in your department
    - ☐ other departments
    - ☐ the higher level management
    - ☐ external ministries and other agencies

36. If you are using information processed (compiled) using different packages (software), do you have problems of integration?
    - ☐ Yes
    - ☐ No

APPENDIX 2 - SOURCE PROGRAM

```
*The Project Class
create session
LOCAL proj
proj = NEW PROJECT ()
proj.Open()

CLASS PROJECT OF FORM
  public know
   Set Procedure To;
C:\DBASEWIN\SAMPLES\BUTTONS.CC; additive

   this.ScaleFontName = "Times New Roman"
  this.ScaleFontSize =       11
  this.HelpId = ""
  this.Text = """
  this.Width =       115
  this.Height =       18
  this.SysMenu = .F.
  this.HelpFile = ""
  this.Left =       0.1426
  this.EscExit = .F.
  this.Top =       0.2607
  this.OnClose = CLASS::FORM_ONCLOSE
  this.MenuFile = "PROJMAST.MNU"
  this.onopen=class::onopen

  DEFINE ENTRYFIELD PRNO OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      116.;
      ColorHighLight "W+/B".;
      Width       16.;
      Height       0.915.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      Enabled .f.;
      Top       0.085
DEFINE ENTRYFIELD LISTTITLE OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      117.;
      ColorHighLight "W+/B".;
      Width       42.;
      Height       1.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      enabled .f.;
      Top       1
 DEFINE ENTRYFIELD LOCATION OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      118.;
      ColorHighLight "W+/B".;
      Width       42.;
      Height       1.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      enabled .f.;
      Top       2
 DEFINE ENTRYFIELD PRIORITY OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      121.;
      ColorHighLight "W+/B".;
      Width       39.;
      Height       1.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      enabled .f.;
      Top       5
 DEFINE ENTRYFIELD FINANCE OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      123.;
      ColorHighLight "W+/B".;
      Width       39.;
      Height       1.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      enabled .f.;
      Top       6
DEFINE ENTRYFIELD DISBURSE OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      124.;
      ColorHighLight "W+/B".;
      Width       19.;
      Height       1.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      enabled .f.;
      Top       3
DEFINE ENTRYFIELD IMPLEMENT OF; THIS;
     PROPERTY;
      FontSize       10.;
      ID      125.;
      ColorHighLight "W+/B".;
      Width       39.;
      Height       1.;
      FontName "Times New Roman".;
      ColorNormal "N/W*".;
      Left       30.;
      enabled .f.;
      Top       7
DEFINE ENTRYFIELD EXECUTE OF THIS;
     PROPERTY;
      FontSize       10.;
      ID      126.;
```

```
    ColorHighLight "W+/B".;
    Width       39.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W*".;
    Left        30.;
    enabled .f.;
    Top         8

  DEFINE ENTRYFIELD STATUS OF THIS;
    PROPERTY;
    FontSize    10.;
    ID      127.;
    ColorHighLight "W+/B".;
    Width       21.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W*".;
    Left        30.;
    enabled .f.;
    Top         4

  DEFINE ENTRYFIELD TOTALCOST OF THIS;
    PROPERTY;
    FontSize    10.;
    ID      128.;
    ColorHighLight "W+/B".;
    Width       14.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W*".;
    Left        68.;
    enabled .f.;
    Top         3
DEFINE ENTRYFIELD LIFESPAN OF THIS;
    PROPERTY;
    FontSize    10.;
    ID      129.;
    ColorHighLight "W+/B".;
    Width       7.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W*".;
    Left        68.;
    enabled .f.;
    Top         4

  DEFINE ENTRYFIELD workdone OF THIS;
    PROPERTY;
    FontSize    10.;
    ID      130.;
    ColorHighLight "W+/B".;
    Width       7.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W*".;
    Left        67.;
    enabled .f.;
    Top         13
DEFINE ENTRYFIELD asof OF THIS;
    PROPERTY;
    FontSize    10.;
    ID      131.;
    ColorHighLight "W+/B".;
    Width       9.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W*".;
    Left        35.;
    enabled .f.;
    Top         13
DEFINE TEXT TEXT3 OF THIS;
    PROPERTY;
    FontSize    10.;
    Text "Total disbursement:".;
    Width       20.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W".;
    Border .F..;
    Left        1.;
    Top         3
DEFINE TEXT TEXT30 OF THIS;
    PROPERTY;
    FontSize    10.;
    Text "Last Report Date:".;
    Width       20.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W".;
    Border .F..;
    Left        1.;
    Top         13
DEFINE TEXT TELE6 OF THIS;
    PROPERTY;
    FontSize    10.;
    Text "Priority given:".;
    Width       23.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W".;
    Border .F..;
    Left        1.;
    Top         5

  DEFINE TEXT SOURCE OF THIS;
    PROPERTY;
    FontSize    10.;
    Text "Source of Finance:".;
    Width       23.;
    Height      1.;
    FontName "Times New Roman".;
    ColorNormal "N/W".;
    Border .F..;
    Left        1.;
    Top         6

  DEFINE TEXT TEXT6 OF THIS;
    PROPERTY;
    FontSize    10.;
```

```
    Text "Implementing Agency:",;
    Width       23,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        1,;
    Top         7

DEFINE TEXT TEXT1 OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Project Number:",;
    Width       19,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        1,;
    Top         0

DEFINE TEXT TEXT2 OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Project Title:",;
    Width       16,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        1,;
    Top         1

DEFINE TEXT TEXT7 OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Project Location:",;
    Width       19,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        1,;
    Top         2

DEFINE TEXT TEXT8 OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Total Coast:",;
    Width       12,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        51,;
    Top         3

DEFINE TEXT TEXT9 OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Project Lifespan:",;
    Width       17,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        52,;
    Top         4

DEFINE TEXT TEXT5 OF THIS;
  PROPERTY;
    FontSize    12,;
    Text "Executing Agency:",;
    Width       22,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        1,;
    Top         8

DEFINE TEXT TEXT10 OF THIS;
  PROPERTY;
    Text "Birr",;
    Width       6,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "R/W",;
    Border .F.,;
    Left        79,;
    Top         3

DEFINE TEXT TEXT11 OF THIS;
  PROPERTY;
    Text "Years",;
    Width       7,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "R/W",;
    Border .F.,;
    Left        78,;
    Top         4

DEFINE TEXT TEXT12 OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Project Status:",;
    Width       27,;
    Height      1,;
    FontName "Times New Roman",;
    ColorNormal "N/W",;
    Border .F.,;
    Left        1,;
    Top         4
DEFINE TEXT PROGRESS OF THIS;
  PROPERTY;
    FontSize    10,;
    Text "Progress in % terms:",;
    Width       22,;
    Height  1,;
```

```
        id 80,;
        FontName "Times New Roman",;
        ColorNormal "N/W",;
        Border .F.,;
        Left        45.;
        Top         13
DEFINE NEXTBUTTON NEXTBUTTON1 OF;
THIS;
      PROPERTY;
        Group .T.,;
        Width       13,;
        Height       1,;
        Left        46,;
        Top         14
DEFINE PREVBUTTON PREVBUTTON1 OF;
THIS;
      PROPERTY;
        Group .T.,;
        Width       10.;
        Height       1,;
        Left        63,;
        Top         14

  DEFINE PUSHBUTTON docpush OF THIS;
      PROPERTY;
        Text "Documents",;
        upbitmap "resource #641",;
        FontName "Times New Roman",;
        FontSize        10.;
        id 81,;
        Height       2,;
        Left        85,;
        Top          0,;
        ColorNormal "N/W",;
        Width       17,;
        Group .T.
DEFINE PUSHBUTTON DESIGNPUSH OF; THIS;
      PROPERTY;
        Text "Designs",;
        upbitmap "resource #221",;
        FontName "Times New Roman",;
        FontSize        10.;
        id 82,;
        Height       2,;
        Left        85,;
        Top          3,;
        ColorNormal "N/W",;
        Width       17,;
        Group .T.
DEFINE PUSHBUTTON IMPLPLAN OF THIS;
      PROPERTY;
        Text "Implem. Plans",;
        FontName "Times New Roman",;
        FontSize        10.;
        id 83,;
        Height       2,;
        Left        85,;
        Top          6,;
        ColorNormal "N/W",;
        Width       18,;
        Group .T.
DEFINE PUSHBUTTON PRINTPUSH OF THIS;
      PROPERTY;
        Text "Print",;
        upbitmap "Resource #652",;
        FontName "Times New Roman",;
        FontSize        10.;
        id 84,;
        Height       2,;
        Left        85,;
        Top          9,;
        ColorNormal "N/W",;
        Width       18,;
        Group .T.


  Procedure SelectAction(controlid)
  Do case
    Case controlid=80

    Case controlid=81
   form.root.documents.Onclick()
    Case controlid=82
    form.root.designs.onclick()
    Case controlid=83
    Case controlid=84
     form.root.file.print.onclick()
  endcase

procedure documents
local idno
idno=project->projectno
create session
set talk off

form.childdocument=new documentform()
form.childdocument.projectno=idno
form.childdocument.parentform=form
form.childdocument.open()

Procedure open
private prno, docmnt
if type("form.init")="U"
  form.init=.t.
  set skip to
  set exact off
  set procedure to document.wfm additive
  set procedure to design.wfm additive
  select select()
  use project again alias temp
  prno=field(1)
  set order to &prno

  use
  select project
  endif
  form::open()

procedure onopen
private srchstring
```

```
set procedure to srchft.wfm additive
srchstring = new srchftform()
srchstring.mdi=.f.
srchstring.readmodal()
srchstring.close()
close procedure srchft.wfm

procedure showdocument
  if type("form.childdocument")<>"U"
    form.childdocument.showdoc(project-
>projectno)

  endif


procedure designs
local idno
idno=project->projectno
create session
set talk off

form.childdesign=new designform()
form.childdesign.projectno=idno
form.childdesign.parentform=form
form.childdesign.open()

procedure callshowdesign
  if type("form.childdesign")<>"U"
    form.childdesign.showdesign;
        (project->projectno)
  endif

Procedure Form_OnClose
  close tables
  * _app.framewin.text=appwinname

ENDCLASS

*The industry class definition
create session
set procedure to project.wfm additive
public projectid, month
LOCAL indus
indus = NEW INDUSTRY ()
indus.Open()

CLASS INDUSTRY OF PROJECT
   this.text="An industrial Project"
   this.view="industry.qbe"
   this.OnSelection=class::SelectAction

   form.prno.datalink="project->projectno"
   form.listtitle.datalink="project->projecttit"
   form.location.datalink="project->location"
   form.finance.datalink="project->source"
   form.implement.datalink="project->implement"
   form.execute.datalink="project->excuter"
   form.lifespan.datalink="project->lifespan"
   form.totalcost.datalink="project->totalcost"
   form.status.datalink="projprog->projstatus"
   form.disburse.datalink="projprog->disbursmnt"
   form.workdone.datalink="projprog->workdone"
   form.asof.datalink="projprog->date"

   projectid=project->projectno


  DEFINE TEXT INDUST1 OF THIS;
    PROPERTY;
     Width      30,;
     Height      1,;
     FontName "Times New Roman",;
     ColorNormal "N/W",;
     Border .F.,;
     Text "Intended Plant capacity (annual;
prod.):",;
     Left      1,;
     FontSize      12,;
     Top      9
DEFINE TEXT INDUST2 OF THIS;
    PROPERTY;
     Width      20,;
     Height      1,;
     FontName "Times New Roman",;
     ColorNormal "N/W",;
     Border .F.,;
     Text "Product to be produced:",;
     Left      1,;
     FontSize      12,;
     Top      10
  DEFINE TEXT INDUST3 OF THIS;
    PROPERTY;
     Width      23,;
     Height      1,;
     FontName "Times New Roman",;
     ColorNormal "N/W",;
     Border .F.,;
     Text "Input would be used:",;
     Left      1,;
     FontSize      12,;
     Top      11
DEFINE entryfield capacity OF THIS;
    PROPERTY;
     Width      37,;
     Height      1,;
     ColorNormal "N/W*",;
     Left      32,;
     ID      130,;
      ColorHighLight "W+/B",;
     Top      9,;
     datalink "industry->plantcapct",;
     enabled .f.
 DEFINE entryfield product OF THIS;
    PROPERTY;
     Width      42,;
     Height      1,;
     ColorNormal "N/W*",;
     Left      30,;
     ID      131,;
     ColorHighLight "W+/B",;
```

```
      Top       10,;
      Datalink "industry->product",;
      enabled .f.
DEFINE entryfield input OF THIS;
     PROPERTY;
      Width       13,;
      Height       1,;
      ColorNormal "N/W*",;
      Left       33,;
      ID       132,;
      ColorHighLight "W+/B",;
      Top       11,;
      Datalink "industry->input",;
      enabled .f.

ENDCLASS

*The Document class definition
#include <Messdlg.h>
shell(.f.,.t.)
create session
set talk off
CLASS DOCUMENT OF FORM
  Set Procedure To;
C:\DBASEWIN\SAMPLES\BUTTONS.CC; additive
  this.Width =       89.833
  this.HelpId = ""
  this.Text = "Form"
  this.HelpFile = ""
  this.MenuFile = "PROJECT.MNU"
  this.Height =       18
  this.Left =       1
  this.Top =       0
  this.view= "document.qbe"
  this.onclose=class::onclose

  DEFINE EDITOR EDITOR1 OF THIS;
     PROPERTY;
      Width       87,;
      Wrap .T.,;
      FontName "Times New Roman",;
      FontSize       12,;
      ColorNormal "N/W*",;
      Border .T.,;
      Height       17,;
      datalink "document->text",;
      Left       1,;
      Top       1


procedure open
 if type("form.init")="U"
form.init=.t.
private orderfield
set procedure to project.wfm additive
set procedure to industry.wfm additive
*select select()
use document again in select() alias temp1

docfield=field(1)
set order to &docfield
use in temp1
select document
if type("form.parentdocument")<>"U"
  form.EscExit=.t.
endif
endif
form::open()

procedure onclose
if type("form.parentdocument")="U"
  shell(.t.)
endif

procedure showdoc(projno)
private idnum
idnum=projno
set order to projectno
set key to "&idnum"
go top
seek projno

ENDCLASS


CLASS DESIGN OF FORM
  Set Procedure To;
C:\DBASEWIN\SAMPLES\BUTTONS.CC; additive
  this.ScaleFontName = "Times New Roman"
  this.ScaleFontSize =       12
  this.HelpId = ""
  this.SysMenu = .F.
  this.Text = "Form"
  this.HelpFile = ""
  this.Height =       19.3037
  this.Left =       0.5713
  this.Top =       0
  this.Width =       72.5713
  this.MenuFile = "PROJECT.MNU"
  this.view= "design.qbe"

DEFINE IMAGE IMAGE1 OF THIS;
     PROPERTY;
      Height       18,;
      Left       1,;
      Top       2,;
      Width       72,;
      datasource "memo design->design"


procedure open
 if type("form.init")="U"
 form.init=.t.
 private orderfield
 set procedure to project.wfm additive
 set procedure to industry.wfm additive
 use design again in select() alias temp2

 desfield=field(1)
 set order to &desfield
```

```
 use in temp2
 select design
 if type("form.parentdesign")<>"U"
   form.EscExit=.t.
 endif
endif
form::open()

procedure onclose
if type("form.parentdesign")="U"
 shell(.t.)
endif

procedure showdesign(projno)
private idnum
idnum=projno
set order to projectno
set key to "&idnum"
go top
seek projno

ENDCLASS

*The Search calling class
#include <Messdlg.h>
set ldCheck off

CLASS mysearch OF FORM
  Set Procedure To BUTTONS.CC Additive
  this.OnOpen = CLASS::ONOPEN
  this.OnClose = CLASS::ONCLOSE
  this.OnSelection = CLASS::ONSELECTION
  this.MousePointer =        1
  this.Text = "Search"
  this.Width =       36.79
  this.Top =        7.29
  this.Left =       33.98
  this.Height =        6.00
  this.Minimize = .F.
  this.Maximize = .F.
  this.HelpFile = ""
  this.HelpId = ""

  DEFINE RECTANGLE SEARCHRECT OF
THIS;
    PROPERTY;
      ColorNormal "N/W",;
      Text "&Search for:",;
      Height       2.92,;
      Width       34.31,;
      Top        0.54,;
      Left       1.32,;
      Border .T.
DEFINE ENTRYFIELD SEARCHENTRY OF;
THIS;
    PROPERTY;
      ColorNormal "B/W",;
      Width       31.67,;
      Top        1.60,;
      Left       2.64,;
      Height       1.32,;
      Value "         ",;
      FontSize       11.00,;
      Border .T.,;
      ColorHighLight "B+/W*"
DEFINE OKBUTTON OKSEARCHBUTTON OF;
THIS;
    PROPERTY;
      Width       14.11,;
      Top       3.98,;
      Left       4.00,;
      Height       1.50,;
      Default .T.
DEFINE CANCELBUTTON;
CANCELSEARCHBUTTON OF THIS;
    PROPERTY;
      OnClick .f.,;
      Width       14.11,;
      Top       3.98,;
      Left       19.50,;
      Height       1.50,;
      Group .F.,;
      Id 0

  ************************************
  procedure OnOpen
  ************************************
  set procedure to Sampproc additive
                        && if Search was called
from customer/
  if type("this.keyName") <> "U"   && orders with
the keyName property assigned
    this.text = FormatStr("Search -- %1",
this.keyName)
    this.searchEntry.picture = this.formatting
  endif
  this.searchEntry.SetFocus()

  ************************************
  procedure OnClose
  ************************************
  close procedure Buttons.cc, Sampproc.prg

  ************************************
  procedure OnSelection(controlId)
  ************************************
  if controlId <> 0   && If Cancel wasn't selected
    form.value = form.searchEntry.value
  endif
  form.Close()
ENDCLASS

*The Control assignment class
LOCAL f
f = NEW SELECT ()
f.open()
CLASS SELECT OF FORM
  Set Procedure To;
C:\DBASEWIN\SAMPLES\BUTTONS.CC; additive
```

```
    this.ScaleFontSize =        11
    this.HelpId = ""
    this.HelpFile = ""
    this.StatusMessage = "Available project
  monitoring areas"
    this.Text = "Available Project Menu list"
    this.OnSelection =
  CLASS::FORM_ONSELECTION
    this.ScrollBar =        1
    this.EscExit = .F.
    this.MenuFile = "FAKEMENU.MNU"
    this.Height =        17.2373
    this.Left =        53.166
    this.ColorNormal = "N/W*"
    this.Top =        0.7617
    this.Width =        42.5
    this.ScaleFontName = "Times New Roman"
  DEFINE PUSHBUTTON AGRICULTURE OF
  THIS;
       PROPERTY;
        Default .T.;
        Text "Agriculture ";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        1.;
        Group .T.;
        Width        20.;
        FontSize        11
  DEFINE PUSHBUTTON WATER OF THIS;
       PROPERTY;
        ID        207.;
        StatusMessage "Press to look for water;
           projects";
        Text "Water";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        13.;
        Group .T.;
        Width        20.;
        FontSize        11
  DEFINE PUSHBUTTON EDUCATION OF THIS;
       PROPERTY;
        ID        202.;
        Text "Education";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        3.;
        Group .T.;
        Width        20.;
        FontSize        11
  DEFINE PUSHBUTTON HEALTH OF THIS;
       PROPERTY;
        ID        203.;
        Text "Health";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        5.;
        Group .T.;
        Width        20.;
        FontSize        11
  DEFINE PUSHBUTTON INDUSTRY OF THIS;
       PROPERTY;
        ID        204.;
        StatusMessage "Press to look for industrial;
           projects";
        Text "Industry";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        7.;
        Group .T.;
        Width        20.;
        FontSize        11
  DEFINE PUSHBUTTON
  TELECOMMUNICATION OF THIS;
       PROPERTY;
        ID        205.;
        StatusMessage "Press to look for;
           telecommunication projects";
        Text "Telecommunication";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        9.;
        Group .T.;
        Width        22.;
        FontSize        11
  DEFINE PUSHBUTTON POWER OF THIS;
       PROPERTY;
        ID        206.;
        StatusMessage "Press to look for power;
           projects";
        Text "Power";
        Height        1.;
        FontName "Times New Roman";
        Left        11.;
        ColorNormal "N/W";
        Top        11.;
        Group .T.;
        Width        20.;
        FontSize        11

  DEFINE PUSHBUTTON TRADE OF THIS;
       PROPERTY;
        ID        208.;
        StatusMessage "Press to look for trade;
           projects";
        Text "Trade";
        Height        1.;
        FontName "Times New Roman";
```

```
      SpeedBar .T.;
      Left        11.;
      ColorNormal "N/W",;
      Top         15.;
      Group .T.;
      Width       20.;
      FontSize    11
DEFINE CLOSEBUTTON CLOSEBUTTON1 OF;
THIS;
    PROPERTY;
      Height      1.;
      Left        32.;
      Top         11.;
      Group .T.;
      Width       10

  Procedure Form_OnSelection(controlId)
  Do case
    case controlid=204
     form.close()
     form.release()
     set procedure to industry.wfm additive
     do industry.wfm
    case controlid=205
  endcase

ENDCLASS


LOCAL f
f = NEW SRCHFT ()
f.Open()

CLASS SRCHFT OF FORM
  Set Procedure To
C:\DBASEWIN\SAMPLES\BUTTONS.CC additive

  this.HelpId = ""
  this.HelpFile = ""
  this.Text = "Search Request"
  this.Height =       15.7646
  this.Left =         1
  this.Top =          0
  this.Width =        53.666
DEFINE RECTANGLE RECTANGLE1 OF THIS;
    PROPERTY;
      Text "A search for a Project".;
      Border .T.,;
      FontName "Times New Roman".;
      FontSize        12.;
      ColorNormal "N/W".;
      Height          6.;
      Left        3.;
      Top         2.;
      Width       43

  DEFINE TEXT TEXT1 OF THIS;
    PROPERTY;
      Text "Do you want to conduct a search?".;
      Border .F.,;
      FontName "Times New Roman".;
      FontSize        11.;
      ColorNormal "N/W".;
      Height          1.;
      Left        6.;
      Top         4.;
      Width       37

  DEFINE CHECKBOX CHECKBOX1 OF THIS;
    PROPERTY;
      OnChange
CLASS::CHECKBOX1_ONCHANGE.;
      Text "".;
      ColorNormal "N/W".;
      Height          1.;
      Left        16.;
      Top         6.;
      Value .F.;
      Width       4.;
      Group .T.

  DEFINE TEXT TEXT2 OF THIS;
    PROPERTY;
      Text "Yes".;
      Border .F.,;
      FontName "Times New Roman".;
      FontSize        12.;
      ColorNormal "N/W".;
      Height          1.;
      Left        7.;
      Top         6.;
      Width       7

  DEFINE TEXT TEXT3 OF THIS;
    PROPERTY;
      Text "No".;
      Border .F.,;
      FontName "Times New Roman".;
      FontSize        12.;
      ColorNormal "N/W".;
      Height          1.;
      Left        26.;
      Top         6.;
      Width       7

  DEFINE CHECKBOX CHECKBOX2 OF THIS;
    PROPERTY;
      OnChange
CLASS::CHECKBOX2_ONCHANGE.;
      Text "".;
      ColorNormal "N/W".;
      Height          1.;
      Left        36.;
      Top         6.;
      Value .F.;
      Width       3.;
      Group .T.

  DEFINE RECTANGLE RECTANGLE2 OF
THIS;
```

```
        PROPERTY;
         Text "Search ",;
         Border .T.,;
         FontName "Times New Roman",;
         FontSize      12,;
         ColorNormal "N/W",;
         Height        7,;
         Left          3,;
         Top           8,;
         Width        43

    DEFINE TEXT TEXT4 OF THIS;
      PROPERTY;
       Text "by title",;
       Border .F.,;
       FontName "Times New Roman",;
       FontSize      12,;
       ColorNormal "N/W",;
       Height        1,;
       Left          5,;
       Top           9,;
       Width        21

    DEFINE TEXT TEXT5 OF THIS;
      PROPERTY;
       Text "by location",;
       Border .F.,;
       FontName "Times New Roman",;
       FontSize      12,;
       ColorNormal "N/W",;
       Height        1,;
       Left          6,;
       Top          11,;
       Width        17

    DEFINE TEXT TEXT6 OF THIS;
      PROPERTY;
       Text "financier",;
       Border .F.,;
       FontName "Times New Roman",;
       FontSize      12,;
       ColorNormal "N/W",;
       Height        1,;
       Left          6,;
       Top          13,;
       Width        21

    DEFINE CHECKBOX CHECKBOX3 OF THIS;
      PROPERTY;
       OnChange
CLASS::CHECKBOX3_ONCHANGE,;
       Text "",;
       ColorNormal "N/W",;
       Height        1,;
       Left         36,;
       Top           9,;
       Value .F.,;
       Width         4,;
       Group .T.

    DEFINE CHECKBOX CHECKBOX4 OF THIS;
      PROPERTY;
       OnChange
CLASS::CHECKBOX4_ONCHANGE,;
       Text "",;
       ColorNormal "N/W",;
       Height        1,;
       Left         36,;
       Top          11,;
       Value .F.,;
       Width         3,;
       Group .T.

    DEFINE CHECKBOX CHECKBOX5 OF THIS;
      PROPERTY;
       OnChange
CLASS::CHECKBOX5_ONCHANGE,;
       Text "",;
       ColorNormal "N/W",;
       Height        1,;
       Left         36,;
       Top          13,;
       Value .F.,;
       Width         3,;
       Group .T.


Procedure CHECKBOX1_OnChange
 form.checkbox2.enabled=.f.

Procedure CHECKBOX2_OnChange
 form.close()

Procedure CHECKBOX3_OnChange
 form.checkbox4.enabled=.f.
 form.checkbox5.enabled=.f.
 if form.checkbox1.value
   class::dosearch()
 endif

Procedure CHECKBOX4_OnChange
 form.checkbox3.enabled=.f.
 form.checkbox5.enabled=.f.
 if form.checkbox1.value
    class::dosearch()
 endif

Procedure CHECKBOX5_OnChange
 form.checkbox3.enabled=.f.
 form.checkbox4.enabled=.f.
 if form.checkbox1.value
   class::dosearch()
 endif


Procedure dosearch
private searchform, searchitem, saverec
set procedure to mysearch.wfm additive
search = new mysearch ()
```

```
searchform.mdi=.f.
searchform.formatting="@X"
if form.checkbox1.value

do case
  case form.checkbox3.value
  searchform.keyname="Enter Project Title"
  searchitem=search.readmodal()
  if type("searchitem")="O" .and. searchitem.id<>0;
      .and. .not. empty(search.value)
    saverec=recno()
    form.enabled=.f.


    locate for projecttit=search.value
    if .not. found()
      go saverec
      InformationMessage(FormatStr("Title Was:
          not found", search.value),"Infor")
    endif
  endif
 case form.checkbox4.value
    searchform.keyname="Enter Location Name"
     searchitem=searchform.readmodal()
  if type("searchitem")="O" .and. searchitem.id<>0;
      .and. .not. empty(searchform.value)
    saverec=recno()
    form.enabled=.f.
    locate for location=search.value
    if .not. found()
      go saverec
      InformationMessage(FormatStr("Location
name Was not found", search.value),"Infor")
    endif
    endif
  case form.checkbox5.value
    searchform.keyname="Enter Financier Name"
     searchitem=searchform.readmodal()
    if type("searchitem")="O" .and.
searchitem.id<>0;
      .and. .not. empty(search.value)
    saverec=recno()
    form.enabled=.f.
    locate for location=searchform.value
    if .not. found()
      go saverec
      InformationMessage(FormatStr("Financier
name Was not found", search.value),"Infor")
    endif
   endif
 endcase
 form.enabled=.t.

 search.release()
 close procedure mysearch.wfm

endif
form.close()
form.release()
```

```
ENDCLASS

*The Main menu class definition
create session
shell(.f.,.t.)

LOCAL f
f = NEW MAINMNU ()
f.Open()

CLASS MAINMNU OF FORM
  Set Procedure To;
C:\DBASEWIN\SAMPLES\BUTTONS.CC; additive
  public appwinname

  appwinname=_app.framewin.text
  _app.framewin.text="A Prototype of Planning and
Policy Database"

  this.ScaleFontSize =       11
  this.HelpId = ""
  this.HelpFile = ""
  this.Text = " Main Menu"
  this.OnSelection =
CLASS::FORM_ONSELECTION
  this.Height =       18
  this.Left =       2.5
  this.EscExit = .F.
  this.Top =       0
  this.MenuFile = "FAKEMENU.MNU"
  this.Width =       100
  this.ScaleFontName = "Times New Roman"
 DEFINE PUSHBUTTON MAIN1 OF THIS;
    PROPERTY;
      Text "General Profile",;
      FontName "Times New Roman",;
      ColorNormal "N/0XE8FFFF",;
      Group .T.,;
      FontSize       12.;
      Default .T.,;
      Height       2.;
      ID       101.;
      Left       10.;
      Top       1.;
      Width       22

  DEFINE PUSHBUTTON MAIN2 OF THIS;
    PROPERTY;
      Text "Project Profile",;
      FontName "Times New Roman",;
      ColorNormal "N/0XE8FFFF",;
      Group .T.,;
      FontSize       12.;
      Height       2.;
      ID       102.;
      Left       10.;
      Top       4.;
      Width       22

  DEFINE PUSHBUTTON MAIN3 OF THIS;
```

```
searchform.mdi=.f.
searchform.formatting="@X"
if form.checkbox1.value

do case
  case form.checkbox3.value
  searchform.keyname="Enter Project Title"
  searchitem=search.readmodal()
  if type("searchitem")="O" .and. searchitem.id<>0;
      .and. .not. empty(search.value)
    saverec=recno()
    form.enabled=.f.


    locate for projecttit=search.value
    if .not. found()
      go saverec
      InformationMessage(FormatStr("Title Was:
          not found", search.value),"Infor")
    endif
  endif
 case form.checkbox4.value
    searchform.keyname="Enter Location Name"
     searchitem=searchform.readmodal()
  if type("searchitem")="O" .and. searchitem.id<>0;
      .and. .not. empty(searchform.value)
    saverec=recno()
    form.enabled=.f.
    locate for location=search.value
    if .not. found()
      go saverec
      InformationMessage(FormatStr("Location
name Was not found", search.value),"Infor")
    endif
    endif
  case form.checkbox5.value
    searchform.keyname="Enter Financier Name"
     searchitem=searchform.readmodal()
    if type("searchitem")="O" .and.
searchitem.id<>0;
      .and. .not. empty(search.value)
    saverec=recno()
    form.enabled=.f.
    locate for location=searchform.value
    if .not. found()
      go saverec
      InformationMessage(FormatStr("Financier
name Was not found", search.value),"Infor")
    endif
  endif
endcase
form.enabled=.t.

 search.release()
 close procedure mysearch.wfm

endif
form.close()
form.release()
```

```
ENDCLASS

*The Main menu class definition
create session
shell(.f...t.)

LOCAL f
f = NEW MAINMNU ()
f.Open()

CLASS MAINMNU OF FORM
  Set Procedure To;
C:\DBASEWIN\SAMPLES\BUTTONS.CC; additive
  public appwinname

  appwinname=_app.framewin.text
  _app.framewin.text="A Prototype of Planning and
Policy Database"

  this.ScaleFontSize =        11
  this.HelpId = ""
  this.HelpFile = ""
  this.Text = " Main Menu"
  this.OnSelection =
CLASS::FORM_ONSELECTION
  this.Height =        18
  this.Left =        2.5
  this.EscExit = .F.
  this.Top =        0
  this.MenuFile = "FAKEMENU.MNU"
  this.Width =        100
  this.ScaleFontName = "Times New Roman"
DEFINE PUSHBUTTON MAIN1 OF THIS;
    PROPERTY;
      Text "General Profile",;
      FontName "Times New Roman",;
      ColorNormal "N/0XE8FFFF",;
      Group .T.,;
      FontSize        12,;
      Default .T.,;
      Height        2,;
      ID        101,;
      Left        10,;
      Top        1,;
      Width        22

 DEFINE PUSHBUTTON MAIN2 OF THIS;
    PROPERTY;
      Text "Project Profile",;
      FontName "Times New Roman",;
      ColorNormal "N/0XE8FFFF",;
      Group .T.,;
      FontSize        12,;
      Height        2,;
      ID        102,;
      Left        10,;
      Top        4,;
      Width        22

DEFINE PUSHBUTTON MAIN3 OF THIS;
```

```
        PROPERTY;
          OnClick CLASS::EXIT.;
          Text "Exit".;
          FontName "Times New Roman".;
          ColorNormal "R+/0XE8FFFF".;
          Group .T.;
          FontSize      12.;
          Height        2.;
          Left      10.;
          Top       7.;
          FocusBitmap "RESOURCE #601".;
          Width     22

      Procedure Form_OnSelection(controlId)
      local idval
      do case
         case controlid=101
         case controlid=102

            set procedure to select.wfm additive
            do select.wfm
      endcase


      Procedure exit
       shell(.t.)
      _app.framewin.text=appwinname

      form.close()
      form.release()

    ENDCLASS
    *The welcome class
    LOCAL f
    f = NEW WELCOME ()
    f.Open()

    CLASS WELCOME OF FORM
      Set Procedure To
    C:\DBASEWIN\SAMPLES\BUTTONS.CC additive
      this.Height =       20.3809
      this.Left =       1
      this.Top =        0
      this.Text = ""
      this.Width =      103
      this.ColorNormal = "G+/0X404080"
      this.EscExit = .F.
      this.MDI = .F.
      this.ScaleFontName = "Times New Roman"
      this.ScaleFontSize =        11
      this.HelpId = ""
      this.SysMenu = .F.
      this.HelpFile = ""

     DEFINE TEXT TEXT1 OF THIS;
        PROPERTY;
          FontItalic .T.;
          Border .F.;
          Height        5.;
          FontName "Times New Roman".;
          Left      3.;
          FontSize      25.;
          Top       1.;
          Text "Welcome to the Database System of;
    the".;
          Width     93.;
          ColorNormal "0x80ff/R*".;
          Alignment       4

       DEFINE TEXT TEXT2 OF THIS;
         PROPERTY;
          FontItalic .T.;
          Border .F.;
          Height        4.;
          FontName "Times New Roman".;
          Left      3.;
          FontSize      18.;
          Top       6.;
          Text "Ministry of Economic Development and
    Cooperation".;
          Width     93.;
          ColorNormal "0x80ff/R*".;
          Alignment       4

       DEFINE TEXT TEXT3 OF THIS;
         PROPERTY;
          Border .F.;
          Height        2.;
          Left      60.;
          FontSize      12.;
          Top       11.;
          Text "Design:".;
          Width     25.;
          ColorNormal "N/W"

       DEFINE TEXT TEXT4 OF THIS;
         PROPERTY;
          FontItalic .T.;
          Border .F.;
          Height        2.;
          Left      69.;
          FontSize      10.;
          Top       13.;
          Text "Hailie Mekonnen".;
          Width     26.;
          ColorNormal "N/W"

    DEFINE PUSHBUTTON continue OF THIS;
      PROPERTY;
       onclick class::goontonext.;
       Default .T.;
       Group .T.;
       Height        2.;
       FontName "Times New Roman".;
       Left      12.;
       FontSize      11.;
       Top       18.;
       Text "Continue".;
       Width     17.;
       ColorNormal "0X80FF00/B*"
```

```
  DEFINE CLOSEBUTTON CLOSEBUTTON1 OF
THIS;
     PROPERTY;
      Group .T.;
      Height      2.;
      Left      35.;
      Top      18.;
      Width      15

procedure goontonext
form.close()
form.release()
set procedure to mainmnu.wfm additive
do mainmnu.wfm
ENDCLASS
```

Appendix 3 - Sample Questionnaires Filled by Respondents

10 March, 1997

Dear sir/Madame,

A survey is being conducted to assess the existing level of information provision for economic planning and policy analysis within the Ministry of Economic Development and Cooperation, with a view of suggesting better ways of organization that increase the accessibility of available information. The work is being done in partial fulfillment for an M.Sc. I.S. degree in information studies.

I realize that you are very busy, but as you would appreciate, the success of my thesis depends on your cooperation. To this end, I am keen to receive your responses, so please make every effort to return the completed questionnaire at your earliest convenience, but no later than five days. All replies will be treated in strict confidence.

If you have any problem in completing the questionnaire, do not hesitate to contact me on 172 internal line.

Thank you in anticipation of your kind cooperation.

Hailie Mekonnen
School of Information Studies for Africa
Addis Ababa University

A SURVEY OF INFORMATION NEEDS AND PROBLEMS

Instruction for completing the questionnaire

Please, put an 'x' mark on the space provided to indicate your response where applicable. In case where responses other than marks are required, please, write your responses in the spaces provided. You may use additional paper where the space provided is not enough.

Part I: Identification

1. Identification information
   Department Name: Economic Macro Planning Policy Analysis
   Profession: Statistician / Economist
   Position: Senior Expert
2. What are the specific activities you are currently engaged in?
   ~~[illegible]~~
   policy analysis and simulation. Estimate National Economic parameters that would help appraise Investment projects etc.

Part II: Category of Information and Sources

3. Below are listed broad categories of information related to economic planning and policy analysis. Indicate the category of information you require to carry out the activities indicated in (2) by using the labels listed below.
   (h=high priority; m=medium priority; l=low priority)

H Economic (Gross Domestic Product (GDP), Growth rate, Inflation rate...)

Geographic

L **Locational data** (latitude, longitude, direction...)
M **Climatic data** (rain fall, temperature...)
H **Resource data (Environmental data)** (Land use and/or coverage types, patterns, Soils...)
M **Human Geographic Data** (Population number and distribution, political maps (countries and distribution)...)

M **Population dynamics** (population growth, total births, birth rate...)

Infrastractural data

M **Building data** (type of building, architectural drawing...)
M **Road data** (type of road (primary, main road, feeder and rural road) ...)
L **Mass media information** (radio and television, press - no of editions (news paper/magazine)...)
L **Air transport** (no of airports, construction type...)
L **Telecommunication data** (no of apparatus (at regional, national level), no of customers (at regional, national level)...)

H **Agriculture data** (land in use, agricultural population density...)

- [ ] **Education data** (literacy rate, ages of compulsory education…)
- [ ] **Health data**(medical care expenditure, access to health care…)
- **Other, please specify** Research data / data generated as a result of Research, say, Agricultural research

4. At what level do you require information of the identified type?

- [x] international
- [ ] continental
- [x] national
- [x] regional
- [x] subregional
- [x] woreda
- [ ] kebele
- [x] enterprise
- [x] project
- [ ] house hold
- [ ] individual

5. What sources do you use to meet your information requirements?

Internal Sources

- [x] Library (documentation center)
- [ ] A central database
- [ ] From meetings, seminars, etc.

External Sources

- [ ] Media (Radio, TV, news paper,...)
- [ ] From meetings, seminars, etc.
- [x] Reports and monographs
  - [x] Government institutions
    - [x] Federal institutions
    - [ ] regional institutions
  - [ ] NGOs
  - [x] World Bank
  - [x] UN agencies
  - [x] Other, please, specify Sample Surveys

Part III: Information Types and Forms

6. Does the information you require includes image types (graphs, maps, etc.)?
   - [ ] Yes
   - [x] No
7. If your response in (6) is "Yes", what kind?
   - [ ] pictures(photographic like satellite images)
   - [ ] cartographic types (maps, etc.)
   - [ ] engineering designs(plans,architectural drawings, etc.)
   - [ ] other, please, specify

8. How do you store your information?
   - [x] as a periodically consecutive information (as a time series data tables/documents)
   - [x] as a one time (cross-sectional) information in a single file or folder regardless of time
   - [x] other, please, specify both cross-sectional and time series i.e panel data

9. How do you classify when you store it?
   - [x] by type of indicators (information)
   - [x] by spatial location (continent, national, region, zone, woreda)
   - [ ] other, please, specify _____

10. When you are provided with information, how do you get it?
   - [x] hard copy(on paper)
   - [ ] on floppy disk
   - [ ] accessing from a central database
   - [ ] others, please, specify Through Sample Surveys

Part IV Accessibility, availability and other factors related to information

11. How do you rate the **availability** of information at your workplace (institution)?
   - [ ] Very good
   - [x] Good
   - [ ] Fair
   - [ ] Poor

12. If you have felt that **availability** of information is fair or poor, what do you think the reason(s) could be?
   - [ ] absence of an organized system such as absence of central database services and poor manual systems
   - [ ] low level of utilization of information technology
   - [ ] poor communication with other offices
   - [ ] low level of recognition for the role of information
   - [ ] difficulty in searching and locating because of the manual nature of the information service
   - [ ] other, please, specify _____

13. How do you rate the **accessibility** of the available information?
   - [ ] accessible
   - [x] moderately accessible
   - [x] poorly accessible
   - [ ] inaccessible

14. If your response for (12) is "poorly accessible" or "inaccessible", what in your opinion is (are) the possible cause(s)?
- [x] lack of proper utilization of information technology
- [ ] absence of tracer slip or file movement register
- [ ] absence of retrieval tools such as accession register and location register
- [ ] absence of finding aids such as lists, indexes and other guides
- [ ] inadequacy of reprographic/micrographic facilities
- [ ] lack of properly trained manpower in the area of information services
- [ ] other, please, specify _____

15. How do you rate the **consistency** of the information you are receiving?
- [ ] consistent
- [x] moderately consistent
- [ ] poorly consistent
- [ ] inconsistent

16. If your response in (15) is "inconsistent" or "poorly consistent", what do you think the reason(s) could be?
- [ ] absence of an organized/integrated information system within the ministry
- [ ] low level of application of information technology
- [ ] depulicated external information sources
- [ ] other, please, specify _____

17. How do you rate the **accuracy** of the information you are receiving?
- [ ] accurate
- [x] moderately accurate
- [ ] poorly accurate
- [ ] inaccurate

18. If you feel that the information you get is "inaccurate" or "poorly accurate", what in your opinion the reason(s) could be?
- [ ] absence of an organized/integrated information system
- [ ] low level of application of information technology
- [ ] unreliable external information sources
- [ ] other, please, specify _____

19. How do you rate the **timeliness** of the information you are getting?
- [ ] very good
- [ ] good
- [x] fair
- [ ] poor

20. If your response for (19) is "poor" or "fair", what in your opinion the reason(s) could be?
- [x] absence of an organized/integrated information system
- [x] low level of application of information technology
- [ ] poor delivery system linked with external sources
- [ ] other, please, specify _____

21. How do you rate the **completeness** of the information provided to you?
    - ☐ very good
    - ☐ good
    - ☒ fair
    - ☐ poor

22. If your response for (21) is "poor" or "fair", what in your opinion the reason(s) could be?
    - ☒ absence of an organized/integrated information system
    - ☒ low level of application of information technology
    - ☐ other, please, specify_____

23. Do you think that the information you receive addresses your needs, i.e., conforms to your demands?
    - ☐ Yes
    - ☒ Yes, but partly
    - ☐ No

24. Do you see problems in comprehending or understanding the information you receive because of complexity of presentation formats?
    - ☐ Yes
    - ☒ No

25. How do you rate the existing level of support provided by the information services?
    - ☐ adequate
    - ☒ inadequate

26. If your response in (25) is "inadequate", what course of action do you suggest to minimize, if not eliminate, the problems you are currently experiencing?

Developing central database database
System would help improve the service

27. To what extent have the information sources/services from within been of use to you?
    - ☒ very useful
    - ☐ useful
    - ☐ less useful
    - ☐ not useful

28. Based on your experience with the existing information service, how do you express the need for integrated information from a central database?
    - ☒ essential
    - ☐ some times important
    - ☐ seldom required

29. Please, indicate how such service facility improves the existing level of service.

Saves time, easily accessible

Part V Computer facilities, their uses and outputs

30. Does your department or service has computers?
- [x] Yes
- [ ] No

31. Where are they located?
- [x] at the desk of secretaries
- [ ] at a central location (office) accessible for all staff members of the department
- [x] at your office
- [ ] other, please, specify _____

32. If your response for (30) is "Yes", do you use the computers in your daily activity?
- [x] Yes
- [ ] No

33. If your response for (32) is "Yes", for what purpose(s) do you use the computer?
- [x] word processing
- [x] financial analysis and forecasting
- [x] statistical analysis (including econometric and time series analysis)
- [ ] records management
- [x] table handling
- [ ] others, please specify _____

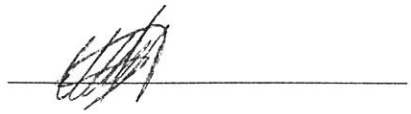
34. How do you present your out put?
- [x] in a form of summarized tables
- [ ] in a form of short notes accompanied by detailed tables
- [x] in a form of a document that includes detailed verbal analysis
- [ ] in a form of graphs, maps, designs alone
- [ ] in a form of graphs, maps or/and designs included in verbally analytical documents
- [ ] other; please, specify _____

35. Who are the users of your out put?
- [x] your colleagues with in your department
- [x] other departments
- [x] the higher level management
- [x] external ministries and other agencies

36. If you are using information processed (compiled) using different packages (software), do you have problems of integration?
- [ ] Yes
- [x] No

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.



Hailie Mekonnen

May 16, 1997

The thesis has been submitted for examination with my approval as a university advisor.

Tesfaye Birru

May 16, 1997