ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF INFORMATION STUDIES FOR AFRICA

INFORMATION SUPPORT SYSTEM

FOR
URBAN-REGIONAL PLAN PREPARATION

AT
THE NATIONAL URBAN PLANNING INSTITUTE

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENT FOR THE DEGREE OF MASTER OF

SCIENCE IN INFORMATION SCIENCE

BY

TEMTIM ASSEFA

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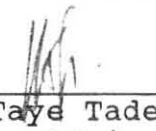

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ABSTRACT

Planning in general and urban-regional plan preparation in particular is now becoming increasingly an information intensive activity so much so that the success of the planning exercise depends on the availability of adequate, timely and reliable information. In Third World countries including Ethiopia, information intensive activities like planning are very much affected by poor information support services.

It is in this context that this study deals with the design of an information support system that can provide information tailored to the needs of NUPI's planners, researchers and other professional staff involved in the preparation of urban-regional plans. The study employed a structured method of system analysis and design technique. The required data to design the system were collected by questionnaire survey, interviews and observations.

The design of the system was preceded by analysis of the existing system problems and suggestions for preliminary problem solutions. The study reveals that the existing system does not have a well-established data processing procedure resulting, at times, in the underutilization and improper use of information collected at high cost.

The users' information requirements were identified as the prime basis for the design of the new system. The information required by NUPI is very diversified including economic, population, services, natural resources, crop production, land use, etc. It covers almost all human experience, generally. In order to satisfy users' information requirement, the system functions such as sample data processing and map preparation that are applied to process the raw data into usable forms are described and documented with the help of data flow diagrams and a set of algorithm descriptions, referred to as **logical system design.** Basing on the logical system, the design of the physical system was developed for implementation which includes generation and selection of system alternatives, and design of prototype output, input data elements, and database. In general terms, the system design proposed in this study can help in partly alleviating the existing problems. The study recommends other system design projects to bring about complete solutions to the prevailing problems.

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ABBREVIATIONS USED

AAMPO	Addis Ababa Master Plan Project Office
DGM	Deputy General Manager
ERD	Economic Research Department
ME	Ministry of Education
MPPD	Master Plan Preparation Department
MUDH	Ministry of Urban Development and Housing
NUPI	National Urban Planning Institute
PIFU	Project Implementation and Follow Up Unit
PPRD	Physical Planning Research Department
PSARD	Population and Social Affairs Research
PWUD	Public Works and Urban Development
R&D	Research and Development
SPD	Spatial Planning Department
UPP	Urban Plan Preparation

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

The rapid changes in modern society have made human life and the relationships among the members of society complicated. The performance of human activities especially gainful decision making, problem solving, planning, plan implementation and monitoring, and technology management, increasingly depend on the extensive and intensive use of information. Societies are moving from a purely agriculture-based economy toward industrial economy and some are moving toward a post-industrial society or an 'information society', "that is, a society that produces, records, handles and utilizes more and more information. The economy of an information society is dependent on its ability to trade in information" (Neelameghan, 1981)

Information is being realized to an increasing extent as a vital resource for a country's socio-economic development. Lorenz (1969) argues that "a strong base of information and the ability to use it can contribute importantly to the prosperity of a nation." Thus, the great disparity in the socio-economic and scientific and

technological development between the developing countries on the one hand and the developed countries on the other is that the former are relatively information poor. As Borko (1968) argues:

> "Information is seen as a means by which a developing nation can increase its gross national product, raise the standard of living for its citizens and narrow the gap between the have and the have-not nations of the world" (Borko quoted in Lorenz, 1969).

Although, information is such an important ingredient in a country's socio-economic development, until recently it did not attract the attention of planners, decision makers and executives of many developing countries. "Africa's poor economic performance has usually been attributed to the humiliation of colonialism, the burden of underdevelopment, the legacy of independence, the negative impact of an alien western culture and the internal turmoil of a continent in transition" (Sturges and Neill, 1990). This lack of appreciation of the value of information in development activities " ... has resulted in a number of policy gaps in those areas which are vital to the acquisition and use of modern technology for implementing socio-economic development objectives" (ECA, 1992). The information services provided to

planners and researchers in Ethiopia is also very inadequate (NSTIDC, 1992). Most of the information, on the other hand, is very personalized in the sense that the information about the developing countries are not often available on recorded documents, it is oral information.

The role of information in this context is, however, increasingly well understood and it is becoming a major issue in international conferences at present time. "Africa's lack of development over the years is attributed principally to the information poverty which has characterized the socio-economic development planning efforts of many of the countries on the content since their attainment of political independence" (ECA, 1992). The establishment of PADIS is a result of this recognition. The main objectives of PADIS are (ECA, 1992):

- to assist African states in strengthening national capacities for collection, storage and utilization of data on development through advisory services, training and user services;
- to promote the exchange of information for development among African member states;
- to establish a system which will improve access

to both published and unpublished documents produced in Africa on questions relating to economic, social, scientific and technological aspects of development;

- to promote the creation of statistical and other numerical data banks in fields of importance to development in the region;
- to promote the improvement of information infrastructure in Africa member states in order to strengthen bibliographic control of national output;
- to train information specialists at national, sub regional and regional levels in order to upgrade skills and introduce modern methods of information handling;
- to promote the utilization of common norms and standards of information handling in the Region in order to ensure compatibility with international information systems.

Therefore, it would appear that one of the prime solutions to the development problems of Ethiopia in particular as well as other developing countries in general is through the development of their information sector such as research institutions, information systems and services. In Ethiopia efforts have been going on to

develop the information sector. The establishment of the National Science & Technology Information and Documentation Centre (NSTIDC) under the auspices of the Ethiopian Science & Technology Commission can be mentioned as the result of this effort. Among other things, the Centre provides training to information professionals, consultancy services and plays a cooperative role among information centres in different economic sectors (NSTIDC, 1992). The Centre sponsered a National Information System and Service Policy Conference to discuss the management of the country's information services development. Following a recommendation of this Conference, a 'National Information Day' to publicize information and its role in national development was organized on 16-17 Nov., 1992. This celebration also drew the attention of information professionals and decision makers to lay emphasis on the development of the information sector.

The importance and value of information is to be measured not on the amount of information a country has but on its accessibility and utilization for the required purposes. "Information becomes a powerful force in the development of a society when it is easily available to users upon request" (Nyang, 1982).

1.2 DEFINITION

Information is a term with several definitions depending on the context in which it is used. Hayes pointed out that "information is slippery concept, amorphous, loaded with connotations and implications and that it has had a variety of meanings" (Hayes cited in Wellisch, 1972). Most frequently the terms 'data', 'information' and 'knowledge' are used interchangeably. To cite some definitions as examples:

Demski (1972):

> "information refers to data that may alter a decision makers predictions."

Methlie (1978):

> "information is knowledge about real world phenomena perceived by direct observations or by semantic interpretations of messages."

Senn (1987):

> "information is data presented in a form that is meaningful to the recipient."

Yovits & Poulk (1985):

> "information is data of value in decision making."

The causes for these variations in definitions rest on the fact that "... information is essentially intangible:

we encounter it operationally, through its subjective effects" (Zorkoczy, 1990).

The difference between data, information and knowledge can be elaborated by considering a simple example. If I receive a message that 'it will be cold tomorrow', I say I have received data. But after receiving this data, if I make a decision to wear an overcoat the following day, it becomes information. On the other hand, if I have already the experience that october is always cold in Addis Ababa, I have the knowledge and I usually wear an overcoat before leaving home in October. It implies that knowledge has the characteristic of eternity in the human mind or in any other storage medium such as book.

Therefore, information can be defined as a meaning that a human derives from processed data and has stimulating value to the recipient in current and prospective decision making. And data can be viewed as "... a group of non-random signs or symbols stored on a medium intentionally arranged to represent "attributes of" real world entities (objects, events or states)"(Methlie, 1978). Unless data is processed in a form meaningful to the recipient, it may not imply anything. For instance, AA296718 are data, but they do not imply any meaning. If they are used in the context of car registration, it has

meaning a car license number. Knowledge, on the other hand, " ... is a structured entity, evolves by the accretion and integration of many increments of information, not necessarily from documents" (Brookes, 1982). For example, we have the knowledge about Addis Ababa that it has a mild weather condition. When we get information about the town's temperature and rainfall data, we assimilate the information to our previous knowledge structure and our knowledge base is incremented. Therefore, knowledge is ever evolving.

In conclusion, "data, information" and "knowledge ... can be viewed as part of a continuum, one leading into the other, each the result of actions on the preceding, with no clear boundaries between them." (Debons, 1988).

1.3 JUSTIFICATION

It is well known that the success of any planning is dependent on the availability of adequate information. The complexity of modern society makes planning an information intensive activity "... to clarify problems, understand the context in which the plan was to operate and provide a sense of dimension, scale and the limits of the probable" (Mcloughlin, 1969). Particularly in urban planning, the required amount of information is "... so

much greater than in most other planning activities: it covers almost the whole of human experience" (Hall, 1975).

However, in Ethiopia in particular as well as other developing countries at large, "planning frequently takes place without sufficient facts, and projections are based on outdated data or inadequate documentation" (ECA, 1992). "The prevailing situation is not because the planning environment of these countries lack data on which they could base various meaningful socio-economic planning exercises" (ECA, 1992), but the data are not readily available in a form meaningful to the users. In general terms, "Much of the available data in developing countries is: a) qualitative, that is, while precise numerical values cannot be assigned to each variable, some of their attributes can be identified, b) collected for some regular record keeping purpose (Chatterjee and Nijkamp, 1983). On the other hand, "... the information systems that do exist in many developing countries are underused (Nyang, 1982). For example, many of the problems that cause under utilization and wastage of information in the existing NUPI's urban-regional information system is due to loose organization of the system components and linkages with other information systems. To this end, the analysis and design of an

information support system that can collect, organize and process data into a form meaningful to the users is an essential prerequisite for the preparation of urban and regional plans. The design of such systems can also improve the researcher's and planner's "... ability to extract information from **inadequate** data sets" (Chatterjee and Nijkamp, 1983). For instance, the data that is considered qualitative becomes quantitative when it is processed using appropriate statistical methods.

The Institute has good computer facilities, though under-utilized at present. The main problem is that there is no suitable communication link between the users on the one hand and the computer specialists on the other in the sense there are users (researchers and planners) with problems in the Institute but they do not know how to solve problems with the aid of computers. On the other hand, there are computer specialists who have the knowledge of how to solve problems but they do not understand the users problem. Therefore, this study is aimed at solving this problem by developing a common interface that enable both the users and the computer specialists to interact with each other meaningfully.

The new Free Market Economic Policy of the Provisional Government of Ethiopia obliges the Institute to be cost-

effective and efficient. Up to now, the Institute operated on a government budget, but in the future the Institute will have to market its services and become self-reliant. Thus, the automation of the existing urban-regional information system will enable the Institute to be more cost-effective and efficient than by using manual methods.

1.4 OBJECTIVE OF THE STUDY

The objective of this study is to propose plans to develop an information support system for urban-regional plan preparation in Ethiopia. The study has the following specific objectives:

1. To conduct system analysis
2. To conduct task analysis
3. To identify problems of the existing urban-regional information system
4. To identify the information needs and sources of urban-regional plan preparation
5. To design a system for implementation
6. To design a pilot database

1.5 METHODOLOGY

1.5.1 Sources and Type of Data

The data used in this study have largely been collected through interviews with the staff of NUPI and examining documents (such as annual reports, organizational charts and research reports) produced by the Institute. The study has given due consideration to the users (staff) involvement starting from problem definition through analysis to system design. The importance of users participation in systems project is that users "... not only ensuring systems are usable, but also providing critical know-how ..." (McCosh and others, 1981).

The data collected from the Institute's staff include tasks performed, information requirements, procedures employed to accomplish tasks and problems of existing system.

Other related/relevant institutions such as UPAD of MUDPW were also consulted. This department used to procure and assemble information about the history of urban planning in Ethiopia before the establishment of NUPI.

Relevant documents on urban planning and system analysis and design have been reviewed. The author's experience as a researcher in NUPI provided valuable information for the study.

1.5.2 Data Collection

The study employed interview, questionnaire surveys, on site observations, and study of documents for data collection. It is generally accepted that communication and interaction between the users and the system analyst through out the project is an essential factor. Interviewing allows such interaction. It also enables the interviewer/analyst to be flexible while interviewing and obtain personal opinions.

Because of time and labour constraints, the author did not interview all the users of NUPI. Persons to be interviewed were chosen on the basis of the following criteria (See Annex I and II for the list pf persons interviewed and list of questions used in interviews):

a) the users (staff) who are from the same field of specialization and accomplish similar tasks were grouped together and one or two representatives was/were interviewed, and

b) top and line managers who could provide information about department tasks and their subordinates were all interviewed.

Questionnaire survey method was used to collect data from each and every staff in research and urban plan preparation departments (See Annex III). Of the total 74 population, 50 (researchers and planners) were surveyed, excluding data collectors and draftmen. In order to minimize the amount of writing by the respondent, the questionnaire provided choices for answer. The questionnaire was also open ended and a respondent was free to add additional comments. The questionnaire was relatively free from likely misinterpretation by respondents. It was presented in connection with another assignment earlier (term paper for INST-527) and this questionnaire has been prepared by modifying some of the ambiguities encountered in the first survey.

Information about the work environment such as office arrangement, work overload and ways of performing tasks, was collected through on site observations. Organizational charts and other documentary sources provided additional organizational and methodological information.

1.6 LIMITATION OF THE STUDY

Tasks such as program development, cost-benefit analysis and the like are not covered. Moreover, the absence of well established methodologies for accomplishing tasks in the Institute constraints the analyst to curtail the scope of this study only to the design of the system for urban socio-economic data processing collected by the questionnaire survey.

1.7 ORGANIZATION OF THE THESIS

The thesis is divided into seven chapters. The first Chapter introduces the theme by giving definitions, stating the objective of the study and methodologies employed, etc. Chapter two reviews urban-regional planning in general terms and the role of information system in plan preparation. Chapter three discusses the existing system of urban-regional plan preparation and data processing activities at NUPI. Problems of the existing system are also identified and possible solutions suggested. For the design of the system, particular problems are spelt out in this Chapter. The details of the system functions, that is, logical system design, are discussed in Chapter four. Chapter five and deals with finding of solutions; how these function are

implemented. This includes database design, output design, selection of programs/packages, etc. Lastly, the thesis summarizes the findings and discussion and formulates the analyst's recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 ETHIOPIAN BACKGROUND

Ethiopia has experienced a long history of urbanization. "Urbanization is a process of transition from agricultural to industrial and service dominated economy which involves the transfer of population from rural to urban areas and intersectoral reallocation of resources" (Asrat Tefera, 1987). According to Peter and Koehn, the northern part of Ethiopia experienced 18 centuries of urbanization. It is said that caravan trade, foundation of regional capitals by feudal lords and the constant shifting of the capital city of the Empire until the foundation of Addis Ababa in 1887 gave rise to establishment and growth of towns (Peter and Koehn cited in Asrat Tefera, 1987). Before Addis Ababa, Axum, Lalibela and Gonder were the prominent capital towns of the country. The Stele at Axum suggests that it had been in existence before the second century B.C. Henride Contenson suggested it was a capital city starting the first century A.D. The rock-hewn church in Lasta indicates that those in Lalibela supports a hypothesis of

a pre-existing capital city. Gonder emerged as the contested capital and urban centre of the 17th and early 18th century in Ethiopia (AAMPPO, 1985).

The establishment of a permanent capital city, Addis Ababa, was related to the rise of Minilik II (1887-1913). Minilik in addition to founding Addis Ababa built modern communication systems. The only Ethio-Djibouti railway line was built in his time. The railway line in turn caused the establishment of many towns such as Nazarethe, Dire-Dawa, Modjo, Debre-Zeit, etc along the route.

The development of towns in Ethiopia was not generally based on agricultural production process as opposed to situation in Europe (Asrat Tefera, 1987). Rather towns were developed in Ethiopia as a result of a settlement of land lords and opening of trade and transport routes. As Donham notes that during the late second half of the last century, there were few towns and they were inhabited by tax collectors, judges, etc, and the rural-urban relationship was characterized by one-way extraction of goods by the town population (Asrat Tefera, 1987). The dominant urban settlers, the land lords owned most lands of the surrounding farm lands, until the agrarian reform in 1974. The land lords employed peasants to share the agricultural production, though the latter procured only

a smaller proportion, more often less than one-third. Although the land lords took most production of the agricultural production, they were not concerned with the improvement of agricultural equipment as well as development of agricultural production based towns.

2.2 CRITERIA USED TO DEFINE URBAN CENTRES

Different criteria are used to distinguish the urban settlement from its rural surrounding. Population size is often used to define the urban settlement, but the problem arises in setting up the threshold size. For instance, "a threshold as low as 200 people is taken as an official indication of urbanity in Denmark, but it is 2000 in Cuba, 2500 in Mexico (Potter, 1985). In most African countries, settlements with population size of 2000 are considered as the urban centres, except Nigeria with 20,000, Senegal with 10,000, Ghana with 5,000 and South Africa with 500 non-agricultural population, and Gabon and Tunisia with 1,000 (AAMPPO, 1984).

The Economic Commission for Africa has recommended the following population sizes to discriminate the urban centres from the rural villages:

1. "Urban Population" - with 20,000 and over inhabitants

2. "City Population" - with 100,000 and over inhabitants

3. "Big City Population" - with 500,000 and over inhabitants

In Ethiopia there was no well established criteria for separating the urban centres from the rural villages. According to the Central Statistical Office (CSO) (now Central Statistical Authority (CSA)), a settlement with 2000 and above population was to be considered as the urban centre. However, this parameter does not indicate a true urban centre as it includes the rural villages. For instance, in Eritrea, rural localities like Emba Derho (10,198), Tzeazegha (7,747), Hemberti (7,273), etc are considered to be urban areas (AAMPPO, 1984).

The criteria developed by MUDH is, however, better than the one recommended by CSO, as it includes "the efforts made at International forums for defining urban in terms of legal and administrative, socio-economic organization and in terms of demographic variable such as population size, density heterogeneity of inhabitants, etc" (AAMPPO, 1984). This include:

a) Suitable geographical location;
b) With 2,000 and over inhabitants;
c) Having governmental administrative offices;

d) Having basic economic services and development for the surrounding areas, and

e) Having basic social infrastructures.

According to these criteria, the country has 427 urban centres (NUPI, 1989). These towns together constitute 4,869,289 population or 11.4 percent of the country's total population (42,114,800) (CSA, 1992). It seems that the level urbanization in Ethiopia is at its infancy stage even on African standards (AAMPPO, 1984).

2.3 PROBLEMS OF URBANIZATION

The rate of urbanization in Ethiopia in particular and in the developing countries in general is very high. According to CSA, Ethiopia will have 12,909,900 urban inhabitants by the year 2000. The rate of growth is around 10 percent per annum, but in the developed countries it is below half of this rate. There are two main reasons for this: low size of urban population and high rural-urban in-migration. This, in turn, has brought about problems of "unemployment and underemployment, congestion in housing, education, transport and health facilities and overall deterioration of the urban environment" (Chatterjee and Nijkamp, 1983). From the studies on urbanization and development in Ethiopia,

Asrat identifies the following problems in relation to Ethiopian urban centres:

1. The urban system does not have an integrated hierarchy. Each town is more or less an isolated settlement without definite economic and social function within a regional and/or national urbanization context.
2. No urban related production is going on in most of the towns. The major occupation of the population in addition to administrative and security affairs is to facilitate the one-way rural-urban flow of resources.
3. Services such as electricity, water, banks, health, education, etc are inadequately available. Even the use of the available services shows that the urban population does not effectively utilize them. This is primarily ascribed to the low level of income (in Addis Ababa, probably with the highest income level in the country, is only around Birr 1000/annum). According to CSO, 1984, about 90 percent of domestic use of electricity is for lighting and only 6 percent electricity and gas for cooking. This also implies a great divergence of income among the urban dwellers.
4. Most of the urban centres are small and economic activities in them are insignificant. This is due to

the negligence of the small urban centres in favour of the primate city, Addis Ababa.

One of the major causes of these problems is the lack of properly prepared and viable plans. It is since 1974 efforts have been made to achieve planned development of the urban centres. For instance, all the master plans prepared for Addis Ababa during the period between 1934 and 1975 did not consider all the necessary planning inputs. Techeste and Ceccarell point out that the previous plans prepared for Addis Ababa (i.e the Italian plan by Guid and Valle (1934-1945), the British and French plans by Sir Abercrombie and B. Menessy (1946-1959) and Arch. Le De Marien (1960-1975) as well as other town plans) laid little emphasis on "... the dynamics of population growth and hence the bases of resources and the social infrastructures which accompany population growth. Moreover, they did neither analyze nor integrate the urban-regional socio-economic and physical relations" (AAMPPO, 1986).

2.4 URBAN PLAN PREPARATION

A remedy to the present urban problems in Ethiopia as well as other developing countries is the preparation of plans responsive to the prevailing problems. As Neelameghan (1992) argues "..., urban planning in developing countries has to deal with such problems as urban poverty, urban migrants, urban unemployed, the urban homeless, the informal sector, basic infrastructure needs, energy conservation, environmental protection, public sector housing, quality of life, etc."

Planning essentially implies "... the making of an orderly sequence of action that will lead to the achievement of a stated goal or goals" (Hall, 1975). Naturally, every human activity is goal-oriented and needs to be directed by planning. Generally, almost every society on earth does some sort of planning to provide goods and services to its population. Thus, planning can be viewed as an important human tool or exercise that enables systematic organization of all necessary actions to the achievement for the well-being of the society.

Urban planning is considered as a human effort to create an urban environment that most citizens deserve to have. As Hall (1975) states "urban planning refers to planning

with a spatial, or geographical component in which the general objective is to provide for a spatial structure of activities (or of land uses) which in some way is better than the pattern existing without planning". Urban planning involves the design of different land uses, such as residential zone, industrial zone and market area as well as smaller urban elements like street lay out and finishes up by physical development (e.g. construction of buildings).

On the other hand, urban planning is deemed to be an attempt to reconcile conflicting actions. Cities are essentially the product of building process of different individuals and groups, each tending to look after their own interests. However, the actions taken for the benefit of one individual or group has often come into conflict with those of others and this problem has sufficiently drawn the attention of many urban planners. In this connection, Mcloughlin (1969) noted that urban planning desires to ".. regulate or control the activity of individuals and groups in such a way as to minimize that bad effects which may arise, and to promote better performance of the physical environment in accordance with a set of broad aims and more specific objectives set out in a plan." Needless to say, urban planning "... seeks to reconcile competing claims and promote equity

and efficiency" (Potter, 1975).

2.4.1 Classical Approach to Urban Plan Preparation

The practice of urban planning in Ethiopia was dominated by the classical approach until the establishment of AAMPPO in 1983. This classical approach, the dominant method of urban planning in the period between 1920 and 1960, emphasized on "... production of blue prints for the future desired state of the area" (Hall, 1975), that is, one-shot plans. Once the plan (blue print) was prepared, it was not revised while being implemented until the next plan is prepared. For instance, in 1965, MUDPW (formerly Ministry of Interior and later MUDH) got 40 towns master plan prepared by contract with the Italian consultant group 'Consorzio Italiano Di Studi Urbanistici' (Municipalities Department, 1965). After the contract was over, the consultant was not available in the country to revise the prepared plans taking into consideration the new developments as a result of the plan implementation. The main drawback of the classical approach was that the plans did not lend themselves to modification with the changes resulting from implementation of the plan. Also, the prepared plan (blue print) was not supplemented by explanatory text. For instance, when the planner prepares the plan, he makes

population projections. When this plan (blue print) is handed over to implementors (city councils), however, there is no explanatory extra document, that explains how the population is projected and the sizes of the projected population.

2.4.2 Modern Approach to Urban Plan Preparation

A new approach to urban planning stemmed from the British Planning Act (BPA) of 1947 and emphasized on 'cybernated planning' (Hall, 1975). In other words, the Act viewed planning as a continuous process which does not have a demarcated beginning and ending. As Waterston notes

> "Planning can't leave off where plan formulation ends and actions to execute plan begins. Planning may begin with the formulation of a plan as a guide to implementation becomes, at a later stage, a guide to revision of the original plan. The whole process is organic and continuous, with plan preparation blending into plan implementation, then into revision of the plan, and again to implementation and the formulation of the next plan" (Waterston quoted in Birke, 1992).

According to the BPA, the entire plan development and implementation period was divided into short-term plans of five year intervals. For each plan phase, all the survey, analysis and plan activities are repeated. Hall

Hall (1975) reveals "... the survey should be carried out again to check for new facts and developments, the analysis should be reworked to see how far the projections needed modifying, and the plan should be updated accordingly."

The new approach to urban planning in Ethiopia began when AAMPPO prepared Addis Ababa master plan in 1984-87. The project was established by Technical Cooperation agreement within the Italio-Ethiopian Economic Scientific and Technical Cooperation and Trade Agreement. In the agreement, the Italian Government agreed to send the necessary manpower and cover all expenses of the project.

The Addis Ababa master plan was prepared with the purpose of achieving a two-way interaction of urban and rural areas. In other words, the project believed that a well-balanced urban hierarchy based on a coherent urban/rural exchange is a strategic condition whose setting up affects directly any urban development strategy and policy (AAMPPO, 1984). To achieve this objective, the master plan was prepared with the following methodological assumptions (AAMPPO, 1986):

1. **Strengthening the urban-regional ties:** the master plan was prepared in such a way that it could create tight correlation between the urban and regional development.
2. **The use of a wide range of tools:** the project employed different tools such models as Regional Sectoral Phasing (RESEPHA) to plan the urban-regional system in an integrated way.
3. **The master plan was not conceived as a one-shot plan.** It was rather understood as a system of legal documents, proposals, decisions which are studied, adjusted and modified along the years according to changing problems".

As a result, the project conducted studies on regional, metropolitan and urban levels. The regional study dealt with a creation of a two-way interaction of urban and rural areas in that the urban centres provides goods and services to its surrounding rural areas and the rural areas in turn furnishes the urban centres with basic agricultural products. The studies made by AAMPPO at metropolitan level is to

- insure a steady supply of food, particularly fresh-vegetables and milk within a reasonable distance from the city centre and create

conditions for balancing the supply and demand of agricultural and industrial goods;

- ascertain that the immediate functional green belt around the core of the city are maintained according to the designed land use, and avoid haphazard development in the immediate surrounding by setting up a machinery for control new developments;
- create conditions for balancing the labour supply with labour demand employment balance, thus creating job opportunities for the present urban unemployed and/or underemployed in the immediate surroundings connected with the supply system for Addis Ababa, and
- help to minimize the disparity in the living standards of the urban and rural population by integrating their respective developments to their mutual benefits, and by developing a hierarchy of urban and rural service centres which will break the present market bottlenecks and high transport costs.

At the urban level the study is aimed at

- fostering new and well designed integrated developments in a restricted number of vacant sites in the peripheral areas of the city with

appropriate topology to meet the housing need

- up-grading selected areas in the areas already urbanized, improve the existing housing stock, at that time nearly decaying;
- renewing other areas and components of the physical structure of the city, and
- improving infrastructure and system of services to increase urban efficiency.

The preparation of the master plan was divided into three phases: long range(20 years), medium range(10 years) and short-range (5 years). For each plan phase, the survey, analysis and plan activities was conducted continuously.

In addition, the project aimed at developing the skill of the participant Ethiopians to equip them to improve or modify and implement the Addis Ababa master plan as well as to conduct similar studies for other urban centres of the country. Immediately, after the completion of the Addis Ababa Master Plan Project, NUPI was established in 1987 by Government Proclamation to prepare plans for all urban centres of the country. The Institute is to prepare plans following the methodologies and experiences developed by AAMPPO.

2.5 INFORMATION NEEDS OF URBAN-REGIONAL PLAN PREPARATION

It is clear that urban planning as well as planning in general terms are concerned with the collection and processing of data about past and present states of the system (i.e. urban system) in order to generate new information for its foreseeable development. Thus, "... planning can be understood as the generation of ideas and of an understanding of what is instead of that which ought to be and how to bring about what ought to be the case" (Rittel, 1982).

In planning, particularly in urban planning, the amount of information required "... is so much greater than in most other planning activities: it covers almost the whole of human experience" (Hall, 1975). Whether it is a developed or developing country, the availability of relevant information upon request is an essential factor for the success of any planning activity. Therefore, the design of an information support system that collects, organizes, stores and process data into 'tailor-made' information to its users is an integral part of any planning system, specifically the urban planning system.

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The trend of urban planning in developing countries is also an information intensive one. As Neelameghan (1992) points out "... the current trend in urban planning in a number of developing countries requires integrated, functional, socio-economic, infrastructure, physical planning information and data". These include:

Economic	- production, investments, labour market, consumption, etc
Housing	- quality and number of dwelling, residential climate, prices and rents, etc
Infrastructure	- accessibility (public and private transport), distances, mobility (migration, recreation, etc)
Finance	- taxes, subsidies, public expenditures, distributional aspects, etc
Facilities	- Health care, cultural, recreational, social, etc.
Environment	- air pollution, noise level, sewerage system, congestion, density, etc
Energy	- energy consumption, insulation of dwellings, central urban heating system, tariff systems, etc.

In Ethiopia, the establishment of NUPI in 1987, immediately after the completion of Addis Ababa master plan project is the effect of this trend. The Institute conducts extensive research studies at urban and regional levels in order to meet the growing demand of information for urban-regional plan preparation and other development planning activities. Therefore, the Institute also acts as the national urban information system with rich information about urban centres.

2.6 SYSTEM CONCEPTS

An information system is one type of system and hence system concepts have important implications in understanding and designing the information system.

A system is defined as an assembly of components that interact and are integrated with one another by relationships to achieve predetermined outputs or goals.

There are innumerable types of systems, to name some, include transport system, information system, computer system, theology system and ecosystem. But each of these systems is distinguished from one another by its components or elements. Systems can be categorized as abstract and concrete systems.

An abstract system is a system that is made up of intangible components. That is, components cannot be seen or touched by our sense organs. A system of theology can be cited as an instance. All the components which belonged to this system are concepts. A concrete or physical system, on the other hand, is "... a system in which at least two elements are tangible objects" (Debons, 1988). An information system can be viewed as a concrete system for at least two of its components are tangible elements.

2.6.1 General Model of a System

The general model of a system is input, throughput and output. In this regard, the information system draws data as input and its throughput processes the data into information as an output. Davis and Olson (1985) include data storage in an information system model, because, any information processing function needs all the data to be available before the processing activities can be applied. The information system also stores data in their original state after processing for subsequent use.

2.6.2 System's Boundary

A system is differentiated from other systems or its environment by its boundary. The system's boundary serves to determine what constitutes the system and what does not. Therefore, anything that exists within the boundary is deemed to be part of the system, beyond that constitutes its environment. The implication of delineating systems boundary in information system analysis and design is that it serves to determine what are the components of the system and what are not.

2.6.3 System's Environment

Any system, except the great system, the universe, operates in an environment. What we call system environment is determined by the system's goals and needs. The system interacts with the environment by taking inputs from and discharging outputs to it. While the system is affected by the changes in the environment, the system in turn affects the environment by the output it produces. The environment consists of a set of existent not deemed to be systems-components, but any change in the attributes of this set of existent affects the system; or the behaviour of the system affects the attributes of this set of existent" (Bhattacharyya,1978).

Systems that interact with their respective environments by taking inputs and discharging outputs are deemed to be an 'open systems'. The inputs that enter the system can take the form of energy, material and information or data. The information system exhibits the characteristics of open system for it interacts with its environment by taking data from and sends out information to it.

In contrast, a closed system is a self-contained system. It does not interact with its environment by way of input and/or output. "A closed system is a concrete system whose boundaries are impermeable to the transmission of matter, energy, or data, both into the system from the environment and from system into the environment" (Debons, 1988). In an information system, there are also relatively closed systems. Computer programmes can be cited as in stance. They accept data and produce output which were previously defined.

2.6.4 Subsystems

A system may be built from the fusion of different subsystems. Although subsystems can stand as a system in their own rights, they are considered as components of the meta-system. The way the subsystems are organized to form a building block of a meta-system has implication in

information system analysis and design. Particularly a complex system is difficult to understand as a whole, but decomposed into its subsystems, it becomes more easily understandable and manageable. The general principle in decomposition is to identify the functional cohesion of components. Components that perform similar function are grouped together as one subsystem.

After the system is decomposed into its subsystems, an interconnection should be established to ensure the system can represent an organized whole of different components. The interconnections and the interactions that are built between the subsystems constitute interfaces. The interface can take the form of input or output, and usually occurs at the boundary. The importance of interface in information system design is that interfaces are the chains that connect the different subsystems into an integrated whole entity.

In conclusion, the design of an information system should take into account the logical, operational and strategic requirements in order to increase its usability and applicability (Neelameghan, 1992):

1. Logical requirements

   - **consistency** - the information produced within the system should not be self-contradictory
   - **comparability** - uniform data classification methods should be adopted in the system in order to allow a comparison through time and with other urban centres
   - **validity**- the information provided should be allow for statistical robustness

2. Operational requirements

   - **availability** - the relevant information should be available to all users upon request
   - **completeness** - the information provided to the users should satisfy his/her information needs
   - **usability** - the data should be usable with out employing complex operations and interpretations
   - **Versatility** - the information produced may also be used for other planning purposes

3. Strategic requirements

   - **relevance** - the information provided should serve the purpose
   - **flexibility** - the system should offer comprehensive information that can easily be adjusted with the changing circumstances or needs of the users

of the users

- **comprehensiveness** - components of the system should provide integrated information that enable the simultaneous judgement of different sectoral policies
- **effectiveness** - the impacts of policy measures can be judged and evaluated (before and after).

CHAPTER THREE

URBAN PLAN PREPARATION: EXISTING INFORMATION SYSTEM AND INFORMATION FLOW PATTERN

3.1 ORGANIZATION

For information system that is operated within an organization, the organization serves as its environment. The components of the system's environment constantly interacts with the system through exchange of input and output. The interaction between information system and the organization may be represented as a data-input information-output mechanism, in that the organization provides data to the information system and the system processes it to information that is used by the organization. The information system thus consists of three components: input, processing and output.

The changes resulting from the interaction between the information system (IS) and organization have a dual aspect. While IS is affected by the changes in the organization, the output from the information system in turn affects the environment. A change in the environment entails an alteration of the type of data, its quantity and quality, and input to IS which consequently causes

adaptation of the IS to the new environment. The information provided by IS may also influence the decision making and other operations of the organization. With the provision of better information (more timely, precise and reliable), the organization may be able to perform its tasks more efficiently and effectively. Therefore, information is a vital resource of the organization required to accomplish various tasks. In NUPI, information is used to write research reports, to prepare plans and to make decisions. As a factory stops operation when it lacks raw material, a similar situation obtains at the Institute when information is not available.

In the analysis and design of an information system, it is necessary to examine its environment, the conditions in which the IS operates, what sort of needs it is expected to satisfy, and how that function may be effectively and efficiently performed. Such analysis will also help in identifying appropriate information to be provided, the type of organization and structure appropriate to the IS's components, the resources necessary, etc.

There are many definition of organization, but for the purpose of this study, it is defined as '...a system of consciously coordinated activities of two or more persons' (Barnard quoted in Steers and others, 1985). It is obvious that the organizations are systems that are established to perform specific functions for the well-being of the society.

3.2 OBJECTIVES OF NUPI

While preparing the master plan for Addis Ababa, the participants of AAMPO realized that all urban centres of the country have one major common problem, that is, the lack of properly prepared plan. To overcome this problem, they recommended to the then government to establish a government institute that can implement the new master plan for Addis Ababa and to prepare other plans for other urban centres in the same way. And they prepared a draft establishment proclamation report and submitted it to the government for approval.

The then government convinced by the recommendation of the project participants, established the new institute, named **NATIONAL URBAN PLANNING INSTITUTE**, by Proclamation No. 317/1987 (Negarit Gazeta, 1987). As stated in the proclamation, the Institute has the following broad

objectives:

i) to carry out appropriate study and research for the preparation of plans for urban centres;

ii) to prepare plans for regional urbanization, metropolitan areas and urban centres, and

iii) to train the manpower necessary for the preparation and implementation of plans for urban centres.

3.3 ORGANIZATIONAL STRUCTURE

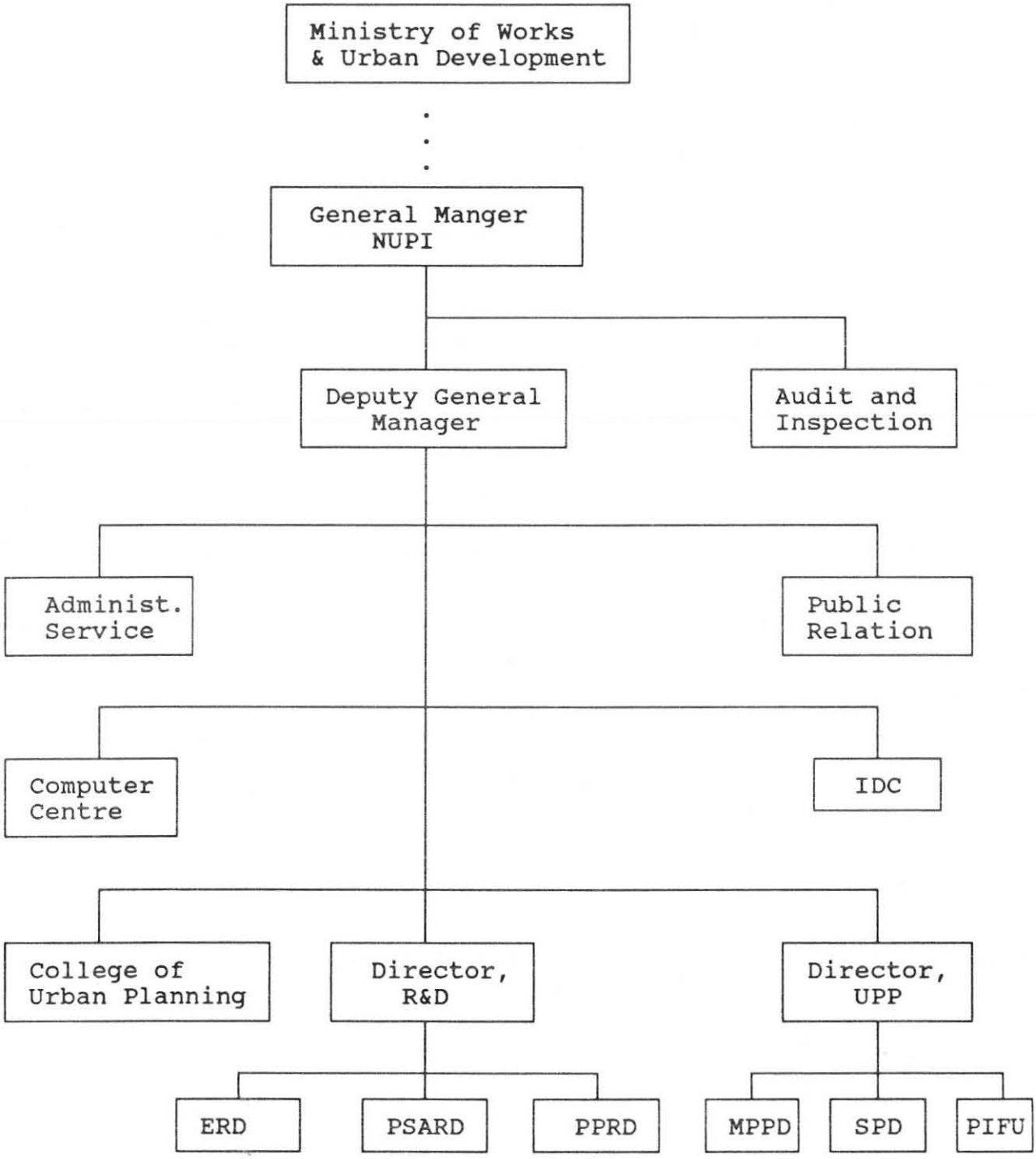
Analysis of the organizational structure in addition to providing necessary information to this study, helps in defining the system's boundary if the entire system is not considered. The present study does not deal with the entire departments of NUPI; but only PPRD, ERD and PSARD in R&D and MPPD, PIFU and SPD in UPP are considered. The analysis of the organizational structure also enables the system analyst to understand what tasks are being performed by each unit/division and to design the information system that would provide relevant information for accomplishing the tasks effectively.

The organizational structure refers to a pattern of internal segmentation of an organization into departments or units and their interrelationships so as to get tasks performed as efficiently as possible. In general terms, 'it is internal differentiation and patterning of interrelationships that we will refer to as structure. Organizational structuring is 'the primary means by which the organization sets limits and boundaries for efficient performance by its members by delimiting responsibilities, control over resources, and other matters ...' (Thompson as quoted in Jackson, 1986).

Fig. 1 shows the organizational structure of NUPI. Each department is represented by a box with a name labelled inside it.

The lines between boxes show the flow of information and instructions within the Institute. However, the existing flow of information and instruction within the organization does not respect the formal channels. There is a direct flow of instructions from MPPD to PPRD, for instance. In a general sense, informal channels of communication are more prevalent than the formal ones.

Fig. 1 Organizational structure of NUPI



Source: NUPI, 1987

There are different ways of dividing a single unit of organization into its subunits. One of these is functional decomposition. This functional decomposition is done '... based on the nature of the work and the skills and technology that are required to perform it' (Dubrin, 1989). For instance, there are the Computer Centre and the PPRD. The former department is named as Computer Centre since it uses computer technology while the later department conducts research and is identified as Physical Planning Research Department.

The Establishment Proclamation of NUPI states that the Institute must accomplish the following functions:

i) Regional and urban studies;
ii) Regional urbanization plan;
iii) Metropolitan area plan, and
iv) Master plan

Moreover, the Institute prepares detailed plans, if

a) the Institute believes the detailed plan of the urban centre is necessary to be prepared by itself, and

b) the Institute is requested by City Councils.

Otherwise, detail plans are prepared by the City Council of the urban centre.

However, the Institute does not accomplish all tasks stated in its establishment proclamation. The following are actually carried out by the Institute at the present time:

i) regional and urban studies;
ii) master plans;
iii) developmental plans, and
iv) detail plans

These tasks are accomplished by all departments of R&D and UPP. The departments do not have specific job descriptions and hence it is very difficult to exactly state the task of each department. Normally, the task of each staff member is determined by his/her profession, say a geologist is instructed by his boss to do tasks related to geology. After he/she completed the task, nobody evaluates and comments on whether he/she has correctly done it or not. As a result, whenever the staff are required to do some tasks, there is no defined instruction about the task given by their heads. As a matter of fact, sometime tasks which are of no present value to the Institute are done.

From the interviews made with the users, the task of each department is described as below (See Annex I for the

compositions of staffs' specialization):

3.3.1 Research and Development

The R&D main department has one director and consists of three sub-departments: ERD, PSARD and PPRD (See Fig. 1). In theory, the Director is to assign tasks to each department so that duplication of tasks can be minimized or eliminated. The director also monitors the quality of the research reports produced by the departments. Until recently, there was no person assigned to this position. As a result, there was serious problem of coordination among these departments. While the same data may be collected and processed by two or more departments, some necessary data may be ignored and therefore not collected and processed. For instance, social services data was collected and processed to produce the same output both by PSARD and PPRD.

The units under R&D departments are expected to generate and provide information to UPP for use in the urban plan preparation. They also prepare regional urbanization plans. The regional urbanization plan is prepared to establish hierarchy of urban centres in the region.

3.3.1.1 Economic Research

The Department conducts studies on economy of the urban centres and their regions. The study made at urban level is to learn about the urban economic base and project future urban economic growth. The department collects employment data, local finance data and commercial activities data and other relevant data that characterize the economic base of the urban centre as well as the study region (See Chapter IV for detail information requirement). For instance, if the economist knows there is adequate raw material available in the region for a brick factory, he/she can confidently recommend the establishment of a brick factory in the urban centre. However, the availability of raw material is not adequate to make this decision. The economist also considers the population income levels and other factors. If ERD proposes projects for execution in the planning period, it is easy for urban planners to allocate the required land for different types of land uses.

3.3.1.2 Population and Social Affairs Research

The Department conducts both urban and regional studies on population and social services. It collects data about population size, age structure, unemployment, migration

and service (See Chapter IV for detail information requirement). Using some population projection methods, it makes population projection for the planning period. It also makes projection for services using the result of population projection and some national and international standards.

The projections made by this Department are also important inputs to the preparation of the urban plans in that if the projected size of population is known, the urban planners can confidently decide the required residential land use on the master plan, for instance. This data also is used as input for the research departments. For example, ERD requires the projected population size to estimate the urban labour supply.

3.3.1.3 Physical Planning Research

The Department studies mostly the physical condition, spatial distribution of population, services and the like of the urban centres as well as their regions. It also makes historical study at urban level (See Chapter IV for detail information requirement). The output of this Department are of great relevance in preparing the master plan. For instance, the wind direction study helps the urban planners to select the appropriate location of the

and service (See Chapter IV for detail information requirement). Using some population projection methods, it makes population projection for the planning period. It also makes projection for services using the result of population projection and some national and international standards.

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factories proposed by ERD so as to avoid environmental pollution. For instance if the factory is situated at the origin of the wind, its smoke will indeed pollute the urban centre.

All these three departments make regional and urban studies. They do not prepare regional urbanization plan, except the unsuccessful attempt made on the Southern Planning Region. In addition, there is very little information flow from the research departments to the urban plan preparation departments, perhaps, only population projection made by PSARD, is provided. The urban plan preparation is assumed as it prepares different types of plans; however, the research departments do not know the type of information supplied to each type of plan preparation.

3.3.2 Urban Plan Preparation

The UPP main department has one director and consists of three departments: MPPD, SPD and PIFU. The director coordinates and assigns tasks to its subordinate departments. Although structurally UPP consists of three departments, all of them work as a single department. That is, they prepare only urban plan, though this task is supposed to be the responsibility of MPPD.

Master Plan Preparation Department prepares three types of plan: master plan, developmental, and detailed plan. According to Tesfaye Beza (DGM) of NUPI, master plan is prepared for towns whose population size is 20000 and more. It is also prepared for towns whose population size is below this threshold limit. The department usually collects data about existing land uses and population (See Chapter IV for detailed information requirements). The plans prepared by this Department is a **blue print**, which is used to guide physical development of the town in the planning period.

Since little has been accomplished by the other two departments (PIFU & SPD), it is very difficult to mention correctly what tasks they are performing. In theory, PIFU is supposed to make housing and building project studies that would help the implementation of approved plans of urban centres. It also carries out follow up study to examine if the prepared plan is properly implemented. SPD, on the other hand, conducts studies that would help in the standardization of urban houses and buildings.

3.4 PREPARATION OF URBAN PLANS

The process of urban plan preparation described here is the procedures which were used in the previous government

system, that is before 1991. Although it is not known officially, there is a change in the preparation of urban plans according to the new government system.

The first step in the preparation of plan is selecting the urban centre for which the plan is prepared (See Fig. 2 for the existing urban plan preparation system). The urban centre is selected in two ways. Firstly, the Institute selects the urban centre based on its role as an administrative centre and population size. Usually, the urban centres that are 'Astedader Akababi'(province) capital are given priority. The other method of selection is a government order. The government orders the Institute to prepare plans for some urban centres or for a new urban centre to be established. For instance, the Institute prepared a master plan for Omorate, a rural village, in 1982 E.C. However, the second method obstructs the work of the Institute. When the Institute is ordered by the government, the preparation of the plan must be started immediately. As a result, it causes the preparation of some other urban centre plan is interrupted and sometimes remain incomplete. However, after the new government came into power, only the second method has become usual. But in the future, the Institute

will prepare urban plans only when requested and agreed with the government of the federal states*.

Next, the Institute's DGM calls the heads of PSARD, PPRD, ERD from R&D and MPPD from UPP for a meeting to form teams that would prepare plans for the selected urban centres. Sometimes, the team is formed by the DGM without consultation with the department heads.

The assigned team takes the whole responsibility of completing the tasks. The team starts its task by preparing/proposing a time schedule. It may conduct a reconnaissance survey to gather background information for the field survey work. However, the reconnaissance survey is not usually conducted. If it is conducted, the survey is sometime, conducted in Addis Ababa and very rarely also in the town concerned. When it is conducted in Addis Ababa, data and information are collected from documents available with IDC and other government organizations. Besides, the purpose of the reconnaissance

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Note * According to the Provincial Government political system, the country is divided into 14 federal states

survey is to gather the necessary documents such as plans and maps that will help to collect data in the field. The survey at urban level is conducted by forming a 'fact finding/special' team that consists of one person from each department involved in the preparation of the plan. The fact finding team not only gathers background information but also identifies the major problems that need special attention during the preparation of the plan and appropriate sources of data. At this time, the fact finding team also explains the importance of data to plan preparation to the organizations identified as data sources so that they may provide all requested data available with them when the team approaches them again after sometime.

Then, the team conducts field work to collect data relevant to the preparation of the urban and regional plans. Usually, the field work may not start according to the schedule due to logistic and managerial problems. Data is collected by conducting questionnaire and sectoral surveys. The questionnaire survey is carried out only at urban level. Its purpose is to collect detailed and up-to-date data about the socio-economic condition of the urban centre. There is a standard questionnaire prepared by the Institute for the survey (See Annex V). The survey is conducted first by selecting and training

enumerators and then selecting a sample population to be surveyed.

The sectoral survey includes data collected by surveying, observation, and document survey. By observation, the users collect qualitative data such as flood problem areas. In the surveying, they gather data about existing land uses using topographic maps. Sometimes, planimeters, altimeters and other instruments are used to collect the data by surveying. Document survey, on the other hand, is to collect data already acquired by other organizations as some data such as geological data that require longer time, one or more years, to be generated. Moreover, it is easier from the point of view of labour and cost to use data already acquired by other organizations rather than moving in the 'vicious circle'. This implies that the team members should have information about the data/information sources.

The main problem of the sectoral survey, except surveying, is that the data to be collected by the team is not defined. Since the information requirement of the users is not defined, different users, researchers and planners, collect different type of data and information which they assume relevant. As a result, the collected data may not usually be fully used, in that some data

remain unused. For instance, the Institute conducted very expensive 'Household Market Survey' in 1988, but it was never processed and reported (Tilahun, 1990).

After the necessary data is collected, the data is processed either manually or by computer (See Section 3.6) to write reports and prepare urban plans. The reports prepared by the research departments are usually of a descriptive type about the existing situation of the urban centres and are not often properly used as input for urban plan preparation.

To prepare urban plans, MPPD uses the 'nearest neighbourhood' analysis method. The basic concept in this method is grouping of urban dwellers into a community hierarchy. The community is analogous with the living organism (NUPI (MPPD), 1991):

Home	as cell
Community	as tissue
District	as organ
City/town	as body

For planning purposes, the above community levels are broken down into more levels of hierarchy (community). Each level is considered as planning units:

1. Home - plot for single family house hold
2. Community class I - home cluster ('Keye')
3. Community class II - Sub-neighbourhood ('Mender')
4. Community class III - neighbourhood ('Kebele')
5. Community class IV - sub-community ('Kefitegna')
6. District - Town-sector ('Kifle-Ketena'/Awraja')
7. City guide/Town

The basic criterion for developing the planning units (community hierarchies) is population size (house hold head). In addition, service and other economic activities are considered (See Table 1).

These planning units are used as basic frame work for preparing the urban plans. There are standards developed by the Institute for each planning units (See Annexes VI to XIV and Table 2). The standards are developed taking the experiences of other developing countries and the standards developed by AAMPO during the preparation of Addis Ababa master plan and NUPI in Assela and Awassa master plans (NUPI(MPPD), 1991). These standards are

Table 1. Level of Planning Units

Planning Units	Population size (house hold head)	Controlling elements
Home	1	-
Community class I	20-80	contact area
Community class II	200-400	Basic Education
Community class III	1000-2000	Elementary "
Community class IV	5,-10,000	Secondary "
District	12,-20,0000	Major Municipal service
Town	-	-

Source: NUPI(MPPD), 1991

used as a reference for planners and implementors (city councils). For instance, if the city consists of planning units up to Community IV, the planners will not make a specialized school recommendation (See Annex VII).

In a general sense, the standards are used to make different types of land use proposals for the urban centre:

- recreation and green
- administration office
- commerce and trade, and
- industry

Residential land use - To make residential area proposal, existing net residential area and projected population are required. The residential area is calculated manually using grid square method. Then, the required residential area for the planning period is determined first by calculating a per capita land consumption of a single dweller and then multiplying the result by estimated total population. During calculation of per capita land consumption, land is required not only a plot for a house but also for external roads & green, civic space & green and special functions.

Service land use - the urban service is viewed as falling into two categories: social service and municipal services. The social services include education, health, religious service, cultural recreation, sport, and municipal administration service, etc. Municipal service, on the other hand, include garbage collection, fire-brigade, abattoir, home for aged and handicapped, municipal cemetery, liquid and solid waste disposal, etc. The land requirement for each type of service is

determined based on the standards set by the Institute (See Annexes VI to XIV)

Administration offices - consists of government administration offices and financial institutions. However, financial institutions are not indicated in administrative office land use. The government administration offices include offices of the central government bodies, ministerial branch offices (non-financial), political groups, police stations, prison, court, etc. The land use proposal for administrative offices is made based on the standards indicated in Annex XII.

Recreation and Green - the required recreation and green area in the planning period for the urban centre is determined as (See Annex XIII for the detail)

- a minimum of one acre (about o.4 ha) of open space per 1000 total population;
- a minimum of 10 percent of the total land area of the municipality devoted to recreation and green, and
- about 40-50 percent of recreation and green area reserved for games or other active recreation

Commerce and Trade land use - consists of three groups of activities: commercial offices, shopping activities and

recreation related commercial facilities. The commercial offices and financial institutions include banks, insurance office, office of trade corporations, lawyers, physicians, architects, ministerial branch offices, etc. The shopping activities include music shop, textile shop, warehouses, building materials shop, etc. The recreation related activities, on the other hand, consists of activities of hotels, restaurants, bars, bowling centres, etc. The required land for commerce and trade land use is determined using the standards indicated in Annexe XIV.

Industrial land use - includes manufacturing plants that produces goods and commodities. They are usually grouped into three classes: light, general and special industries. Light industries include activities such as printing and publishing, weaving, food processing, work of gold smiths, paper mill work and wood working, etc. General industries, on the other hand consists of brick & lime kilns, sintering of sulphur bearing materials, glue maker, blood and bone processing, soap making, etc, and special industries include the making of any article or parts of article, production of non-alcoholic beverages and plastic products, slaughtering livestock, the generation of electricity, etc. The industrial land use is determined for the planning period based on the standards indicated in Table 2.

Table 2. Industrial land use standard

Level	Type of activity	Area (m^2/ inh.)	% Built up area	Location
Comm. class IV	Light industry	-	60-70	mixed with any activity
District	General industry	14-17 ($70-140m^2$ per employee)	50-60	can have their own location with special consent
City/ Town	Special industry	"	40-50	Zoned & excluded from other urban activities with buffer

In a general sense, the master plan shows the major land use types. According to the Institute's establishment proclamation, the master plan shows:

a) the supply system;
b) the detailed land use program, and
c) the details of scheme necessary for the improvement of the physical features.

The master plan must be complemented by explanatory texts. This text is used as reference by city councils to implement the new master plan. It also includes the proposed policies and guidelines.

The detailed plan is prepared on the basis of the prepared master plan. In the master plan, only the major land use types are indicated, for instance residential land use. This residential land use may incorporate some other minor land use activities such as schools, health establishments and small shops. During the preparation of detailed plan, all the detailed land use activities are shown on the plan. Generally, the prepared detail plan shows for the urban centre (Negarit Gazeta,1987):

a) the detailed supply system;
b) the detailed land use program;
c) the details of schemes necessary for the improvement of the physical feature, and
d) urban zones.

The Institute has very serious problems in that the prepared plans never get approved and implemented. However, the Institute Establishment Proclamation states that plans prepared by the Institute shall be approved, if it is (Negarit Gazeta, 1987):

i) the regional urbanization plan, the Institute submits the plan to the Regional Urbanization Council. Next, the Regional Urbanization Council examines the prepared plan and submits the same to

i) the regional urbanization plan, the Institute submits the plan to the Regional Urbanization Council. Next, the Regional Urbanization Council examines the prepared plan and submits the same to the Minister together with its recommendation. Then the Minister shall after approving the regional urbanization plan submitted to him, forward the same to the National Committee for Central Planning (later Office of the National Central Planning and now Ministry of Planning and Economic Development)

ii) the metropolitan area plan, the Institute submits the plan to the Metropolitan Council. Then the Council examines and submits the same to the Regional Planning Council together with its recommendation. The Minister shall, after approving the metropolitan area plan submitted to him, forward the same to the Office of the National Central Planning, and

iii) the master and detail plans, the Institute submits them to (a) the Metropolitan Council where the urban centre falls within the boundaries of a metropolitan area, or (b) the Regional Planning Council where the urban centre does not fall within the boundaries of a metropolitan area. Next, it transfers the same to

detailed plan with the master plan; cause the publication in the Negarit Gazeta of the approval of the plan.

The prepared plans and drawings, diagrams and explanatory texts prepared in connection therewith shall come into force on the date of the publication in the Negarit Gazeta of their approval by the Government (Negarit Gazeta, 1987).

However, all of these directives are rarely implemented. Even the master plan of Addis Ababa which was prepared by Italian and Ethiopian experts at a 10 million Birr expense and completed some six years ago was approved lately on 26 April 1993 (Ethiopian daily news, 26 April 1993). Almost all work of the Institute are paper exercises that get accumulated in IDC (See Fig.2).

3.5 EXISTING INFORMATION SYSTEM

The Institute has good computer facilities (See Section 3.6) for data processing although their utilization can be improved. Presently, the computer is used to process only data collected by the questionnaire survey (See Fig. 2).

The questionnaire data is entered into the computer system through key-to-device inputting technique. A sample of data collected by the questionnaire is presented in Table 3.

Table 3. A Sample data collected by the Questionnaire Survey

Name	Sex	Ethnicity	Religion
Muluneh Degu	2	1	1
Abdulahi Ahmed	1	70	4
Nurya Ebrahim	2	70	4
Yosef Mengesha	1	1	1
Shiwonz Mokonnen	1	1	1
Kelil Omer	1	40	4

Before any program is run, the data is printed out and given to the users to check for errors. The questionnaire data are stored in eight files based on the blocks of the questionnaire. A sample records are indicated in Annex XV from data collected for Dire-Dawa town in 1989 to show how data is stored in the existing sample database. The files consist of only the data values and other files are created, called documentation file, for each data file. The documentation file is created to identify each field in the data files. Annexes XVI shows the existing documentation files. For instance a Documentation file for Block2 data file says the first **Variable** (Column 1) is serial number, the second **Variable** is job number, and so on (See Annex XVI).

The types of output requested from the system is usually frequency tallies. A program, used to produce this output is a **'Cross Program'**, and it is a very powerful program, easy to use even by non-computer personnel. For instance, to produce the output that shows the number of houses in different age groups and tenures, the command is written as follows:

```
Data      Database filename
Doc       Documentation filename
Output    Filename to save the output
Cross     Housing_age  Tenure
```

Then, the command produces a sample output indicated in Annex XVII.

The existing cross program can access only one file at a time. If there is a need to use the data in the other file (block), the required data for processing must be available in one file. Examining Annexes XVI shows how data is duplicated in the existing files. For instance, one may inquire births by ethnic group. The data for ethnic type in the questionnaire is maintained in Block2, but during file creation, this data must be procured duplicated in both Block2 and Block3 data files.

In addition, the Centre develops in-house programs for some applications. For instance, during the study of the Southern Planning Region, the Centre developed a SEROMO (Southern Planning Region Model) program, using PASCAL language, to process data for the preparation of regional plan for the study region.

Presently, the data collected by the sectoral survey is not entered into the computer. The reason is that the users do not employ mathematical operations that involve complicated calculations. They employ just only the calculation of percentages and totals. This does not mean that urban-regional plan preparation does not require to employ sophisticated mathematical equations or models to process data. But the problem is that almost all staff of the Institute are inexperienced, employed after the establishment of the Institute, and thus there are well established methodologies either for preparation of plans or for data processing.

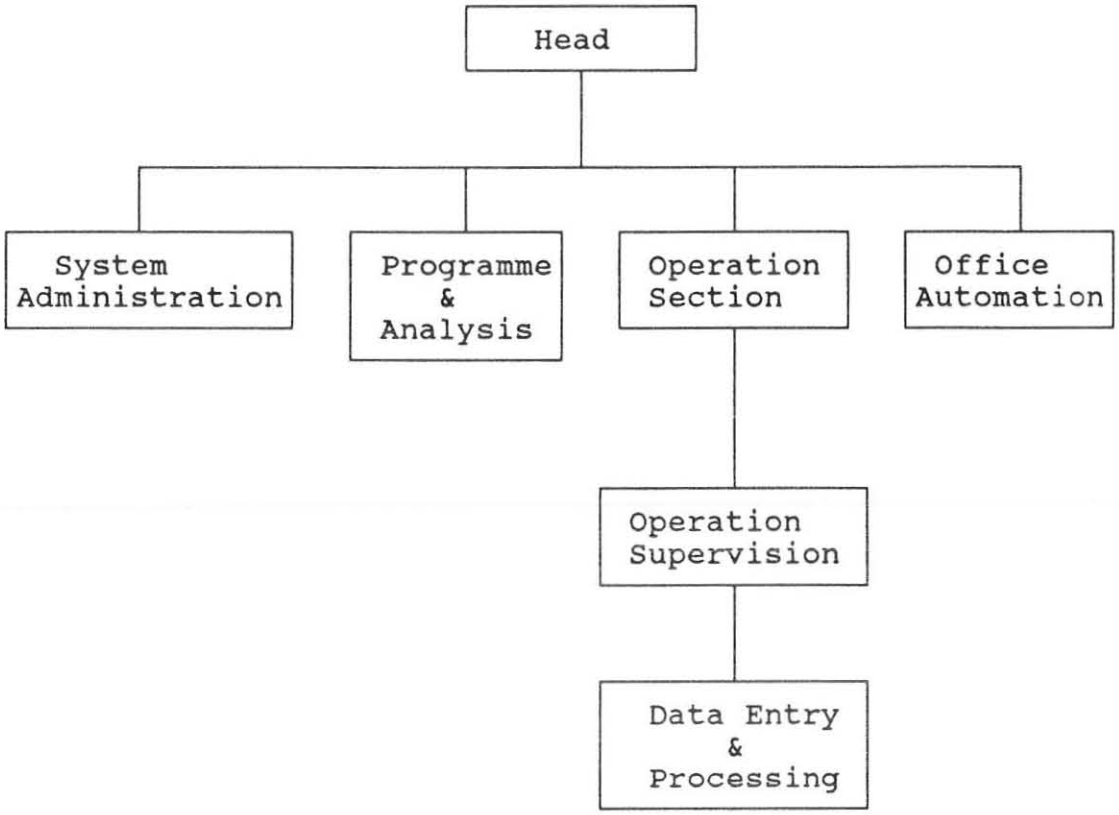
3.6 THE COMPUTER CENTRE

The Computer Centre was established by the AAMPO for data and text processing. When the status of the project was raised into an institute level, the Centre was reorganized as one of its Departments to perform more

wider range of tasks such as information requirement analysis. This is clear from the organizational structure of the Centre (See Fig. 3). However, the Centre is still providing only data and text processing services to all departments of the Institute.

Whenever users have tasks to be done by computer, first they must get permission either from DGM, the Centre Head or the Administrative Service Head. Structurally, the Centre is directly accountable to the DGM (See Fig. 1).

Fig. 3 Organizational structure of the Computer Centre



Source: Computer Centre, 1989

The Institute computer centre has mainframe computers and microcomputers. However, there are features that are common to all computer-based data processing systems: hardware, software and people.

3.6.1 Hardware

The centre's hardware configuration consists of IBM-5340 and HP-9050 mainframe computers.

The IBM mainframe computer has 64mb of primary (hard disk) memory capacity. It has five video display terminals (CRTs) and one disk pack which can contain 20 diskettes at a time.

The IBM mainframe computer has two printers: IBM-5219 character wheel printer and IBM-5256 dot matrix.

The HP-mainframe computer is a 500 series with 8mb RAM and 570mb ROM capacity. It has 3 CPUs and built-in communication channels. The channels are RS-232C ports/interface and HP-LB ports. Furthermore, it has two drivers: HP-7800 magnetic tape and cartridge tape drivers.

This mainframe computer has

- 2 colour graphic terminals, model 2397a and 98700
- 4 display terminals model 2397A, and
- 5 display terminals model 700192, but they are not yet installed, and

- 1 Benson 6301 absolute coordinate digitizer that converts maps and diagrams into a data for computer processing.

It has the following output devices:

- 1 line printer, model 2563B
- 1 letter quality dot matrix printer, model 2934
- 1 think jet printer
- 2 C. ITOH 310 printers
- 2 EPSON LQ 1050 printers
- 1 Laser printer, and
- 2 plotters, model HP7585

The Centre has also three micro computers, each of which has

- 80286 CPU
- 640kb RAM
- more than 20mb ROM
- floppy disk drive
- serial and parallel interface boards, and
- mouse

To protect loss of file due to power interruption, the Centre has 10KW UPS with half an hour battery backup.

To facilitate transfer of data between IBM-5340 mainframe computer and HP-9050 mainframe computer, the Centre has KMW TWINAX protocol.

3.6.2 Software

The centre has the following software:

	Software	Function
1.	CROSS	data processing
2.	THMAP	preparing maps & drawings
3.	RGRE	data processing
4.	Component analysis	" "
5.	FIXED	" "
6.	ADDAEST	data clustering
7.	CLUSTER	" "
8.	DBASE	data storage and retrieval
9.	LOTUS	preparing graphs and charts
10.	CAD	preparing graphs and maps
11.	SPSS	data processing
12.	VENTURA	printing
13.	WP	text processing
14.	WS	" "
15.	WORD	" "
16.	PM	" "
17.	HG	preparing graphs and charts

3.6.3 Personnel

Despite we are dealing with computers, people must be always there to make computers operational. The people in the computer system performs manual tasks such as machine on and off. Table 4 shows the positions of Computer Centre staff. The role of people in the Computer Centre is very high in the sense that the benefits that are procured from the computers is strongly dependent upon

Table 4. Staff of the Computer Centre by their Positions

Position	Number
Head	1
System Administrator	1
System analyst	1
System supervisor	1
Programmer	1
Engineer	1
Operators	3
Encoders	11
Total	20

Source: Computer Centre, 1992

Table 5. The Staff of the Computer Centre by their Qualification

Qualification	Staffs
MSc(Mathematics)	1
BSc(Electrical Engineering)	2
BA(Management)	2
BA(Economics)	1
BA(Mathematics)	1
Diploma(Computer Science)	6
Diploma(Civil Engineer)	1
Diploma(Statistics)	1
Diploma(Mathematics)	1
Diploma(Secretarial Science)	1
12 + 3	3
Total	20

Source: Computer Centre, 1992.

the skill of the persons assigned. In this regard, the Centre has reasonably adequate trained staffs (See Table 5).

3.7 EXISTING SYSTEM PROBLEMS

From the analysis of the Institute's tasks and existing information system, the following problems have been identified as the prime bottlenecks:

1. The sample data collected by the questionnaire survey is not processed in a convenient format to the users in that the users must cross-check the output reports with the questionnaire manuals to get the description of codes.

2. There is a great deal of data duplication in the existing file system. To identify each record, 10 similar data fields (job number, planning region, administrative region, awraja, town, keftegna, kebele, enumeration area, house number and house hold head number) are used in each file. On the other hand, the cross program cannot access more than one file at a time. As a result, the required data must be maintained duplicated in all files (See Annexes XVI). This unnecessary duplication of data not only congests computer storage space but also substantially reduces processing efficiency.

3. The Centre does not have standard output formats, but different users ask the same output in different formats.

4. The data collected by the sectoral survey are not entered into the computer system. As the data is handled by individual users, it is very difficult for one user to access data collected by another user. Presently, there is very poor information exchange among the Institute's staff. As each department collects and maintains all data it requires, it leads to the problem of data duplication and inconsistency. For instance, data about population by age group is required both by PSARD, PPRD, and ERD and this data is available in these departments' files.

5. The Institute's tasks involve the preparation of many maps, plans and graphs. First, the researchers and planners prepare the draft and then the final drawing is done by draftmen/girls. As to the maps prepared in PPRD, in particular, there is a usual complaint by draftmen/girls. The reason is that the task does not involve their skills and creativity.

6. MPPD and PPRD calculate areas manually, using 'grid square' method and sometimes using planimeter. This task is very laborious and liable to errors.

7. The maps and plans are always prepared on a large scale (1/250000, 1/50000, 1/10000 and 1/5000). And they must be reduced into smaller scales that can be attached to the reports. Presently, the Institute does not have any machine for map reduction. This is done by Ethiopian Mapping Agency, on the average paying Birr 450 for each map which is very expensive.

8. Information misuse/wastage: one of the prime objective of the research departments is to furnish UPP with input information for urban plan preparation. Hence, a considerable amount of information is produced in the research departments, but very little information is used. There are two main reasons for this: (a) the information produced in the research departments is not supplied at the right time when UPP needs. Both R&D and UPP departments start and finish their tasks at the same time, and (b) the information generated in the research departments is not often supplied to UPP departments in a usable format.

Almost all the staff of the Institute are inexperienced, employed after the establishment of the Institute, to the tasks they are performing. It is known that the Institute is established to prepare urban-regional plans, tasks effected at present are contrary to this objective. Extensive amount of data and information are collected and processed to write descriptive reports. Tilahun notes that because of the absence of well defined methodological approach, research reports prepared by the departments are generally descriptive and academic, and not used in the preparation of master plans, whereas these reports are supposed to help the preparation of the master plans (Tilahun, 1992). As a result, urban plans are often prepared based on inadequate data, that is, excluding the information required from the research departments. Regional plans, on the other hand, are not prepared, except the unsuccessful attempt of SEROMO.

3.8 FEASIBILITY STUDY

The Institute has adequate computer machines, even more than the need.

Computers have a lot of applications to solve most problems of the Institute. This has already been recognized by the Institute. Presently, the utilization of computers by the Institute is limited to data and text processing while there are many areas where computer is applicable:

The preparation of maps, plans and graphs can be done by computer. The Centre has the necessary hardware such as digitizer and plotter and software such as TMAP, HARVARD and CAD. The automation of this task is feasible and will solve many problems of the Institute associated with it. Once maps and plans are maintained in machine-readable form, it is possible to accomplish many tasks by computer:

- calculation of area which provides fast and accurate results;
- map reduction and enlargement, which can curtail the expensive costs paid for EMA;
- production of outputs in the desired quality that

avoids the need to prepare the maps and plans repeatedly, and

- to avoid wastage of papers (semi-original and blue print papers) that are purchased by hard currency. In the automated system, corrections can be made on the screen without making computers busy in printing and wastage of papers. In manual methods, the wastage of papers, particularly of papers purchased in hard currency and labour is very high.

The problem of data duplication and inconsistency can be avoided by developing and designing better database systems.

The processing of sample database can be well effected if the system procures commercially available statistical packages.

The main cause of information misuse/wastage is inappropriate data processing activities, that is, presentation of data only to describe existing situation. This problem will be improved &/or solved if the users can develop models such as population projection model, economic growth model, etc. that allows to have in advance understanding about the foreseeable future. Once

necessary parameters for projections are defined by the users, the computer facility is available there for solving these problems.

By taking the users recommendation, system problems and system priority into consideration, the subsystem indicated in Fig.4 is selected for further system design. This subsystem takes data collected by questionnaires from the users and produces various socio-economic reports and distribution maps that will be used by the users to prepare reports and urban plans.

CHAPTER FOUR

USERS' REQUIREMENTS ANALYSIS

4.1 INFORMATION NEEDS

The survey and interviews undertaken as mentioned in chapter One enabled the identification of information needs of the different categories of staff of NUPI and the purpose for which the information is needed. This Chapter summarizes the findings.

The analysis and identification of user's information requirement, is a prerequisite for the success of information systems (IS). As Senn (1987) says 'Much of the success of the information system depends on identifying the right requirement for the application and ensuring that the development meets these requirements'.

Although the proposed system is designed primarily for the subsystem (urban socio-economic data processing system) of urban-regional planning information system, in the discussion of information needs, it would be helpful to examine the information requirements of the total urban-regional plan preparation. This would also provide information to study other subsystems. Information is

required for a variety of purposes, in the performance of the tasks to achieve goals, ranging from problem solving, decision making, planning, keeping updated in research, etc. The factors that motivate the NUPI's staff to seek information are planning, problem solving, keeping updated about developments in their respective research areas and general awareness (See Table 6).

Table 6. Use of information

Purpose	users
Planning	41.1
Problem solving	27.1
Keeping updated about development in research area	16.9
General awareness	11.9
Not for particular purpose	3.0
Total	100
Surveyed Users	50

Information for planning (41.1%) is the most frequent purpose followed by problem solving (27.1%) among the users surveyed. The survey also shows that some users appear to collect information without any defined purpose (3%).

The information requirement of each department is outlined below:

ERD - requires information that enables it to make urban and regional studies and prepare regional urbanization plan. The Department collects data that can characterize urban and rural economic bases.

Information required on:

Urban Level

- Municipal revenue and expenditure
- Employment and unemployment data - number of employees, by industrial group, occupational status, income group, etc.
- Commercial activities data - hotels, bars, 'tej-house', tea-room, warehouses, textile shops, music shops, applicants for licence, etc
- Market data - periodic and 'Gult' markets, items sold at the market, etc.
- Population data by sex and age structure
- Industrial and handicraft data - type of industries, raw materials used, products manufactured, ownership, etc.
- Urban consumption and expenditure
- Forestry - forest seed germination test, type of plants in different climatic zones, etc

Regional Level

- Meteorological data - temperature and rainfall
- Population data - size of population and heads of house hold
- Crop production data - cultivated land under different crops, yield per hectare, production used for home consumption and market sale, etc
- Livestock - population by age, sex and type (cattle, sheep, goat, poultry, equine, camels), livestock products, etc
- Rural non-farming activity - handcraft, fishing, fuel-wood collection and sale, beverage, etc
- Rural service delivery system - service cooperatives, villages, agricultural extension services, etc
- Food consumption - food items produced and consumed by farmers, food items purchased, ritual holidays celebrated with meat, beverage and stimulants, etc
- Migration - in-and-out migrants, reason for migration, etc
- Transport data - freight rate, volume of traffic, roads standard, etc

PSARD - conducts research on population characteristics and social services. The required information for this task are:

Urban Level

- Population data - age, sex, composition, deaths, births, house hold heads, marital status, educational level, migration, etc
- Educational services - number of schools in each level, classrooms, sections, shifts, enrolments and their origin, teachers by sex and qualification, problems, etc
- Health services - health establishments by hierarchy, personnel, services (programme), family planning, environmental sanitation, number of patients by type of diseases, problems, etc
- Housing data - stock, purpose, construction materials, physical conditions, housing amenities (kitchen, water supply, electricity, cooking, garbage collection, etc), applicants, projects, problems, etc

Regional Level

- Population data
- Educational services data
- Health services data

The Department also requires information on national and international standards to make projections. The following educational standards developed by Unesco are accepted by the Ministry of Education.

1. School age standard
   - 7-12 age for elementary school
   - 13-14 age for junior secondary school
   - 15-18 age for senior secondary school
2. Student - class room standard
   - 50 students per class room for elementary school
   - 40 students per class room for junior secondary school
   - 40 students per class room for senior secondary school
3. Student - school standard
   - 900 students per school for elementary school
   - 480 students per school for junior secondary school
   - 960 students per school for senior secondary school

PPRD - conducts research on geographical, geological and historical aspects of the study areas. The information requirement of the Department is similar to that of the

other two Departments mentioned above, but a difference is that PPRD makes spatial analysis. The required information is:

Urban Level

- Meteorological data - temperature, rainfall, wind direction, humidity, evaporation rate and climatical zones.
- Housing data
- Urban utilities - power supply, water supply, telecommunication, postal services, market services, problems, etc
- Sports, recreation and cultural activities - sport fields, green areas, cinema, tourism, museums, art galleries, libraries, etc
- Natural resources data - forestry like fuel wood supply, construction, recreation, availability of construction materials like stone, sand, etc
- Geological data - geological history, lithological units, seismicity, etc
- Soil data - suitability of soil for construction purposes
- Hydrogeology - drainage basin, hydrologic water balance, surface and ground water hydrology, water quality, etc

- Historical data - development of the town, causes for the establishment of the town, etc

Regional Level

- Educational services data
- Health establishments data
- Population data
- meteorological data
- Transport data - road network, traffic volume, roads under construction and under plan ,etc
- Existing land use map
- Geological data - geological history, lithological units, land forms, etc
- Mineral occurrences
- Hydrogeology - drainage basin, hydrologic water balance, surface and ground water hydrology, water quality, etc
- Topographic map at scale 1/50000, 1/250000 and 1/1000000

MPPD - prepares only urban plans and requires the following information

- Exiting land use
- Topographic maps at scale 1/2000, 1/5000, 1/10000 and 1/50000

- Projected population size health establishments, schools, housing stocks, commercial activities and industries for the planning period
- Wind direction information
- Summary reports from the research departments
- Standards (See Annexes VI to XIV

For the purpose of analysis, the above types of data and information are grouped into 13 categories (See Table 7). Of these population, services, and maps and plans, natural resources and meterological data are required more frequently than the other types of information (11.4, 10.1, 8.4, 8.4 and 8.0 percent, respectively). Although the users in each department require all types of data and information, the users in one department may require some types of data and information more frequently than those in the other departments. The top

Table 7. Information Requirements Among Departments

Type of info.	ERD (%)	PSARD (%)	PPRD (%)	MPPD (%)	Total %
Agriculture	17.5	-	8.2	6.4	9.3
Industrial & Handcraft	12.7	-	4.1	7.7	7.2
Commercial	9.5	-	2.7	7.7	5.9
Transport	4.8	8.7	8.2	6.4	6.8
Employment & Unemploy.	6.3	17.4	1.4	5.1	5.9
Population	11.1	26.1	8.2	10.3	11.4
Services	7.9	21.7	11.0	7.7	10.1
Natural resources	11.1	-	12.3	5.1	8.4
Historical	-	-	2.7	6.4	3.0
Maps and plans	3.2	-	12.3	11.5	8.4
Housing	1.6	21.7	8.2	7.7	7.2
Geological	3.2	-	5.5	6.4	4.6
Meteorological	6.3	-	11.0	9.0	8.0
Others	4.8	4.3	4.1	2.3	3.8
Total	100	100	100	100	100
Frequency	63	23	73	78	237
Surveyed Users	14	6	13	17	50

three most frequently required data related to agriculture, natural resources and population data in ERD; population, services and housing data in PSARD; and maps and plans, natural resources, services and meteorological in PPRD, and maps and plans, population and meteorological data in MPPD (See Table 7).

4.2 DATA AND INFORMATION SOURCES

Data and information collected/required by the users are not usually available in the Institute. It is thus

necessary to identify sources of data and information so that users' accessability to the right sources can be improved in the course of data collection.

In response to the survey, seven groups of information sources were identified (See Table 8). The major sources of data and information are other government and non-government organizations (24.2%), surveying and observation (19.5%), and interviewing local people at work site (17.4%). These sources are also the main data and information sources at department level (See Table 8). This is generally the case in developing countries where published materials are not easily available, unpublished materials (annual reports, minutes of meetings, data collections, conference papers, thesis

Table 8. Sources of data and information

Sources	ERD %	PSARD %	PPRD %	MPPD %	Total %
Books	10.0	15.8	16.3	10.6	12.8
Periodicals	0.8	-	4.7	8.5	6.0
Other Government and Non-government organizations	27.5	31.6	23.3	19.1	24.2
Databases	10.0	5.3	9.3	10.6	9.4
Other Departments in the Institute	10.0	10.5	7.0	14.9	10.7
Individuals at field survey work	15.0	15.8	20.9	17.0	17.4
Surveying and Observation	20.0	21.0	18.6	19.1	19.5
Total	100	100	100	100	100
Frequency	40	19	43	47	149
Surveyed Users	14	6	13	17	50

technical rules, etc) are the major sources. 'The vast majority of research material produced on Africa can be identified as belonging to the category of information source referred to as ephemera, fugitive, non-conventional, informal, or the more generally accepted term - Grey literature' (Sturges and Neill, 1990).

In response to sources of data and information, the users listed more than one source (See Table 9). Since each user requires different types of data and information, it is very unlikely all the required data and information will be available from a single source. Besides, the same data and information may be available from different sources. For instance, population data may be available from databases, other government and non-government organizations, other departments of the Institute, surveying and observation.

Table 9. Types of data and information by sources

Type of data & info.	Sources of data and information							
	Books	Jour. & per.	DBs	Other gover. & non-gover. organs.	other dept. in Inst.	Inter. with people	survey. & obser.	Total
Agricultural	4.2	8.3	4.2	33.3	16.7	12.5	20.8	100
Inds. & hand.	-	6.7	-	40.0	20.0	6.7	26.7	100
Commercial	5.0	5.0	-	30.0	20.0	10.0	30.0	100
Transport	14.3		14.3	42.9	21.4	14.3	7.1	100
Emp. & Unemp.	-	4.8	-	28.6	28.6	14.3	23.8	100
Population	3.7	-	3.7	37.0	22.2	14.8	18.5	100
Services	3.1	6.2	6.2	31.3	21.9	9.4	21.9	100
Natural res.	7.4	3.7	3.7	25.9	14.8	11.1	33.3	100
Historical	14.3	-	7.1	18.0	18.0	21.2	21.4	100
Maps & plans	4.2	-	8.3	58.0	29.2	-	21.4	100
Geology	-	-	6.7	33.3	4.0	6.7	13.3	100
Meteorology	6.3		12.5	43.8	25.0	-	12.5	100

If the major sources of information are other government and non-government organizations, the users were asked to list the name of the organizations from which they collect data and information. The result is indicated in table 10, fifteen government and non-government organizations are identified by the users. Government organizations which were less frequently visited are grouped under others.

Table 10. Government and non-government organizations used as sources of data and information

Name of Organizations	Users	
Central Statistical Authority	27	13.2
Min. of Public Works & Urban Devt. (City councils)	51	24.9
Min. of Environmental & Natural Resource Conservation	23	11.2
Ministry of Health	5	2.4
Ethiopian Mapping Agency	12	5.9
Ministry of Transport & Communication	8	3.9
Eth. Electric, Light & Power Authority	4	2.0
Water Resource Commission	11	5.4
Ministry of Education	5	2.4
Institute of Agricultural Research	11	5.4
International Livestock Centre for Africa	3	1.5
Ministry of Mines & Energy	7	3.4
Regional Plan Offices	15	7.3
National Meteorological Service Agency	11	5.4
Addis Ababa University	4	2.0
Others	8	3.9
Frequency	205	100
Surveyed Users	50	

As the table above indicates the Ministry of Public and Urban Development (24.9%), Central Statistical Authority (13.2%), Ministry of Environmental and Natural Resources Conservation (11.2%) and National Meteorological Service Agency (7.3%) are the major sources of data and information among government and non-government organizations.

data available at national level is too abridged to satisfy the detailed information requirement of NUPI. However, information institutions that provide information services to their respective organizations and other external users like NUPI are often available only at national level. At regional branch offices, data are handled to prepare summary monthly, quarterly and annual reports that will be handed over to their respective main offices. As a result, after these reports are sent, the data are not properly maintained which consequently resulted in inavailability of information upon request. Sometime data reported by one and the same organization are conflicting. Theses problems are mainly ascribed to the lack of information professionals, inadequate document preparation equipment, even the ordinary type writer, lack of awareness to the importance of information, etc. While the required information is wasted due to such carelessness, the country tries to purchase similar information, perhaps of a lower quality produced in the developed countries at a higher cost.

4.3 LOGICAL SYSTEM DESIGN

A logical system is designed by developing a data flow diagram. The data flow diagram shows data sources and destinations, data stores, data flows and data processes. Since it does not say anything about the physical implementation of these elements, it is easily modified as the system analyst gets more knowledge about the new system.

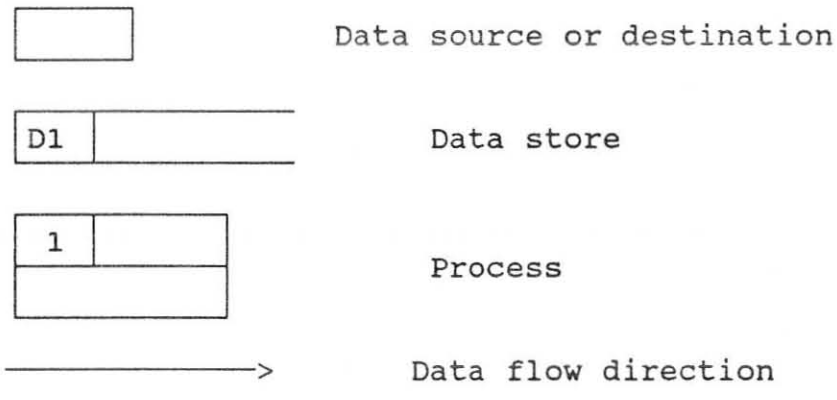
The starting point for developing the data flow diagram is the existing system flow chart (See Fig. 4). The data required by the system is generated when the user conducts questionnaire survey. For the system discussed here, data is obtained from the users and hence the users are considered as data source. After the data pass through the necessary processes, it again goes to the users to prepare urban regional plans. Thus, the users are considered both as data sources as well as destinations.

Data store: a data store is any media such as paper and magnetic disk used for storing data for a while. In the existing system flow chart, the users provide questionnaires and the data is maintained from the questionnaires and stored in sample data files for

processing. The processed data is again stored in the socio-economic reports and distribution maps data stores for distribution to the users. Therefore, **sample data**, **socio-economic reports** and **distribution maps** are used as data stores to the existing system dataflow diagram. Lastly, data processes are **maintain data**, **process sample data**, **prepare distribution maps** and **distribute reports and maps.**

After the necessary components have been identified, the existing system dataflow diagram can be developed using the symbols indicated in Fig. 5 (See Fig. 6). This data flow diagram is an important communication tool between the system analyst and the users.

Fig 5 Data flow diagram symbols



Source: Rowley, 1990

4.3.1 System Analysis

The analysis of system starts from the system outputs and then goes back to the data sources. The purpose of this analysis is to identify the necessary elements of outputs and data sources as well as algorithms that process input data elements.

There are several reasons why the analysis starts from the output. First of all, information systems exist to provide outputs to the users. If this is the case, the main emphasis must be on the output. Moreover, once the output is defined, it is straight forward to define what inputs and processes are required. The output can serve as a controlling mechanism in that it enables to save resources during system design.

The following output reports are distributed to the users:

1. **Socio-economic Reports.** These consist of the following reports. The data elements in each report are indicated below:

1.1 Population Report
- enumeration area*
- age group
- sex

1.2 Marital Status Report
- status
- sex

1.3 Ethnic Composition Report
- enumeration area*
- ethnic group
- sex

1.4 Birth Place Report
- region*
- wereda*
- town*
- sex

1.5 Length of Continuous residence Report
- year
- sex

1.6 Reason for Coming Report
- region*
- wereda*
- town*
- reasons
- sex

1.7 Educational status Report
- Educational levels
- sex

1.8 Out-migration Report
- enumeration area
- age group
- sex

1.9 Out-migration Reason for Moving Report
- reasons
- sex

Note: The data elements with an asterisk (*) are used to prepare distribution maps

1.10 Out-migrants Destination Report
region
wereda
town
sex

1.11 Out-migrants Educational Levels
educational levels
sex

1.12 Fertility Report
first marriage age
children ever born
alive
deceased

1.13 Births Last 12 Months Report
reproductive age group
females
born alive
sex
born dead
sex

1.14 Mortality Report
enumeration area*
age group
sex

1.15 Unemployment Report
enumeration area*
reason for unemployment
sex

1.16 Employees by Job Report
job type
sex

1.17 Employees by Sectors Report
sectors
sex

1.18 Employees by Economic Activity Report
enumeration area*
economic activity
sex

1.19 Employees by Income Group Report
enumeration area*
income group
sex

1.20 Work Place Report
- place
- sex

1.21 Expenditure Basket Report
- item
- expense (birr)

1.22 Age of Housing Unit Report
- enumeration area*
- age group
- stock/number of houses
- house hold head
- population

1.23 Builder of Housing Units Report
- enumeration area*
- builder of houses
- stock
- population

1.24 Amount (birr) of Rent/Tax Report
- enumeration area
- rent/tax group (birr)
- stock (rented)
- land tax (private owned)
- house tax (private owned)

1.25 Status/Legality of Housing Units Report
- enumeration area*
- status
- stock

1.26 Housing Units by Function Report
- function
- stock

1.27 Housing Typology Report
- typology
- stock

1.28 Housing Flooring Materials Report
- type of material
- stock
- population

1.29 Housing Walling Materials Report
- enumeration area*
- type of materials
- stock
- population

1.30 Housing Roofing Materials Report
enumeration area*
type of materials
stock

1.31 Housing Physical Condition Report
enumeration area*
scores
foundation
floor
wall
ceiling
roofing
plastering

1.32 Housing Water Supply Report
enumeration area*
type of supply
stock
population

1.33 Housing Toilet Facility Report
enumeration area*
toilet facility
stock
population

1.34 Housing Light Service Report
enumeration area*
light service
stock
population

1.35 Housing Telephone Service Report
Telephone service
stock

1.36 Housing Units by Number of Rooms Report
enumeration area*
number of rooms
stock
population

1.37 Availability of Service Quarters (S.Q.) Report
houses with S.Q.
stock

1.38 Owners Acquisition Report
acquisition
owners

1.39 Owners House Construction Report
building time (months)
stock

1.40 House Construction Delay Report
reason for delay
stock

1.41 Owners Intension to Sell Houses Report
reason to sell
stock

1.42 Renters Intension to Buy Houses Report
intention to buy
renters

1.43 Reason for not to Buy Houses Report
reason not to buy
renters

1.44 Renters Intension not to Build House Report
reason not to build
renters

2. Distribution Maps

The following data elements are used to prepare distribution maps:

- Population
- Ethnic type
- Birth place (by town and wereda)
- Unemployment
- Economic activity
- Income level
- Reason for out-migration
- Out-migrants destination (by town and wereda)
- Mortality
- population per housing unit
- Age of housing unit
- Builder of houses
- Housing function
- Hosing status/legality
- Population by number of rooms
- Housing units walling materials
- Hosing units roofing material
- Housing units overall physical condition
- Water supply
- Toilet facility
- Light service, and
- Garbage collection

After output reports and data sources have been identified, algorithms for converting the raw data obtained from the data sources are needed. At this stage one may consider the algorithms at a black box level. In the sense that what the black box performs is not known, but when it is given input data, it produces outputs. The black box, process sample data, receives input data from the questionnaires and produces socio-economic reports.

4.3.2 Defining the Logical System

The system analysis done above is not complete. All detailed data elements and algorithms that are required to develop the new system need to be identified. To do so each data element and algorithms must be examined one by one to complete what is missing.

Consider the data elements in the questionnaires. For the purpose of convenience, the Institute's questionnaire is designed to use codes when it is filled by a data collector during the survey. Instead of writing 'Amhara' for a surveyed person's ethnic type, the data collector fills code '1'. As a result, unless the data elements in the questionnaires are cross-referenced with code description tables, they are not meaningful to the users. Therefore, to produce a compete socio-economic reports,

meaningful to the users, the system must also maintain **code tables** data store (See Fig. 7). This is obtained from the questionnaire manual.

To prepare the distribution maps, the system also needs to access base map. This map is obtained from the users and the system dataflow diagram must include **Maintain base map** and **Base map** data store (See Fig. 7).

The algorithm for process sample data described at the black box level does not tell us in detail what the system performs. The data collected from the questionnaire survey is about each individual person socio-economic condition such as age, sex, income, etc (See Annex II). Since the Institute is not interested about individual person data, the algorithm for process sample data performs frequency tabulation for each data value (e.g. how many persons by ethnic type) and then translates the codes so that the output is meaningful to the users. The algorithm for process sample data processing is the same for all socio-economic reports.

The system operates some algorithms to process the data obtained from the socio-economic reports for distribution map preparation. Consider that a planner wants to prepare a population distribution map. The population size is

grouped into classes and then the enumeration areas are identified in each class and shaded the same symbol on the map. The resulting map shows the distribution of population in the town. The distribution map is also prepared for ratio between two data elements. For instance, to show population congestion per housing unit, the ratio is computed by dividing the population by the number of houses for each enumeration area and the map is prepared as mentioned above. Similarly, population density per unit area is prepared by the same procedure.

Although the data element **population** is defined in the socio-economic reports, here the analyst needs to describe the algorithms the system must use to get the area of each enumeration area. The area is computed from the base map. Usually, area is calculated by the grid square method. The base map that consists of enumeration areas is divided into equal grid squares by 1 by 1 centimetre and then the number of grids counted. Incomplete grids are rounded/approximated to a single complete grid. The area is computed multiplying the number of grids by the square of the map scale. For example, if the number of grids is 100 and the map scale is 1/5000, the area of the map is computed as

$$= 100 \times (5,000)^2$$
$$= 100 \times 25,000,000$$
$$= 2,500,000,000 \text{ sq. cm}$$

Since the area is usually expressed in sq. meter or hectare and if the area is expressed in sq. meter, the above result is divided by 10,000, giving 250,000 sq. meter. The algorithm is the same for all distribution maps.

4.3.3 Exploding Data Flow Diagram

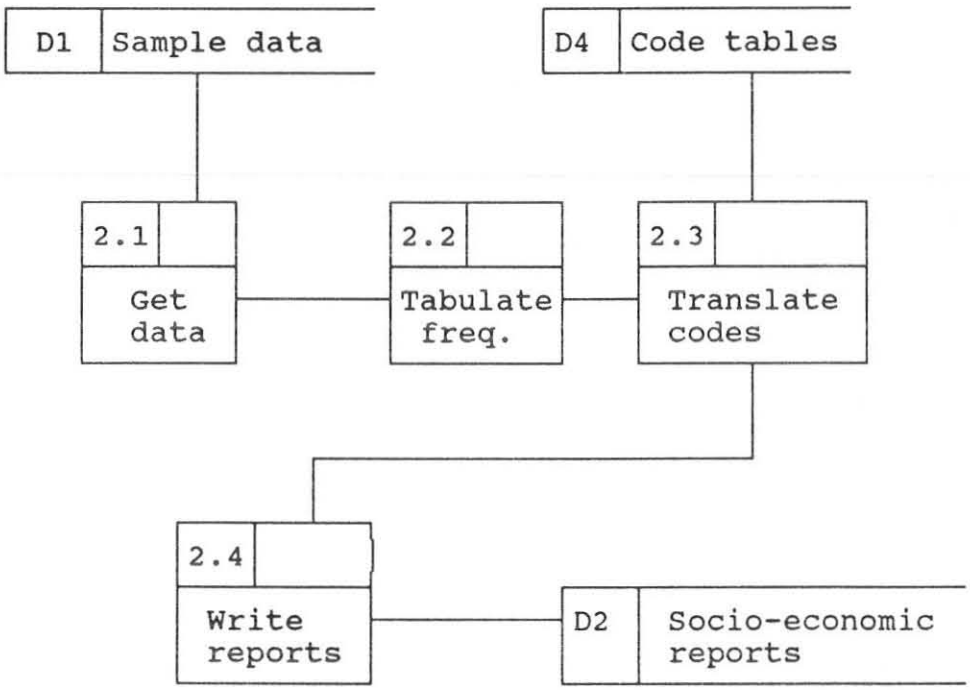
Up to this point, data elements and algorithms are considered independently, but in the actual case they are not. The flow of data and the operation of algorithms on the data is done in a certain sequence. This will become clear by exploding some of the process.

Starting from **Process 2** (process sample data) the system functions are exploded to its lower level functions. This process is the driving process for all activities of the system in that the data produced by this process is used as input for all processes in the system. Fig. 8 shows the detailed functions of sample data processing.
Therefore, sample data processing involves the following steps:

1. Get data
2. Tabulate frequencies
3. Translate codes
4. Write reports

The data flow diagram for detailed functions of process 2 is indicated in Fig. 8. The data for statistical data processing is obtained from questionnaires and the output reports are maintained in the socio-economic data store.

Fig. 8 Data flow diagram of sample data processing



Note: The direction of data flow is from top to down and left to right

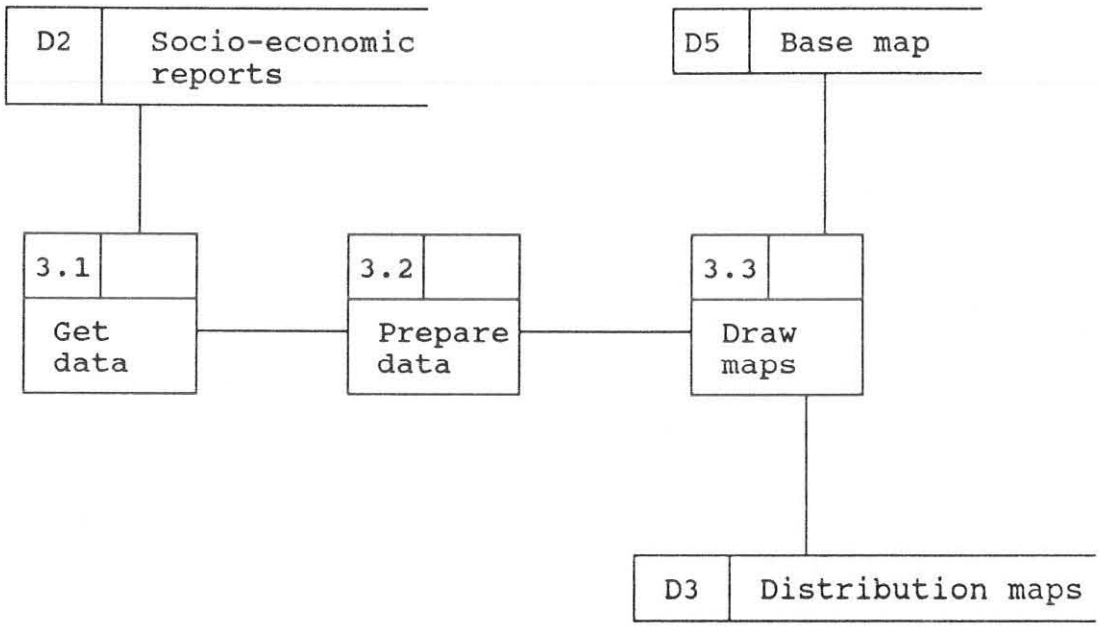
Similarly, process 3, **Prepare distribution maps**, involves the following subfunctions (See Fig. 9):

i) Get data

ii) Prepare data

iii) Draw map

Fig. 9 Data flow diagram of prepare distribution map



Note: The direction of data flow is from top to down and left to right

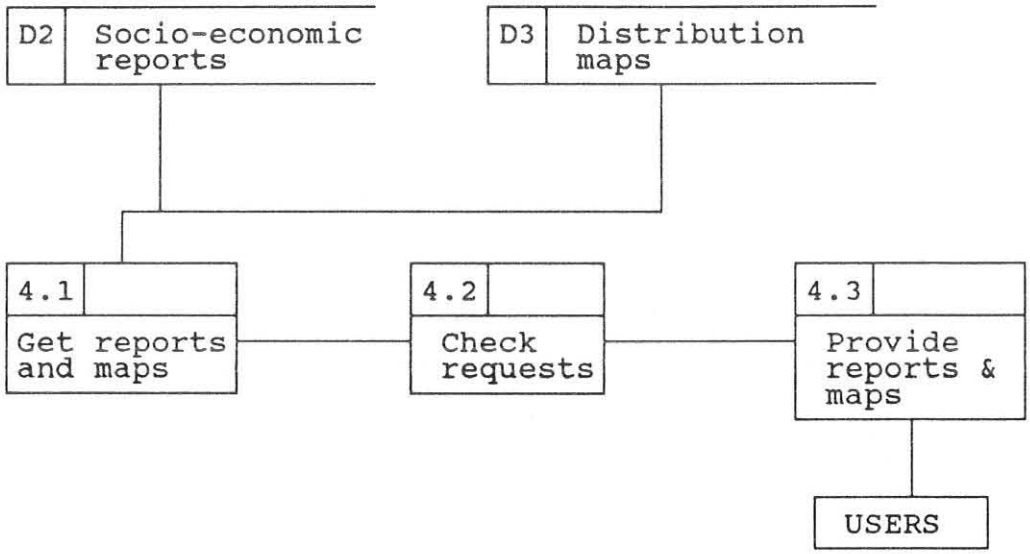
Likewise, Process 4, **Distribute reports and maps**, involves first getting reports and maps and then checking requests to provide reports and maps to the users. In general terms, the steps in distribute reports and maps are (See Fig. 10)

i) Get reports and maps

ii) Check requests

iii) Provide reports and maps

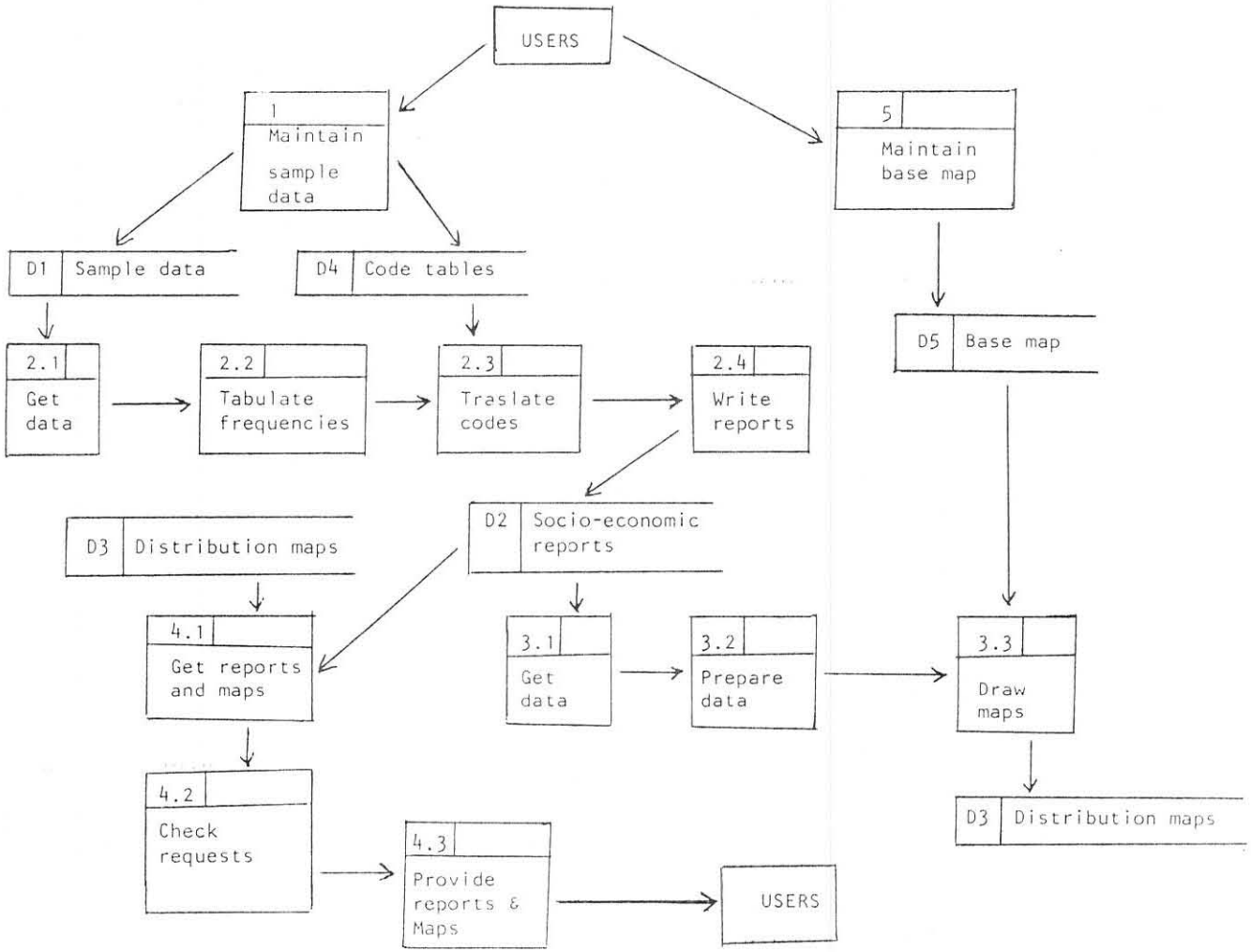
Fig. 10 Dataflow diagram of distribute reports and maps process



Note: The direction of data flow is from top to do
and left to right

Fig 11 shows the exploded data flow diagram of the system.

FIG.11 EXPLODED SYSTEM DATA FLOW DIAGRAM



4.4 DATA DICTIONARY

A data dictionary is a collection of data about data. It is used to define more meaningfully the system's data. The question 'What do you mean by population', may have different meanings among different users. Some users may understand it to mean people, but others particularly statisticians may assume it as a collection of things - people, houses, animals, etc. The data dictionary is a means to avoid such inconsistencies in interpretation. It is also used to control data redundancy. It tells us what is available in the system and what is not thereby it protects duplicate data from creeping back into the system. In a general sense, the data dictionary provides '... information on the definition, structure, and use of each data element an organization uses' (Davis, 1983).

There are many commercially available software packages to create data dictionary. Some may be available with a particular database management system (DBMS) software and others may be general purpose to suit to a variety of DBMS. Since the creation of data dictionary is a laborious task, these software packages provide support during data entry.

A complete data dictionary maintains information about each data element (Davis, 1983):

General

Name
Aliases or synonyms
Description

Format

Data type
Length

Usage Characteristics

Range of values
Frequency of use
Input/output/local
Conditional values

Control information

Source
Date of origin
Users
Programs in which used
Change authorizations
Access authorizations

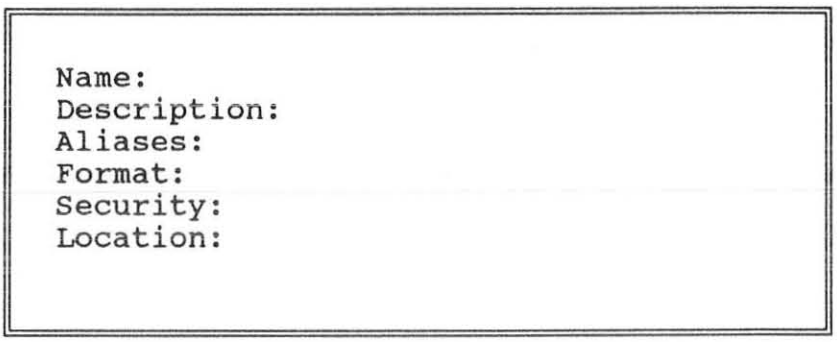
Group information

Parent structure
Subsidiary structure
Repetitive structure
Physical location
    Record
    File
    Database

For the documentation of data elements for the system just designed, a simulated data dictionary is used (See Fig. 12). The information recorded for each data element is name, description, aliases, format, security and

location. The description is used to maintain information about the meaning of the data element in the system. Some data may have more than one name and all the synonym words are recorded in the aliases. The format, on the other hand, indicates the data type whether it is numeric

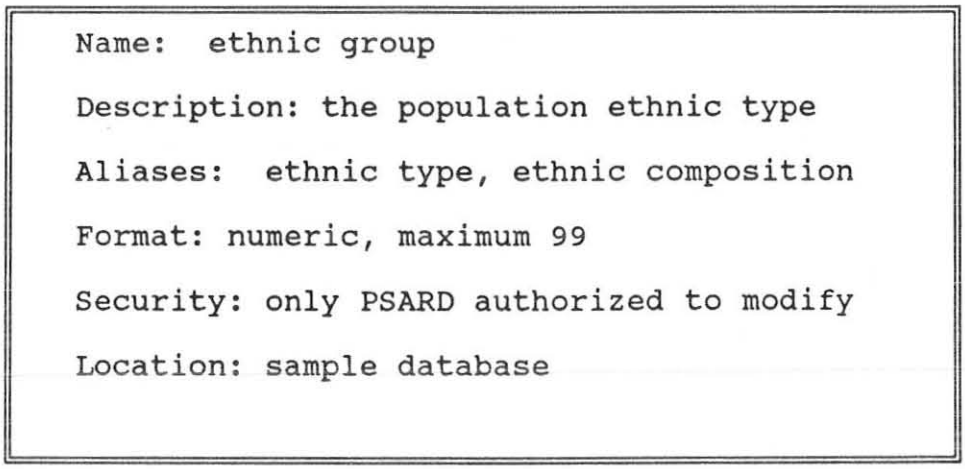
Fig. 12 A simulated data dictionary



or alphabetic. It also records its maximum length. We used '9' for numeric and 'X' for alphanumeric data type. Who is authorized to modify the data is indicated in the **security** elements to protect data from being damaged from intentional and unintentional actions. The information maintained by **location** tells the user where the data is available such as a file or database in the system so that duplicate data are not maintained.

The data dictionary for all data elements is not given

Fig. 13 A data dictionary for ethnic group data element



here. As an example, ethnic group data element has been selected to demonstrate how the information is recorded in the dictionary (See Fig. 13).

CHAPTER FIVE

GENERAL SYSTEM DESIGN

5.1 GENERAL ALTERNATIVE CONSIDERATIONS

The functions the system should perform were described during logical system design. The system's functions were also documented with data flow diagram, data dictionary and a set of algorithm descriptions. A physical system design can thus be initiated to find means and methods for implementing the functions. At this stage physical components of the system - design of outputs, inputs and files (databases), and selection of software may be described at a general level.

The system design is carried out by delineating possible automation boundaries. Each process is examined one by one and the process that can form a single automation boundary will be identified. The functions delineated for a single automation boundary are considered to be performed by a single program.

Consider **maintain sample data** and **sample data processing**. Can they be grouped in a single automation boundary for automation or improved manual procedure? This is

impossible. Because **maintain sample data** involves manual intervention such as coding and data verification while sample data processing is not done manually.

What about **base map maintenance**? It cannot be treated in the **distribution map preparation** automation boundary. The preparation of distribution map is not carried out immediately it gets the base map. It also requires other input data from sample data processing. Thus, unless the system gets both input data together, it cannot perform its function. Moreover, **distribution map preparation** can be automated but **maintain base map** cannot be.

Distribution of reports and maps must be done manually. To automate distribution of reports and maps, each department must have at least one terminal. This is not economically viable at present and also each department must employ one person to work on the computer.

From the analysis of alternative solutions, the following functions are selected for automation:

1) Sample data processing, and
2) Distribution maps preparation

5.2 SYSTEM FLOWCHARTING

The system flowchart is presented in Fig. 14 (See Annex XVIII for the system flowchart symbols). The required **input data** to the system are organized manually and entered through key-to-disk device and stored on **magnetic disk**. For data entry, two terminals are used: one for entering sample data and the other for cartographic data. The **sample data** files are created using a **database management system (DBMS)** and the **base map** file by a **graphics program**.

Sample data processing is done using a statistical program. This program accesses the data through the DBMS. It creates **socio-economic data file** for other processing and generates **reports** to be distributed to the users (See Fig. 14).

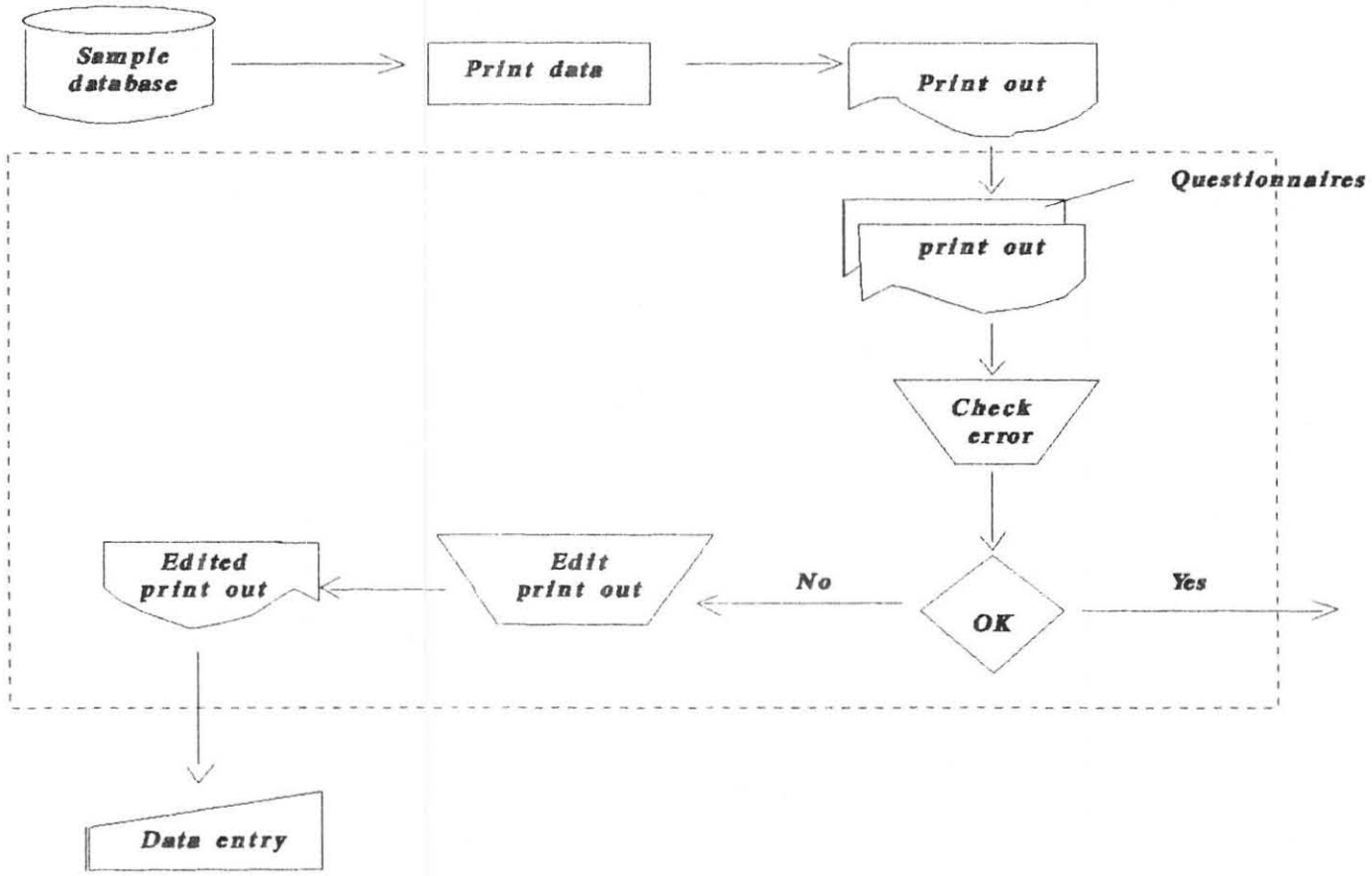
The preparation of distribution maps is done by the **graphics program**. The program accesses both socio-economic data file and base map file to produce distribution maps that will be distributed to the users (See Fig. 14).

5.3 MANUAL PROCEDURE

In the design of manual procedure, only data verification process is considered. In data entry through key-to-device system, the DBMS controls some of the errors. For instance, if the field length is specified as two digits and the data entry clerk enters three digits data, the system automatically rejects incorrect data entry. However, there are some errors the system cannot detect. For instance, the sampled person sex data is collected as **1** or **2**. If the data entry clerk wrongly enters **A** or **3**, the database management system detects the error. But if the data is entered as **2** instead of **1**, the program cannot detect the error. Such errors are expected to be frequent and the system should be protected against from such errors. Therefore, data entered through key-to-disk device system should be also verified manually.

As indicated in Fig. 15, the data is printed from the files and then the print out and the questionnaires are cross-referenced for data correctness. If an error is detected in the print out, it is edited and then submitted for data entry to update the existing files.

FIG. 15 MANUAL PROCEDURE FOR DATA VERIFICATION



5.4 RECOMMENDED SOLUTIONS

Presently, sample data processing is partly automated and partly not automated. A **Cross Program** is used to tabulate frequencies while the code translation is done manually. However, both functions can be done by computer and the cross program is thus rejected for the new system implementation. Is it possible to develop an in-house program that performs all functions of sample data processing? It is possible but this alternative is not feasible, and also because there are many specialized statistical packages such as Statistical Application System (SAS) and Statistical Package for Social Scientists (SPSS), available on the market and provide fast and efficient data processing facilities.

From the analyst's experience and the system functions, the mainframe SAS package is recommended. It performs all functions described in the sample data processing, that is, tabulation of frequencies and formatting of output reports. This package is also interactive with the DBMS.

To explain some of the functions SAS performs, let us consider the data items (variables) of sex and marital status. After the data is retrieved from the database using DBMS, SAS organizes the data into SAS dataset as

shown below:

```
data class;
     input sex marital_status
cards;
     1 1 2
     2 2 1
     3 1 2
     4 1 1
     5 2 3
     6 2 4
     7 1 1
     8 2 2
     9 2 1
    10 1 4
    11 1 3
    12 1 1
;
```

The SAS frequency (**FREQ**) procedure produces one-way to n-way cross-tabulated frequency tables. The statement

```
proc freq;
     tables sex;
     title 'Population Sex Composition'
run;
```

produces one-way frequency table indicated in table 11.

Table. 11 A Sample output report of one-way frequency table

Population Sex Composition

sex	Frequency Percent
1	7 58.33
2	5 41.66
Total	12 100.00

A two-way cross tabulation table for two variables, is the common output report requested by users. For example, the statement

```
proc freq;
    tables marital_status*sex;
     title 'Population by Sex and Marital Status';
run;
```

produces a table with marital_status values on the left side and sex values across the top position of the table indicated in table 12. In the FREQ procedure different data items (variables) are separated by asterisk (*).

Table 12 A sample output report of two-way frequency table

Population by Sex and Marital Status

marital_status sex

Frequency Percent Row pct Col pct	1	2	Total
1	3 25.00 60.00 42.86	2 16.67 40.00 40.00	5 41.67
2	2 16.67 66.67 28.57	1 8.33 33.33 20.00	3 25.00
3	1 8.33 50.00 14.29	1 8.33 50.00 20.00	2 16.67
4	1 8.33 50.00 14.29	1 8.33 50.00 20.00	2 16.67
Total	7 58.33	5 41.67	12 100.00

The **FREQ** procedure also provides the facility to format output reports rather than the preformatted report. For instance,

NOCOL suppress printing of the column percentages in cells of a cross tabulation

NOFREQ suppress printing of the cell frequencies for a cross tabulation. This also suppress frequencies for row totals.

NOPERCENT suppress printing of cell percentages for a cross tabulation

Oroder=Freq produces output with frequency values listed in their descending order.

In the sample database, the data values of sex, for instance, are stored by codes (**1** is used for **male** and **2** for **female**). The output report with **1** and **2** does not provide adequate information to users. The SAS **label** procedure allows incorporation of the description of codes in the output reports. The following statement

```
Proc freq;
     tables sex;
     title 'Population Sex Composition'
     label 1 = 'Male';
           2 = 'Female'
run;
```

produces an output report indicated in table 13.

Table. 13 A Sample output report of label procedure

Population Sex Composition

sex

Frequency Percent		label
1	7 58.33	Male
2	5 41.66	Female
Total	12 100.00	

In addition SAS can also produce graphical output reports such as bar charts, pie charts and plots.

Generally, SAS provides a variety of facilities which include

- information storage and retrieval
- data modification and programming
- report writing
- descriptive statistics
- file handling

The programming tools of the SAS system has powerful programming tools such as DO/END and IF-THEN/ELSE

statements to develop in-house programs and incorporate in the SAS system as one total system.

Furthermore, the SAS Institute also provides technical support, training, news magazine and sample library services to its customers. These supports are promising for continual operation of the system.

To avoid data redundancy inherent in traditional file systems. SQL (Structured Query Language) database management system (DBMS) is recommended from observation of Agricultural and Industrial Development Bank Computer Centre and machine compatibility.

SQL was developed in 1970 by IBM as a common language and has been adopted as an ANSI (American National Standard Institute) standard. The command set of SQL is representative of other widely used relational database management systems, including those that run microcomputers (Senn, 1987).

The command expressions of SQL are made up of three clauses: **Select**, **From**, **Where**. The query is expressed as

select $Attribute_1$, $Attribute_2$, ..., $Attribute_n$
from $Relation_1$, $Relation_2$, ..., $Relation_m$
where predicate

As an example, consider

Relation$_1$ (name#, sex, age)

Relation$_2$ (name#, education, job)

To select only one attribute from the relation, the query in SQL is posed as

select sex **from** Relation$_1$

retrieves all data about sex.

To retrieve data only females' age from Relation$_1$, the query is posed as

select age **from** Relation$_1$
where sex = females

To join to relations, the query is posed as

select sex **from** Relation$_1$, education **from** Relation$_2$

For automation of distribution map preparation, there are also commercially available packages such as Urban Database Management System (UDMS), Thematic Map (THMAP) and SAS/Graph. According to the recommendation of Abebaw Tadesse (NUPI's Computer Centre Consultant), it is

not necessary to recommend additional graphic software. The exiting **thmap** software can perform the functions described for distribution map preparation process.

5.5 OUTPUT DESIGN

In the output design, the output's content, form, media and layout are defined. The content refers to data fields that must appear in each output to convey complete information to users. It has a strong relation to the satisfaction of users information requirement; a poorly designed content is likely to cause dissatisfaction in users and hence to poor perception of the system's capability. The content of the outputs was already described in Chapter Four.

Form refers to the output presentation. The form of the output may be statistical, graphical or textual or a combination of these. The outputs required from the system are usually both statistical and graphical. Graphical outputs are often distributed to PPRD as well as to MPPD. Media, on the other hand, refers to the materials used to deliver the outputs to users. The output media are often paper, video display, and microfilm. Depending on the use, volume and frequency of the output, the appropriate media are selected. The

outputs distributed are used to prepare research papers and hence printed outputs are recommended. Lastly, the layout refers how data fields are positioned and sequenced to increase readability. For instance, title is usually located at the top and printed in bold.

For the output layout, the recommended package produces preformatted reports and it is better to utilize already developed standards.

5.6 INPUT DESIGN

The task of input design is to identify the data fields required to produce the outputs mentioned earlier. It involves describing each field's name, size and type, in addition to a source of the input.

To design the inputs, the necessary data fields are easily determined from the Institute's standard questionnaire. Examples are given below for the sample database inputs:

1. Population

Source: questionnaire survey
Media: questionnaires

Fields	size	type (9 = numeric X=alphanumeric)
Household head code	6	9
Family code	7	9
Wereda/kefitegna	2	9
Kebele	3	9
Enumeration area	3	9
Relation to H of HH	2	9
Sex	1	9
Age	2	9
Marital status	2	9
Ethnic group	2	9
Region (birth place)	2	9
Wereda	3	9
Town	3	9
Length of residence	2	9
Reason for coming	2	9
Educational status	2	9
Age at first marriage	2	9
Children ever born		
- living with	2	9
- living out	2	9
- deceased	2	9
Births last 12 months		
- male alive	1	9
- female alive	1	9
- male dead	1	9
- female dead	1	9
Engagement last 12 months	1	9
Reason for unemployment	2	9
Status (type)	1	9
Type of job	2	9
Occupational status	2	9
Sector	2	9
Economic activity	2	9
Gross income	4	9
Work place	2	9
Means of transport used	2	9
Food and Energy (birr)	4	9
Shelter "	4	9
Beverage "	4	9
Clothing & Footwear "	4	9
Occasional (birr)	4	9
Tax and contribution "	4	9
Saving (traditional) "	4	9
Saving (modern) "	4	9
Others "	4	9

2 Out-migrants

Source: questionnaire survey
Media: questionnaires

Fields	size	type (9 = numeric X=alphanumeric)
Household head code	6	9
Migrant's code	4	9
Wereda	2	9
Kebele	3	9
Enumeration area	3	9
Relation to head of HH	2	9
Sex	1	9
Age	2	9
Reason for moving	2	9
Educational status	2	9
Marital status	2	9
Region (destination)	2	9
Wereda	3	9
Town	3	9

3. Mortality

Source: questionnaire survey
Media: questionnaires

Fields	size	type (9 = numeric X=alphanumeric)
Household head code	6	9
Deceased code	3	9
Wereda/Kefitegna	2	9
Kebele	3	9
Enumeration area	3	9
Relation to head of HH	2	9
Sex	1	9
Age	2	9

4. Housing Input

Source: questionnaire survey
Media: questionnaires

Fields	size	type (9 = numeric X = alphanumer
Household head code	6	9
House code	6	9
Wereda	2	9
Kebele	3	9
Enumeration area	3	9
Age	1	9
Builder	1	9
Tenure	1	9
Rent	3	9
Tax (land)	5	9
Tax (house)	3	9
Purpose	1	9
Status/Legality	1	9
Typology	2	9
Type of Kitchen	2	9
Rooms (main house)	2	9
Rooms (service house)	2	9
Foundation	2	9
Walling material	2	9
Ceiling material	2	9
Roofing material	1	9
Foundation (phys. cond.)	1	9
Floor (phys. Cond.)	1	9
Walling (phys. cond.)	1	9
Ceiling (phys. cond.)	1	9
Roofing (phys. cond.)	1	9
Plastering (phys. cond.)	1	9
Water supply	2	9
Bathing facility	1	9
Toilet facility	1	9
Light	1	9
Telephone	1	9
Fuel/Energy	2	9
Garbage collection	1	9
Owners acquisition	1	9
Building time	2	9
Reason for delay	2	9
Owners intension to sell	1	9
Owners reason to sell	1	9
Renters intension to buy	1	9
Reason not to buy	1	9
Renters intension to build	1	9
Reason not to build	2	9
Renters looking for another house	1	9
Duration of waiting time	2	9

A sample code description input is designed as below for out-migration input data:

Fields	size	type (9 = numeric X = alphanumeric)
Relation to head of HH	15	X
Sex	6	X
Reason for moving	30	X
Educational status	20	9
Marital status	15	X
Region (destination)	15	X
Wereda "	20	X
Town "	18	X

5.7 DATABASE ORGANIZATION

5.7.1 A Database

Data consists of conventional symbols that represent real world objects. If one is interested to know the sex composition of the population in a town, data about each person's sex is collected. This is a single data or fact about the town's population.

Putting together all the data of a single real world object is important for various purposes. For example, using the data for sex composition and age structure, one can calculate the fertility rate of the population. The collection of all relevant data about a single person

constitutes a **record** and one data type (e.g. sex) in the record constitutes a **field** or a **data item**. When two or more related records are put together, usually in the form of a table, is thought as a **file**.

The collection of related files constitutes a database. It is created with multipurpose so as to satisfy the wide ranging information/data needs. The concept of database approach has become operational in the late 1960s with the development of database management systems (DBMS) and database administration functions. The database together with DBMS and application programmes is a database system.

A data base management system is a software which assists the creation, definition, and manipulation of databases. It also has data retrieval capacity. An important feature of DBMS is its ability to present the same data in different forms so that it avoids the need to store the same data in different files. For instance, the data stored in the traditional file system consists age and sex composition of the population in one file. And the other file consists of the sex and employment composition of the same population. But in the database approach, the sex composition of the population is not handled twice; in the second file only the employment composition is

maintained. Whenever the data is required, the DBMS retrieves the required data from the two files. A data administration function carried out by a data administrator is to maintain the quality of data in the required standard, and to ensure data security.

5.7.2 Objective of the Database Approach

Storing corporate data in the database system has been advancing rapidly, chiefly for the following reasons: avoiding unnecessary redundancy; shareability; data independence; data integrity; and data security.

Avoiding unnecessary redundancy - in the traditional file systems, the same data used by different programs must be available in all files. This duplicate data unnecessarily consumes storage space. This also leads to an avoidable data inconsistency. When the data in one file is updated, in the other file may not be updated at the same time. As a result, different values of the same data appear in the organization. In the database approach, on the other hand, the data is stored just once so that there will not be problem of data inconsistency due to different update cycles.

Data independence - in the database approach, application programs access the data through the data base management systems. This allows both data and programs to be designed without the influence of one the other. In doing so, any change either in the content of the data or program can be carried out without affecting each other. Thus, data are independent from programs in the database approach.

Data integrity - after the data are stored in the database, any data creation, access and updating is done by DBMS. Besides, addition of new records is made to conform with the existing system. For instance, if a person's code is designed with six digits, the new record must conform to it.

Data shareability - the data available for one program in the database are also accessible for other programs or queries. In general terms, there is no monopoly of data by one department or programs in the database system.

Data security - the database is centrally managed by a database administrator. Any modification of data in the database is not made by unauthorized persons. As a result, the database approach saves data from being destroyed by intentional or unintentional actions.

5.7.3 Data Models

One of the important steps in the design of database is construction of data models that represent the logical structure of the database to be created. The data model is similar to the architect's 'blue print'. The blue print is nothing but it represents the structure of the building to be constructed. It shows the number of rooms, doors, windows, etc. Thus, "A data model is an abstraction device that allows us to see the forest (information content of the data) as opposed to the trees (individual values of data)" (Tsichritzis and Lochovsky, 1982). It shows entities, attributes, relations between entities and access paths between entity types.

One of the main ways to see the structure of data is through abstraction. There are two common ways of abstraction, that are, generalization and aggregation. Generalization is a technique of data abstraction by taking common attributes and leaving their differences. For instance, people are grouped into different ethnic groups, but the people in one ethnic group may differ in their religion, i.e some may be **christian** and the others **moslem**. On the contrary, "Aggregation is abstraction by which an object is constructed from its constituent objects" (Tsichritzis and Lochovsky, 1982). For example,

from the objects cow, ox and calf, one may aggregate a new concept called **cattle**.

There are different types of data models. The three data models, hierarchical, network and relational, are used widely and most of the data base management systems available commercially are designed basing these models. For the database to be designed, a relational data model is selected for its advantages over the other models. In order to appreciate its overwhelming advantages, first general concepts that underlay the hierarchical and the network models are discussed and then the relational data model is considered in detail. Before the discussion of data models, it is appropriate to clarify three important terms that would frequently appear in the following discussion:

i) Entity;
ii) Attribute, and
iii) Relationship.

5.7.3.1 Entities

Data modelling requires identification of entities. The object about which organizations collect data is called **entity**. An entity is an existent which can be seen,

touched or sensed and is distinguishable. "An entity is any person, place, thing, or event: in grammatical terms an entity is a noun" (Brackett, 1987). Each person is an entity, for instance. So is each house, each town, and each mortality. In this example, mortality is not a physical object but we only understand its existence.

A group of similar entities form an entity set. For example, all persons form an entity set. Similarly, all towns, all marital status, all houses and so forth are entity sets.

A database design requires identification of all organizations entities. Since it enables us to incorporate all desirable data in the database. Besides, it is easier to identify relationships between entities rather than between data. Therefore, in the database approach data is considered as an entity in its own right.

5.7.3.2 Attributes

Entities are represented by their attributes. "Attributes are characteristics that describe or characterize an entity: in grammatical terms an attribute is an adjective" (Brackett, 1987). For instance, NUPI is

interested about the entity set population demographic characteristics. And the attributes collected to qualify this entity (demographic characteristics) each and every person's name, sex, age, ethnicity, religion, birth place.

Attributes have specific domains from which they take values. "Values are the specific data in an attribute describing an entity" (Brackett, 1987). The domain for attribute sex is **male** and **female**. Any entity in the entity set person has value either male or female for the attribute sex. A value outside this domain is not acceptable for this attribute. Usually domains are a set of numbers (e.g. the domain for age) or string of characters (e.g. the domain for sex) or a combination of both.

The entity type and entity set need to be distinguished at this level. An entity type refers to the aggregation of entity set. For instance, from the attributes of person - name, sex, age, ethnicity, religion and birth place, one may aggregate a new concept called **population**. Thus, the entity type is the name and list of all attributes in the entity set. The entity type for the entity set **persons** may be

Population (name, sex, age, ethnicity, religion, birth place)

An entity set refers to " ... all actual values currently associated with each attribute of the entity type" (Tsichritzis and Lochovsky, 1982).

5.7.3.3 Relationships

When the data model is designed, relations must be identified between entity types. "A relationship can be defined as a logical connection or dependency between occurrences of one entity type and occurrences of another (Downes, 1989).

There are three common types of relations between entity types:

- one-to-one
- one-to-many or many-to-one; and
- many-to-many relationships

The simplest form of relationship is a one-to-one or a **flat file** relation where the occurrence of one entity in the entity type is accompanied by the occurrence of one entity in the other. The relationship between entity type **person** and **birth place** exemplifies this relation.

In one-to-many relationship, the occurrence of one entity in the entity type causes the occurrence of zero, one or many entities in the other. For instance, the relationship between **birth place** and **persons** could be one-to-many in that many people may be born in one place.

The occurrence of one entity may cause the occurrence of zero, one or many entities in the other and at the same time the occurrence a single entity in the other also brings the same result in the former entity type. This relationship takes the form of many-to-many relationship. The relationship between residence and persons could be many-to-many relationship, for instance. One person may live in different places and at the same time many people live in one place.

5.7.3.4 Hierarchical Data Model

A hierarchical model establishes relationship between entity sets in a father-son/superior-subordinate relation. Although the son has always one father, the father may have one or more sons. Similarly in the hierarchical model the superior (father) entity is capable of having many subordinate entities but the subordinate entity has always only one superior entity. However, the subordinate entity is capable of branching

into one or more sub-subordinates of its own and so on. An organization chart is a typical example of a hierarchical model.

Structurally, "... the hierarchical model is shown as an upside down tree with the highest level of the tree known somewhat paradoxically as the root" (Senn, 1987). The tree has always one trunk and many branches emerge from it. Each branch is also capable of having other subbranches. The connection at which branches emerge is called a node. In the hierarchical database, nodes represent entity sets. In general terms, hierarchical model maintains one-to-one or one-to-many relationship.

As an example consider an agricultural database which consists of entity types land use with attributes Wereda, type and area(ha); crop production with attributes crop type, area(ha) and production(qt); livestock with attributes animals and number; livestock products with attributes products, amount and unit price; and population with attributes Wereda, house hold head and family.

Entity type in the Agriculture database:

1. Entity type - Land use

Wereda	type	Area
Shashemene Zuria	Cultivated land	53148
Shashemene	Grazing land	8077
Awassa	Forest land	1754
Ziway	Cultivated land	47348

2. Entity type - crop Production

Crop type	Area (ha)	Production
Maize	17293	273458
Teff	15384	123795
Barley	2731	58278
Maize	27909	263044
Wheat	11074	138278
Sorghum	2584	36957
Teff	7745	50898

3. Entity type - live stock

Animals	Number
Ox	17726
Cow	135793
Sheep	21001
Goat	21124
Cow	95742

4. Entity type - Livestock product

Products	Amount	Unit price (birr)
Milk	930 (lt)	0.44
Honey	492 (kg)	8
Egg	133	0.13
Milk	1538 (lt)	0.50

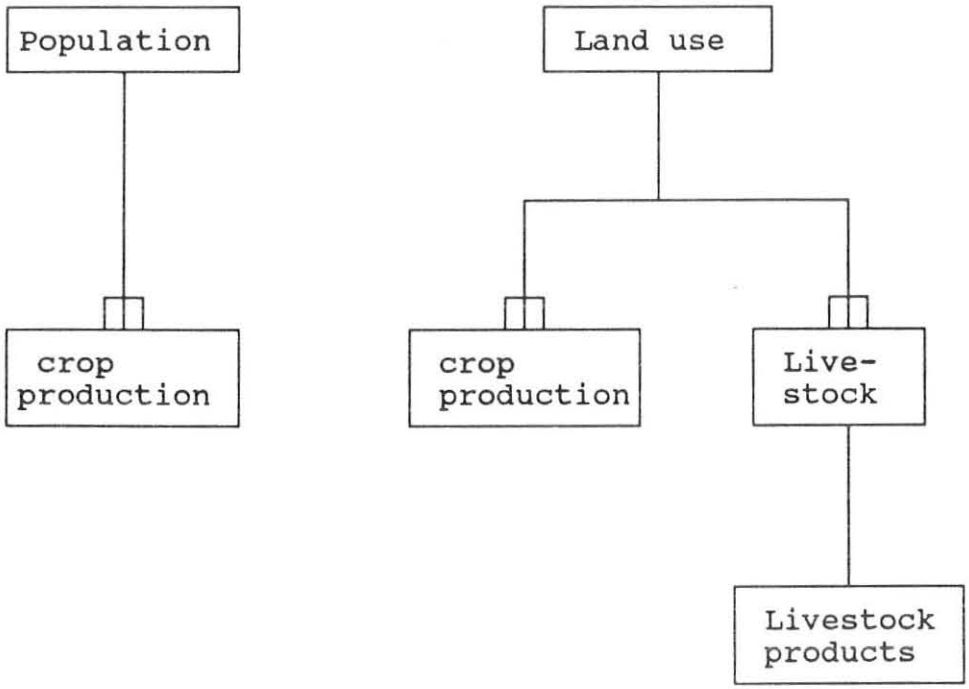
5. The entity type - population

Wereda	House hold size	Family
Shashemene	35,200	173,000
Arsi-Negele	24,000	120,200
Awassa	32,760	165,550
Ziway	29 5000	147,800

In the above entity types, the occurrence of one entity in the land use causes the occurrence of many entities in the subordinate entity type (e.g crop production). The occurrence of cultivated land in the land use entity type may cause the occurrence of the entities maize, sorghum, teff, etc. in the entity type crop production, that is, many types of crops can grow in one Wereda. The hierarchical model for the above entity types is indicated in Fig. 16.

In the agricultural data model, there is population and crop production relation. This relation is necessary to determine which weredas are deficient and which have surplus. If the entity type population is stored under land use, access to population data may not be fasted, as users do not seek population data through land use. A similar situation arises if the database is designed by making population as a superior entity. To avoid this problem, the solution is to maintain the population relation as a separate relation as depicted in Fig. 16.

Fig. 16 A Hierarchical model for agriculture



Note: The arched link shows a one-to-many relationship.

In the hierarchical database links between entity types are established when the data model is designed and the database is created. These links provide fast retrieval response to users' query for data.

There are three grave difficulties into a database of the hierarchical model:

Insertion - to add a new subordinate entity, its superior entity type must be known, otherwise it will not be

maintained in the database. For example, if one wants to add data in the entity type crop production, one must know to which wereda the crop data relates to.

Deletion - if the parent entry is deleted from the database, the hierarchical database requires the deletion of all its subordinate entity types. For example, if the land use entity type is deleted from the agricultural database, crop production and livestock production entity types data must also be deleted. But in reality this may not be desired.

Updating - hierarchical data maintains redundant data. During updating, the data being updated may not be modified in all of its locations. For instance, if one is updating the crop production data in the agricultural database and if the person is aware of only the data available under the entity type land use, the crop production data under population entity type may not be updated, hence the database will contain inconsistent data for the same object (See Fig. 16)

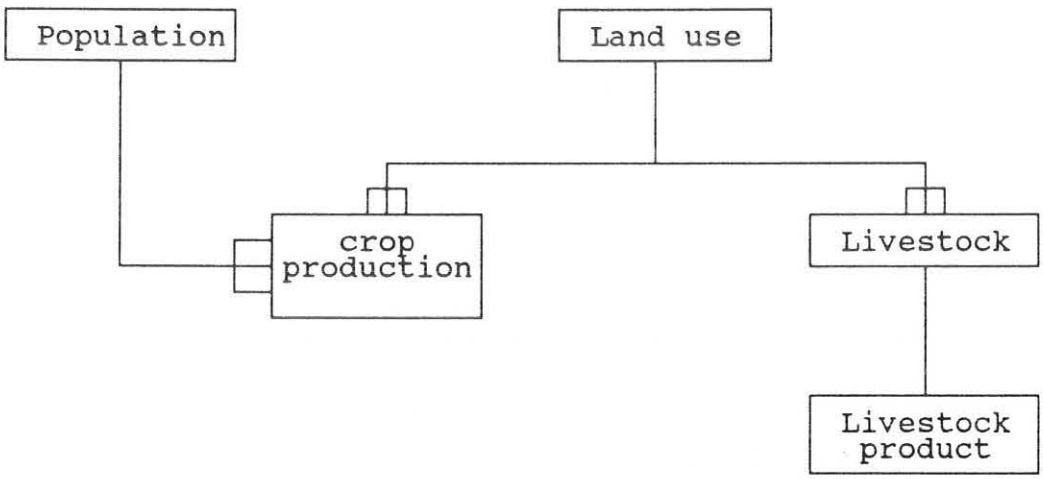
5.7.3.5 Network Data Model

A network model is similar to a hierarchical model except that an entity is not stuck to a maximum of one superior.

Thus the network model can represent many-to-many relationship.

Consider the agricultural database in Fig. 17. In the network model, there is no restriction either to make the entity type population as a subordinate entity type or to create a separate relation; simply a link is established between the entity type population and crop production so that the crop production data is just maintained only once.

Fig. 17 A net work model for Agriculture database



Note: The arched link shows a one-to-many relationship.

The most widely used network model is the one designed by the Database Task Group (DBTG) of the Conference on Data Systems Languages (CODASYL), "... an independent organization of vendors, researchers and governmental

agencies that have worked to establish guidelines and recommendations for computer software" (Senn, 1986). Although many-to-many relationship is handled in the network model, it must be split into one-to-many relationship according to DBTG proposal. A one-to-many mapping from one entity type to another is considered by DBTG as a **set**. The DBTG set which consists of owner-member relationship is analogous to the father-son relation of the hierarchical data model. To retrieve data from the network database, both the owner and member entity types must be specified.

Like the hierarchical database, in the network model also the relations between entity sets must be established when the data model is designed and the database created. These links/relations also provide fast retrieval response in the network database.

The network database has also some anomalies discussed in the hierarchical database. For instance, if the owner entity set is deleted from the database, the rule says remove the member entity sets, though one may not to do so. Similarly, during insertion, owner entity set must be known, to add new data in the database.

5.7.3.6 Relational Data Model

The relational model is relatively new as compared to hierarchical model and network model. It was developed by the mathematician Edgar F. Codd of IBM in 1970 when he published a paper entitled "A Relational Model of Data for Large Shared Data Banks" (Gillenson, 1984).

The relational data model is designed based on mathematical set theory. The model represents entities in the form of tables. The table is named as a 'relation' in mathematics, from which the relational model obtains its name. Generally, "The relational database consists of three parts. The structural part defines relations of data and their interrelations. The integrity part assures that each occurrence of a relation is unique. The manipulative part provides operators for processing relations" (Brackett, 1987).

5.7.3.6.1 Relational Database Structure

Structurally, the relation consists of columns and rows. The column part of the relation refers to the entity attributes. Each of this attribute has values selected from its permissible domain. The value of attributes may form a number of rows in the table. A single row,

commonly known as a tuple (or n-tuple) in the relational database, represents a distinct entity (See Table 14)

Table 14. Population relation

Name#	RHHH	Sex	Age	Ethnicity	Religio
Abdulahi Ahmed	head	male	43	somalie	moslem
Nurya Ebrahim	wife	female	32	somalie	moslem
Halim Abdulahi	daug.	female	15	oromo	moslem
Mulunesh Degu	head	female	68	amhara	orth.
Yosef Mengestu	son	male	51	amhara	orth.
Tizta Mengistu	daug.	female	24	amhara	orth.

A relation is nothing but a collection of similar tuples. It is "... a subset of the cartesian product of the underlying domains" (Wiederhold, 1983). Consider the population relation and assume the domain of these attributes are D1, D2, D3, D4, D5, D6, respectively. Each row in the table is a 6-tuple (d1,d2,d3,d4,d5,d6), where d1 is the value for name selected from the domain D1, d2 is the value for residential status selected form D2, and so on. Therefore, a relation (REL) for population is expressed as

$$REL(d1,d2,d3,d4,d5,d6) \subseteq D1 \times D2 \times D3 \times D4 \times D5 \times D6$$

In general, a table of **n** columns will have a relation

$$REL(d1,d2, d3,..., dn) \subseteq D1 \times D2 \times D3 \times .... \times Dn$$

A relation scheme is a list of relation name and attributes (Korth & Silberschatz, 1986). The relation scheme for population is

Relation scheme (name, RHHH, sex, age, ethnicity, religion)

Usually, the relation scheme consists of the description of attribute domains. If the relation scheme is named as **Population**, it will be described as follows:

Population-scheme (name:string, RHHH:string, sex:string, age:integer, ethnicity:string,religion:string)

The relation scheme and the entity type seem to be confusing as they appear to be the same. However, they differ at some point. If the relation scheme is created as the result of the interaction of two entity types, the relation scheme is not the same as entity type, otherwise they are identical.

Each occurrence of entity type in the relation must be uniquely identified. An attribute that has no repeated value on different tuples in the relation is considered as entity identifier. In other words, if the tuples have

the same values for all attributes of the relation, they are one entity and additional tuples are not maintained. Such attribute used to uniquely distinguish each entity in the relation is a **Primary key**. The primary key is usually positioned in the first column of the relation and must have a unique value. But it is possible to have repeated value for non-key attributes. In Table 11, the attribute **name** representing a person can be taken as a primary key for population relation in the sense that there are no two persons (in the table) with the same name. To identify the primary key in the relation, a hash mark (#) is suffixed to the attribute.

The primary key exercises the ruling role in the relation in that if the value of the key attribute is deleted, all its other values must be removed from the relation, as it may cause to exist identical tuples in the relation.

Sometimes a single attribute may not be sufficient to uniquely identify each entity in the relation. To maintain entity's uniqueness, two or three attributes are taken together to form a primary key for the relation. "If a compound key contains more than three attributes to achieve uniqueness, an arbitrary attribute should be created as a primary key" (Brackett, 1987). Because a

combination of more than three attributes is not convenient as it causes data redundancy and makes retrieval and processing inefficient. This arbitrary attribute can be a serial number or any other character.

5.7.3.6.2 Operation of the Relational Database

There are three main operations in the relational database:

1) To select;
2) To project, and
3) To join.

The select operation by mentioning the value of the primary key selects a single tuple from the relation. To select a single tuple using the DBMS package from **Dbase III**, the query is expressed as

```
Use Population file
     Select Abdulahi Ahmed
```

This operation retrieves the following data

Name#	RHHH	Sex	Age	Ethn.	Relig.
Abdulahi Ahmed	head	male	43	somalie	moslem

The **project** operation selects one or more columns from the relation, but smaller number of columns from the original relation,. The query is expressed as

```
Use Population file
     Project Ethnicity
```

This same query in SQL is posed as

```
select  ethnicity from population
```

This operation retrieves all data about ethnicity from population file.

Ethnicity
somalie
somalie
oromo
amhara
amhara
amhara

Likewise, the **join** operation selects either tuples or columns from different relations/files. Consider the following education relation

Table 15 Education relation

Name#	Qualification
Abdulahi Ahmed	B.A
Nurya Ebrahim	illiterate
Halim Abdulahi	12 grade complete
Mulunesh Degu	12 grade complete

The query for join operation using SQL is

select age **from** population, qualification **from** education

This operation retrieves the following data from the database:

Age	Qualification
43	B.A
32	illiterate
15	12 grade complete
68	12 grade complete

In conclusion, the relational database has the following overwhelming advantages over the hierarchical and network data models:

a) the relational database does not require to establish paths between entity sets. Relationships between entity types are established by replicating attributes in different relations. In the relational database, relationship is established at the time of retrieval. As a result, a new relationship can be established without the need to reorganize the database. On the contrary, in the hierarchical and network databases, new relationships require reorganization of the database. Thus, they are user unfriendly.

b) since links are not established in the relational database, the relational database requires less space for the same data stored in the hierarchical and network databases. In the later two databases, links occupy more storage space than the actual data require.

c) the relational database has its bases on mathematical set theory. Thus, the concepts of relational data model such as the **relation** are provable.

d) techniques like normalization used in the relational database are the same for the design of a small or a large database.

The main problem of relational database is slower retrieval of data/records. Since the Institute is not providing day to day services like banking, fast retrieval is not the main concern in the design of the database.

5.7.4 Steps to Design a Database

5.7.4.1 Identification of Relevant Data

The relevant data to the design of the database were identified from the Institute's standard questionnaire in the input design. In the existing file systems, the data collected by the questionnaire survey are stored in seven files, based on the questionnaire blocks. To uniquely identify each tuple in the blocks, 10 similar attributes are used in each file. These attributes are job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number and house hold number.

a) **Population scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number and house hold number, name, residential status, relation to head of house hold, sex, age (in years), ethnicity, religion, birth place, length of residence, reason for coming, educational status and marital status

b) **Fertility scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number, house hold number, name, first marriage age, duration of current marriage, children ever born, birth in the last 12 months

c) **Employment scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number, house hold number, name, engagement last 12 months, reason for not working, status(type), job, occupational status, sector, economic activity, work place, work residence distance, means of transport used, days worked in the last month, gross income earned last month

d) **Expenditure scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number, house hold number, name, food & beverage, shelter & energy, clothing & footwear, occasional, tax & contribution, savings (traditional), savings (modern), others, amount in birr

e) **Out-migrant scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number, house hold number, name, relation to head of house hold, reason for moving, educational status when leaving, destination

f) **Mortality scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number, house hold number, name, relation to head of house hold, sex, age

g) **housing unit scheme** with attributes job number, planning region, administrative region, awraja, town, kefitegna, kebele, enumeration area, house number, house hold number, name of house hold head, age, builder, tenure,tax/rent, function,

legality, typology, rooms, service quarters, type, quarters room, foundation, foundation type, flooring, walling, ceiling, roofing, physical score, water, bathing, toilet, light, telephone, fuel, garbage collection, acquisition, construction period, construction delay, reason for delay, sell, reason to sell, buy, reason not to buy, build, reason not to build, another house, waiting time, place.

5.7.4.2 Data Modelling

The second step in database design is a data modelling that meets the requirement of a specific DBMS model. In this respect, the relational data model is already selected and the data will be modelled to meet the requirements of the relational database management systems.

There are different kinds of data modelling techniques, such as normalization, entity-relation and binary relationship. In this study the technique of normalization is adopted. "Normalization theory is associated with relational theory and defines how data entities are formed to capture their inherent nature, structure, and meaning" (Brackett, 1987). The result of normalization is the relational data model.

The technique of normalization allows us to create small stable tables to avoid insertion, update and deletion problems. In unnormalized data tables, data become redundant in multiple locations. During updating, one may not be certain as to how many times particular data are maintained duplicated in the database so that after updating the database may consist of inconsistent values for the same object.

The problems can be removed at different stages of normalization. The basic steps of normalization are first normal form relation (1NF), second normal form relation (2NF), and third normal form relation (3NF). There are also fourth and fifth normal form relations but they are rarely used in practice. For the purpose of this study normalization up to third normal form relation produces the data model that is sufficient to meet the requirement of the relational model DBMS. The lower level normal forms are nests of the higher level normal form in that the higher level normal form satisfies all requirements of its lower levels.

5.7.4.2.1 First Normal Form Relation

The first normal form excludes repeating nests of attributes or groups of attributes (Wiederhold, 1983) so

that each row and column intersection consists of simple values. "Simple values cannot be decomposed into multiple values, and cannot themselves be sets or relations" (Wiederhold, 1983). The assessment of the population scheme shows that there are many repeated nested relations.

The first normal form requires to identify a primary key for the relation. The primary key attributes used in the existing file systems are not usable for the database to be designed. To identify each person in the population relation, a compound of more than three attributes are required. This primary key is not desirable from the point view of data redundancy and processing efficiency. Thus, an arbitrary attribute is used. For the database to be designed, two attributes are used as primary key - house hold head code and family code. The values of the codes are consecutive serial numbers.

The attributes job number, planning region, administrative region, awraja, town, house number and house hold number are not required for any data processing in the system and hence they are abandoned from the sample database. Moreover, the values for attributes wereda (kefitegna), kebele, enumeration area are repeated in different tuples and they violate the

rule of first normal form. Therefore, these attributes must be separated and maintained in different relation from the population relation. To integrate the two relations house hold head code is sufficient since it does not repeat itself for different tuples. After transformation of the first normal form relation, the population relation consists of the following attributes:

1) **Population scheme** with attributes house hold head code#, family code#, residential status, relation to head of house hold, sex, age (in years), ethnicity, religion, birth place, length of residence, reason for coming, educational status and marital status

2) **Address scheme** with attributes house hold head code#, kefitegna, kebele, enumeration area

To integrate the fertility relation as well as other relations in the database, the attribute house hold head code is added in each of the relation. Once the relation is maintained integrated with the other relations, it is not necessary to maintain duplicate data already available in the other relations required for particular processing. Thus, the fertility relation in the first normal form is:

3) **Fertility scheme** with attributes house hold head code#, family code#, first marriage age, duration of current marriage, children ever born, birth in the last 12 months

Similarly, employment and expenditure relations may be transformed as shown below:

4) **Employment scheme** with attributes house hold head code#, family code#, engagement last 12 months, reason for not working, status(type), job, occupational status, sector, economic activity, work place, work residence distance, means of transport used, days worked in the last month, gross income earned last month

5) **Expenditure scheme** with attributes house hold head code#, family code#, item, amount in birr

To uniquely identify the out-migration relation, an out-migrant code is added to the out-migrant relation. The house hold head code alone does not uniquely identify since there are two or more out-migrants in a single household. As done for the other relations, identification variables are removed from the relation.

6) **Out-migrant scheme** with attributes house hold head code#, out-migrant code#, relation to head of house hold, reason for moving, educational status when leaving, destination

For mortality relation, deceased code is added to maintain uniqueness in the relation. Thus, the mortality relation in the first normal form is:

7) **Mortality scheme** with attributes house hold head code#, deceased code#, relation to head of house hold, sex, age

Similarly, a code is also required to be assigned to housing relation so as to identify each house uniquely. One may think that since the number of house hold head is the same with the number of housing units and it is not necessary to give codes for house once the house hold head is uniquely identified. This is not the case always, because two or more house hold heads may live in one housing unit. This is common in developing countries like Ethiopia where housing shortage is very severe. Therefore, the housing relation in the first normal form is:

8) **housing unit scheme** with attributes house hold head code#, house code#, age, builder, tenure,tax/rent, function, legality, typology, rooms, service quarters, type, quarters room, foundation, foundation type, flooring, walling, ceiling, roofing, foundation (physical condition), floor (phys. cond.), wall (phys. cond.), ceiling (phys. cond.), roofing (phys. cond.) plastering (phys. cond.), water, bathing, toilet, light, telephone, fuel, garbage collection, acquisition, construction period, construction delay, reason for delay, intension to sell, reason to sell, intension to buy, reason not to buy, intension to build, reason not to build, look for another house, waiting time, place.

5.7.4.2.2 Second Normal Form Relation

The first normal form relation does not consider functional dependency existing between primary key and non key (dependent) attributes. "A functional dependency is a special relationship between two attributes that is central to the definition of second and third normal form relations" (Harrington, 1989).

Harrington (1989) noted that the non-key attribute 'Y' is functionally dependent on its primary key 'X' if there

exists a unique value of X for every value of Y. The functional dependency usually written as X ---> Y, implies that X is functionally determines Y or Y is functionally dependent on X. Thus, for each value of Y, there exist one unique value of X, but for each value of X the value of Y may not be necessarily unique.

Consider the out-migration relation, as primary key is formed from compound attributes of house hold head code and out-migrant code. While there is a unique value for out-migration code for each occurrence of non-key attributes, there is no uniqueness for house hold head code. Therefore, the non-key attributes are dependent only on part of the primary key. For this reason the out-migration relation reflects a partial dependency. The second normal form removes any partial dependency from the relation. Normally, partial dependency exists when there is a compound primary key.

As discussed above, in the out-migration relation the attribute house hold head code does not functionally determine non-key attributes. However, the relation shows that it does. For instance, if the house hold head code is deleted, the tuple associated with this code must be deleted from the relation. Since the tuple with null value in its primary key is not permitted in the first

normal form relation.

To avoid this problem, the attribute house hold head code can be removed from the out-migration relation. After normalization of the first normal form into the second normal form relations, the following relations are identified:

1) **Population scheme** with attributes, family code#, residential status, sex, age (in years), ethnicity, religion, birth place, educational status, marital status

2) **Address scheme** with attributes house hold head code#, kefitegna, kebele, enumeration area

3) **House hold head-family scheme** with attributes house hold head code#, family code# and relation to head of house hold

4) **Fertility scheme** with attributes, family code#, first marriage age, duration of current marriage, children ever born, birth in the last 12 months

5) **Employment scheme** with attributes, family code#,

engagement last 12 months, reason for not working, status(type), job, occupational status, sector, economic activity, work place, work residence distance, means of transport used, days worked in the last month, gross income earned last month

6) **Expenditure scheme** with attributes house hold head code#, food & beverage, shelter & energy, clothing & footwear, occasional, tax & contribution, savings (traditional), savings (modern), others and amount in birr

7) **Out-migrant scheme** with attributes, out-migrant code#, reason for moving, educational status when leaving, destination

8) **Population-out-migration scheme** with attributes house hold head code#, out-migration code#, relation to head of house hold

9) **Mortality scheme** with attributes, deceased code#, relation to head of house hold, sex, age

10) **Population-mortality scheme** with attributes house hold head code#, deceased code# and relation to the head of house hold

11) **Housing scheme** with attributes house code#, age, function, legality, typology, main house rooms, kitchen type, kitchen rooms, foundation materials, flooring materials, walling materials, ceiling materials, roofing materials, foundation (physical condition), floor (phys. cond.), wall (phys. cond.), ceiling (phys. cond.), roofing (phys. cond.) plastering (phys. cond.), water, bathing, toilet, light, telephone, fuel and garbage collection

12) **Population-housing scheme** with attributes house hold head code#, house code#, builder, tenure, rent (amount), land tax, house tax, acquisition, construction period, construction delay, reason for delay, intension to sell, reason to sell, intension to buy, reason not to buy, intension to build, reason not to build, look for another house, waiting time, place.

On removal of house hold head code form each relation, the original information is not lost, because other relation, that is, population-family, population-out-

migrant, population-mortality, population-housing schemes are used to integrate all files in the database.

5.7.4.2.3 Third Normal Form Relation

The relation is transformed into third normal form relation from the second normal form if there is any transitive dependency in the later. As far as the second normal form relation does not maintain any transitive dependencies, it also satisfies the requirement of the third normal form.

Transitive dependency exists if there is a dependency between two non-key attributes. Consider a relation X#, Y, Z as non key attributes. If X---->Y and Y--->Z, then the transitive dependency in this relation is X--->Z. If there is such transitive dependency in the relation, the third normal form requires the decomposition of the relation into small relations. Thus, this relation exhibits transitive dependency and must be decomposed into two relations with attributes (X#,Y) and (Y#,X) (Harrington, 1989).

Examination of the second normal form relations in the sample database shows the following transitive dependency.

Starting from the population scheme, there is transitive dependency in that the attributes **marital status** and **education** are dependent on the non-key attribute **age.** Unless the person's age is above a ceratin age limit, he will not have values for educational level and marital status attributes. Therefore, these attributes must be separated and maintained in separate relations according to the rule of the third normal form relation. Likewise, the attribute **reason for coming** depends on non-key attributes of region, wereda and town and it must be split in an independent relation.

The employment relation also exhibits transitive dependency. All the attributes are dependent on the non-key attribute **engagement** in most of the last 12 months. If the value for this attribute is **'No'**, except reason for not working, all the other attributes will have null values. But storing a null value is a wastage of storage space and hence the relation must be separated into a different relation.

Likewise, for the population-housing relation, all of the attributes are dependent on non-key attributes **builder** and **tenure.** In the sense that if the tuple has **present occupant** for builder and **owner** for tenure, it will not have values for the attributes land tax, house tax,

intension to buy, reason not to buy, intension to build, reason not to build, look for another house and waiting period.

Therefore, from the analysis of the above transitive dependencies, the second normal form relations mentioned above are transformed into the third normal form relations:

1) **Population scheme** with attributes, family code#, residential status, sex, age (in years), ethnicity, religion,
2) **Birth place scheme** with attributes family code# and reason for coming
3) **Educational level scheme** with attributes family code# and level
4) **Marital status scheme** with attributes family code# and status
5) **Address scheme** with attributes house hold head code#, kefitegna, kebele, enumeration area
6) **Population-family scheme** with attributes house hold head code#, family code# and relation to head of house hold

7) **Fertility scheme** with attributes, family code#, first marriage age, duration of current marriage, children ever born alive, children ever born dead, birth in the last 12 months (male alive, female alive, male dead and female dead)

8) **Engagement scheme** family code# and engagement last 12 months

9) **Unemployment scheme** with attributes family code# and reason for not working

10) **Employment scheme** with attributes family code#, status(type), job, occupational status, sector, economic activity, work place, work residence distance, means of transport used, days worked in the last month, gross income earned last month

11) **Expenditure scheme** with attributes house hold head code#, food & beverage, shelter & energy, clothing & footwear, occasional, tax & contribution, savings (traditional), savings (modern), others and amount in birr

12) **Out-migrant scheme** with attributes, out-migrant code#, reason for moving, region, wereda and town

13) **Population-out-migration scheme** with attributes house hold head code#, out-migration code#, relation to head of house hold

14) **Out-migrants educational level scheme** with attributes out-migrant code# and educational level

15) **Mortality scheme** with attributes, deceased code#, sex, age

16) **Population-mortality scheme** with attributes house hold head code#, deceased code# and relation to the head of house hold

17) **Housing scheme** with attributes house code#, age, function, legality, typology, main house rooms, kitchen type, kitchen rooms, foundation materials, flooring materials, walling materials, ceiling materials, roofing materials, foundation (physical condition), floor (phys. cond.), wall (phys. cond.), ceiling (phys. cond.), roofing (phys. cond.) plastering (phys. cond.), water, bathing, toilet, light, telephone, fuel and garbage collection

18) **Population-housing scheme** with attributes house hold head code#, house cod#, builder, tenure,

19) **Rent house scheme** with attributes house code#, rent (amount), intension to buy, reason not to buy, intension to build, reason not to build, another look for house and waiting time

20) **Owner house scheme** with attributes house code#, land tax, house tax, acquisition, construction period, construction delay, reason for delay, intension to sell, reason to sell

For the purpose of physical database creation, some of the relations in the third normal form are combined and form one relation, not that when the relations are merged, it is possible to economize the computer storage space. During merging relations, the problem mentioned above will not affect the database. Because once the data is correctly entered and stored in the database, there is no any change to update the exiting data. Whenever required, new questionnaire survey is conducted and data is collected about new sampled person. Therefore, the following files are identified for physical database creation:

1) **Population scheme** with attributes, family code#, residential status, sex, age (in years), ethnicity, religion, reason for coming, level, and status

2) **Address scheme** with attributes house hold head code#, wereda/kefitegna, kebele, and enumeration area

3) **Population-family scheme** with attributes house hold head code#, family code#, and relation to head of house hold

4) **Fertility scheme** with attributes, family code#, first marriage age, duration of current marriage, children ever born alive, children ever born dead, and birth in the last 12 months (male alive, female alive, male dead and female dead)

5) **Engagement scheme** with attributes family code# and engagement last 12 months, and reason for not working

6) **Employment scheme** with attributes family code#, status(type), job, occupational status, sector, economic activity, work place, work residence distance, means of transport used, days worked in the last month, and gross income earned last month

7) **Expenditure scheme** with attributes house hold head code#, food & beverage, shelter & energy, clothing & footwear, occasional, tax & contribution, savings (traditional), savings (modern), others, and amount in birr

8) **Population-out-migration scheme** with attributes house hold head code#, out-migration code#, relation to head of house hold, reason for moving, region, wereda, town and educational level

9) **Population-Mortality scheme** eme with attributes deceased code#, house hold head code#, relation to head of house hold, sex and age

10) **Housing scheme** with attributes house code#, age, function, legality, typology, main house rooms, kitchen type, kitchen rooms, foundation materials, flooring materials, walling materials, ceiling materials, roofing materials, foundation (physical condition), floor (phys. cond.), wall (phys. cond.), ceiling (phys. cond.), roofing (phys. cond.) plastering (phys. cond.), water, bathing, toilet, light, telephone, fuel, and garbage collection

11) **Head-Housing scheme** with attributes house hold head code#, house code#, builder, and tenure,

12) **Rent house scheme** with attributes house code#, rent (amount), intension to buy, reason not to buy, intension to build, reason not to build, look for another house, and waiting time

13) **Owner house scheme** with attributes house code#, land tax, house tax, acquisition, construction period, construction delay, reason for delay, intension to sell, and reason to sell

As far as the code description data is concerned, it is stored together with the data collected by questionnaires. This data is already in third normal

form. Each attribute code description must be maintained in a single file and the file will consist of the attribute code in the questionnaire and the description of the code obtained from the questionnaire manual. As an example, consider the sex attribute. The code description file for the attribute sex consists of the sex codes and the description of these codes as shown below.

A code description file for the attribute sex

sex code#	Code description
1	male
2	female

The value of the code is not repeated in the code description file and used as primary key to navigate from code description file to the data file (e.g. population file).

5.8 PLANNING FOR IMPLEMENTATION

Most of the new system requirements - hardware, software, personnel - are already procured by the existing system. However, additional software and training are still required to implement the new system.

Acquisition of Software

The SAS package is obtained from SAS Institute. The package must be obtained within six months. To licence the package, the Institute can call or write by the following address

SAS Institute Inc.
SAS Circle, Box 8000
Cary, NC 27512 - 8000
(919) 467 - 8000

SQL database management system will be subscribed through IBM agent in the country. This package must be procured within four months.

Training

Although the existing system has already acquired graphics package, the distribution map preparation tasks are done manually at present due to the lack of trained personnel on the use of graphics packages. Therefore, to make the new system practical, one user must be trained in semi-annual training program.

As far as SAS is concerned, the users can implement the new system without further training. However, to make effective utilization of the package, one user is recommended to train in semi-annual courses offered by the SAS Institute. This must be undertaken during the acquisition process of the package.

The users are familiar with Dbase III which is a relational database management system at present and they can use SQL database management without further training.

Changeover

Changeover is the process of transition from old to new system. It includes file creation, maintaining system backup, use of new package, etc. This process must be carried out with careful consideration. Because whatever the system is good, the users are resistant for immediate change. In addition, the success of the new system must be assured before the old system is abandoned. Therefore, the new system is implemented through **phase-in of system.** In the sense that, as the new system successfully accomplishes the old system task, the old system are gradually abandoned. Generally, the changeover system should not be extended long. Because before the effects of the new system is understood, it may be outdated.

Therefore, the changeover process must be completed within six months. All the requirements of the new system will be ready in the next 8 months and the new system should start operation from Dec. 1993.

Backups

To protect the system from human and natural disasters - fire, hardware failure, corruption, etc. - backups of the system should be maintained. The backup should be also kept in another location.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 FINDINGS OF THE STUDY

The trend of urban-regional plan preparation is becoming an information intensive activity not only in the developed countries but also in the developing ones. This requires the timely provision of precise, reliable and adequate data and information to all those involved in the plan preparation. An information support system that process data and provides information tailored to the needs of the different users groups should be considered as an integral part of the planning exercise.

The information requirement of urban-regional planning is diversified and covers economic, demographic, physical condition, social services, infrastructures, etc. It covers almost all of human experiences, generally.

In Ethiopia, the information required for the preparation of urban and regional plans is partly generated in the National Urban Planning Institute (NUPI) and partly (perhaps a greater proportion) is procured from different sources including government and non-government organizations.

The prevalence of poor information service due to inadequately trained professionals, low level of information technology, lack of awareness about the importance of information among the majority of the population, etc., also affects the efforts of urban regional plan preparation. As a result, urban and regional plans are prepared based on inadequate information. The information collected from external (outside the Institute) are subject to problems of inconsistency, inadequacy, and unreliability. Even data reported by one and the same organization at times contradict each others. After monthly or annual performance reporting, some organizations do not keep the data properly for subsequent use. As a result, whenever there is a request for such information, they are not available.

In NUPI, there is no well established methodology to prepare urban and regional plans and process the collected data as well. One of the objectives of AAMPPO was to provide proper methodologies and guidelines for the preparation of urban and regional plans in the country. However, this objective has not achieved at NUPI. Some of the reasons for this problem are that the staff of the Institute are inexperienced, and were employed after the establishment of the Institute.

After the data are collected, the records are not properly maintained before they are processed and used in urban and regional plan preparation. Because of this, available resources (computers and other facilities) are also not adequately used. The Computer Centre is trying to use the resources by providing short term computer training to the staff of the Institute.

Theoretically, the data collected and processed by research departments in addition to their use in the preparation of regional plans, are to be used as input to the preparation of urban plans by the urban plan preparation departments. However, this objective has never been satisfactorily attained. Both the research departments on the one hand and urban plan preparation departments on the other start and complete their tasks at the same time and the information produced by the research departments are used neither for regional plan preparation or for urban plan preparation. It is kept in the Institute's Information and Documentation Centre.

The Institute has problem of inadequacy of professional expertise among its staff. To avoid this problem, the Institute is providing post-graduate training programmes, but the staff were/are not being trained in the fields where the Institute has chronic problems, that is, the lack of adequate staff trained in planning.

6.1 RECOMMENDATIONS

The following recommendations are suggested to alleviate the prevailing problems:

1. The entire information system of the Institute must be studied to design a new system, because the system design suggested in this study solves only part of the over all system problems.

2. A job description must be prepared for each department of the Institute. If the functions and activities of each department is known, it is possible to define each department's information needs so as to avoid duplication of work in data collection and processing and making unnecessary efforts in collecting data that have no present value. At present, each member of staff of the Institute collects data on the assumption that it may be useful in the future. The **Market Survey** questionnaire survey is the result of this unnecessary effort.

3. There must be a time gap in carrying out tasks by the research departments on the one hand and urban plan preparation departments on the other. The

research departments must start their task at least six months earlier than the urban plan preparation departments. If such sequential relationship is maintained, the problem of information misuse and delay can be overcome and information produced in the research departments can be used for the purposes it is collected and processed.

4. An information network should be established between the Institute and the information sources identified in this study. Since substantial amount of information required by the Institute come from these government and non-government organizations, establishment of network will improve exchange of information among the nodes (institutions connected by the network). Linking through a network calls for a better understanding of information needs of other nodes and better provision of information services. This networking will benefit not only NUPI but also other organizations connected by the network. For instance, the main objective of CSA is to provide information services to all information users in the country, and to achieve this objective it collects new information generated in other organizations while such data is also collected through the standard questionnaire survey by NUPI.

The networking can be manual or automated. Among the organizations which procures computer and telecommunication facilities, it is possible to establish automated network.

5. A well established methodology should be established to prepare plans and process data that are relevant to the preparation of urban and regional plans. To achieve this objective, the Institute must employ on contract basis and utilize the personnel who participated in the project so that the inexperienced staff can acquire the required skills and experience. If this is not possible, rather than following methodologies with which users are not familiar, it is better to develop new methodologies that are clear to all users.

6. There must be a responsible organization that approves and follows up implementation of the plans in the right way. Plans are prepared, but not approved for implementation at present.

7. The National Science and Technological Information and Documentation Centre (NSTIDC) should frequently organize symposiums, training courses, conferences, etc. through which the Centre can make people aware

of the importance of information so that the country's information resource can be optimally utilized. The Information Day celebrated last year was appreciated but many of the concerned organizations such as NUPI, which provide urban information services in the country, could not participate as they did not receive an invitation to participate.

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Annex I

LIST OF PERSONS INTERVIEWED

Name	Title/Position
1. Hadigu Barya-Gebre	Director, Research & Dev.
2. Tesfaye Beza	Deputy General Manager,NUPI
3. Asefa Bekele	Acting Head, SPD
4. Mathewos Asfaw	A/Head, MPPD
5. Demissu W/Yohannes	Architect, MPPD
6. Gizachew Tilahun	A/Head, ERD
7. Tilahun Fekade	Researcher, ERD
8. Melku Mola	Researcher, ERD
9. Tadesse G/Giorgis	A/Head, PPRD
10. Yibeltal Gebeyehu	Researcher, PPRD
11. Girmaye Mehari	Researcher, PPRD
12. Bekele Tesfaye	A/Head, PSARD
13. Hagos Ahmed	Researcher, PSARD
14. Zewdu Teferi	Supervisor, Computer Centre
15. Ababaw Taddese	Consultant, Computer Centre

Annex II

LIST OF QUESTIONS USED IN INTERVIEWS

1. What is your function in the Institute?
2. Do you have job description?
3. What type of information do you frequently require?
4. What sources of information do you frequently use?
5. What methods do you use to process data?
6. For what purpose do you use information?
7. Do you use computer to process data?

   7.a) If no, mention the possible reason?

   7.b) If yes, do you get the output as you requested?
8. What problems of do you encounter while accomplishing yo task?
9. What solution do you propose to alleviate the existing system problems?

Annex III

QUESTIONNAIRE DISTRIBUTED FOR THE SURVEY

Date _____/_____/93

Name _____

Department _____

1. Your area of specialization is

_____

2. The types of data/information that you frequently use are (Tick Mark)

   1. Metrological data
   2. Geological data
   3. Hydrogeological data
   4. Historical data
   5. Maps and plans
   6. Social services such as education, health, etc. data
   7. Infrastructure such as water, electricity, telephone, postal, etc. data
   8. Housing data

9. Employment and unemployment data
10. Land use data
11. Crop production data
12. Market data
13. Population data
14. Natural resources data
15. Others (Specify) _____

3. The sources of information that you frequently visit to collect data and information are (Tick Mark)
   1. Other government and non-government organizations
   2. Databases
   3. Books
   4. Journals and periodicals
   5. Other departments in the Institute
   6. Surveying
   7. Other (specify) _____

4. Please list the sources of information by type of data and information ?

5. Which other government and non-government organization provide you information (Tick Mark)?

   1. Central Statistical Authority
   2. Ethiopian Mapping Authority

3. Ministry of Public Works and Urban Development
4. Ministry of Environmental and Natural Resource Conservation
5. Ministry of Health
6. Ministry of Mines and Energy
7. Ministry of Health
8. Water Resource Development Commission
9. National Meteorological Service Authority
10. Addis Ababa University
11. Others (Specify) _____

6. Please specify data processing techniques (models, mathematical equations, ...) that you frequently use?

7. Do you use computer to process data

1. Yes 2. No

7 (a). If yes, do you get the output in the way you requested?

1. Always
2. Frequently
3. Sometime
4. Rarely

7 (b). If no, Please specify the reason

_____

8. For what purpose do you use information

   1. Problem solving
   2. Planning
   3. General awareness
   4. Keeping updated research

9. Please mention the problems that you frequently encounter in the collection and processing?

10. Please suggest ways of improving the existing problems?

ANNEX IV

EMPLOYEES BY FIELD OF SPECIALIZATION

Specialization	< 1988	1988	1989	1990	1991	1992	1993
Regional Economist	1	1	1	1	-	-	-
Invest. & Manpower Exp.	1	1	1	1	1	1	-
Housing Expert	-	-	-	1	1	-	-
Mathematician	2	2	2	2	2	1	1
Economist	3	5	6	6	6	5	5
Agro-economist	-	2	6	6	6	5	5
Plant scientist	-	-	-	1	1	1	1
Animal scientist	-	-	-	2	2	2	2
Statistician	1	1	1	1	1	1	1
Agro-engineer	-	-	-	1	1	1	1
12 complete	6	6	5	4	4	3	3
ERD	14	18	22	26	25	20	19
Demographer	2	2	2	2	2	4	4
Sociologist	-	3	3	3	3	-	-
Statistician	-	-	-	1	1	1	1
Mathematician	-	-	-	1	1	1	1
12 Complete	4	4	4	4	4	4	4
PSARD	6	9	9	11	11	10	10
Geographer	1	4	7	11	11	10	10
Geologist	-	1	2	2	2	2	2
Historian	-	1	1	2	2	2	2
12 + 3	1	1	1	1	1	1	1
Draftmen	2	2	2	3	1	-	-
PPRD	4	9	13	19	17	15	15
Architect town planner	7	8	13	12	12	12	11
Engineer	1	2	1	1	1	1	1
Surveyor	3	3	3	5	5	5	5
Draftmen	2	2	2	5	5	4	4
MPPD	13	15	20	24	23	22	21
Architect town planner	1	5	6	6	6	6	6
Engineer	1	1	1	1	1	1	1
Draftmen	-	-	1	1	1	1	1
PIFU	2	7	8	8	8	8	7
Architect	1	1	1	1	1	1	1
SPD	1	1	1	1	1	1	1
Total	40	69	73	89	85	76	73

NATIONAL URBAN PLANNING INSTITUTE
DEMOGRAPHIC, SOCIO-ECO. & HOUSING
SAMPLE SURVEY IN SELECTED TOWNS 19

PART 1 SOCIO-ECO & DEMOGRAPHIC CHARACTERISTICS

BLOCK 1 IDENTIFICATION VARIABLES

1	2	3	4	5	6	7	8	9	10
Job number	Planning reg.	Adm. region	Awraja	Town	Keftegna	Kebele	En. area	House number	HH n°

BLOCK 2 SOCIO-ECONOMIC & DEMOGRAPHIC VARIABLES

11	12	13	14	15	16	17	18	19	20	21	22	23
Serial number	Name of usual household members and visitors	Residential Status	Relation to H of HH	Sex	Age (completed years)	Marital status	Ethnic group	Religion	Birth place: Urban (town)	Birth place: Rural (awraja)	Birth place: Abroad (country)	Length of continous res	Reason for coming	Educational status

BLOCK 3 FERTILITY

24	25	26						27			
Age at first marriage	Duration of current marriage	Children ever-born: Living with		Children ever-born: Living out		Children ever-born: Deceased		Birth in last 12 months: Alive		Birth in last 12 months: Dead	
		M	F	M	F	M	F	M	F	M	F

BLOCK 4 EMPLOYMENT

28	29	30	31	32	33	34	35	36	37	38	39	40
Engagement in most of last 12 months	If no, reason for not working	If yes, type	N° of days worked last month	Type of job	Gross income earned last working month (birr)	Occupational status	Sector	Economic activity	Work place	W/R dist. (k.m.)	Means of transport	Commuting

BLOCK 5 OUT-MIGRATION

41	42	43	44	45	46	47	48	49
Serial Number	Name of the out migrant	Relation to H of HH	Sex	Age at moving	Reason for moving	Educ. before leaving	Destination: Urban (town) / Rural (awraja) / Abroad (country)	Marital status

BLOCK 6 MORTALITY

50	51	52	53	54
Serial Number	Name of deceased	Relation to H of HH	Sex	Age

BLOCK 7 EXPENDITURE BASKET (LAST YR)

Serial Number	Item	Expense (Birr)
56 1	Food / beverage	
56 2	Shelter / energy	
57 3	Clothing & footwear	
58 4	Occasional	
59 5	Tax & contribution	
60 6	Savings (trad.)	
61 7	Savings (mode.)	
62 8	Others	
	Total	

PART 2

HOUSING CHARACTERISTICS

BLOCK 8 GENERAL

63. Age of Housing unit
1. Under construction
2. Less than one year
3. 1-4 years
4. 5-9 years
5. 10-14 years
6. 15-19 years
7. 20+ years

64. Builder of the Housing unit
1. Present occupant
2. Relative
3. Other private
4. Public organization

65. Tenure
1. Owner occupied (without paying difference)
2. Owner occupied paying difference rent
3. Renter (Private)
4. Renter from UDA
5. Renter RHA
6. Rent free
7. Other (specify) _____

66. Rent (renter)
Amount (BIRR) _____

5. Tax (owner) (BIRR)
Land _____
House _____
Total _____

67. Purpose
1. Residence
2. Res + Commerce
3. Res + Workshop
4. Res + Dairy
5. Res + Office
6. Other (specify) _____

BLOCK 9 TYPOLOGY

68. Unit Type
1. Conventional
2. Improvised (chere/kabet)
3. Improvised (legaty)
4. Mobile
5. Other (specify) _____

69. Building Type
1. S.S. Detached villa
2. Duplex
3. S.S. Row (3-5 units)
4. S.S. Row (6+units)
5. Two and overstorey (detached)
6. Two and overstorey (duplex)
7. Two and overstorey (3-5units)
8. Two and overstorey (6+units)
9. Other (specify) _____

70. Service Quarter
Does the house have a separate service quarter?
1. Yes
2. No

71. No of rooms

Room	Main house	Total

BLOCK 10 CONSTRUCTION MATERIALS AND PHYSICAL CONDITIONS (STRUCTURE)

72. Foundation
Does the building have a Foundation
1. Yes
2. No
What type?
_____

73. Flooring Materials
1. Earth mud
2. Wood Tiles
3. Cement Concrete Finish
4. Plastic Tile
5. Cement or Clay Tile
6. Marble Tile
7. Stone
8. Bamboo Reed
9. Other (specify) _____

74. Walling Materials
1. Bricks and Cement Material
2. Masonary and Chika
3. Masonry and Cement
4. Blocks Cement
5. Wood + Chicka Plaster
6. Bamboo + Chicka reed + Chicka
7. Concrete
8. Corrugated iron sheet
9. Other (specify) _____

75. Ceiling material
1. None
2. Fabricks
3. Soft board
4. Plywood
5. Concrete
6. Chiawood
7. Timber boarding
8. Bamboo
9. Other (specify) _____

76. Roofing material
1. Corrugated iron Sheet
2. Concrete
3. Wood + Chicka
4. Thatch
5. Reed bamboo
6. Thatch + Chicka
7. Asbestos
8. Other (specify) _____

77. Physical condition

Element code	Score
78. Foundation	
79. Floor	
80. Wall	
81. Ceiling	
82. Roofing	
83. Plastering	

BLOCK 11 DWELLING SERVICE

84. Type of kitchen
1. No kitchen
2. Traditional kitchen - shared
3. Traditional kitchen - private
4. Modern kitchen - shared
5. Modern kitchen - private
6. Modern and traditional
7. Modern and traditional - private
8. Other (specify) _____

BLOCK 11 DWELLING SERVICES (Continued)

86. Water supply
1. Tap in the house
2. Tap in compound-private
3. Tap in compound-shared
4. Public tap
5. Tap outside compound-shared
6. Protected well spring
7. Unprotected well spring
8. River, Lake, Pond
9. Other (specify) _____

87. Bathing facility
1. None
2. Bath tub private
3. Bath tub shared
4. Shower private
5. Shower shared
6. Bath tub and shower shared
7. Bath tub and shower private
8. Other (specify) _____

88. Toilet facility
1. None
2. Flushtoilet private
3. Flushtoilet shared
4. Pit, private
5. Pit, shared
6. Other (specify) _____

89. Light
1. Electricity/meter private
2. Electricity/meter shared
3. Masha
4. Tantern
5. Kerosine lamp
6. None
7. Other (specify) _____

90. Telephone
1. Yes
2. No

91. Fuel/Energy
1. Electricity
2. Gas
3. Electricity and gas
4. Electricity, Firewood & Charcoal
5. Gas, firewood and charcoal
6. Firewood and charcoal
7. Firewood only
8. Kerosine stove
9. Other (specify) _____

92. Garbage collection
1. Dustbin
2. Free space around the house
3. Garbage pit
4. Others (specify) _____

BLOCK 12 HOUSE SEARCHING AND MARKETING

92. Owners Acquisition
1. Heirdom
2. Relative
3. Private
4. Public organization
5. Other (specify) _____

93. Owners Waiting time
1. Nothing or less than 1 year
2. Until 2 years
3. Until 3 years
4. Until 4 years
5. 5 years and over

94. Building time
N° of months _____

95. Reason for delay
_____

96. Owner, Will you sell?
1. Yes
2. No

97. Why? (if yes)
1. To get a better
2. Too expensive maintenance
3. To get cash
4. Migration
5. Other (specify) _____

98. Renter, Plan to buy?
1. Yes
2. No

99. If no, Why?
1. Bad condition
2. Not properly located
3. Too expensive
4. Too small
5. Other (specify) _____

100. Renter, will you build?
1. Yes
2. No

101. If no, Why?
Reason _____

102. Look for another house?
1. Yes
2. No

103. For how long?
N° of months _____

104.
Where?
1. In the same town
2. In other town (specify) _____
3. Elsewere (specify) _____

BLOCK 13 AUTHENTICATION

Name	Date	Sign.
Enumerator		
Supervisor		

Level	Type of Service	Included activity	Area (m^2/inhb.)	Area (m^2)	Optimal Catchment	Served Population	Typology	Location
Community class III (kebele)	Health service	- infirmacy - offices x surveyours, Animators - Waiting hall	0.02-0.06	100 - 600	500 - 1000	5000 - 10000	-1 storey building (one unit)	-Central part of service area -Adjoining to kebele center in a well accessible site
Community class IV (keftegia)	Health service	- health center - pharmacy	0.05-0.06	1250 - 3000	1000 - 1500	25000 - 50000	-As for health center	-If possible adjoining to senior secondary school and to green area/park
District (Kefle-Ketena)	General hospital	-	0.033 - 0.05	2000 - 5000	3000 - 5000m	60000 100000	-2 or 3 storey building	-Outside city center adjoining to green -Accessible by means of urban transport system
Town	Referal hospital	-	-	-	-	-	-According to detail study and programme of Ministry Health	-As for general hospital

SERVICE: Health Service Standards

ANNEX VI

Level	Type of Service	Users by Unit	Students by class	Area (m^2/inhb.)	Built up Area(%)	Area (m^2) Catchment	Optimal Catchment	Served Population	Typology	Location
Community class II (Mender)	Kinder-garten (2-4 classes)	60-160	30-40	0.4-0.5	15-20%	400-1250	400-800m	1000-2500	-1 storey building	-Scattered within residence -Not along mainroad -In connection with green/ playgrass
Community class III (Kebele)	Elementary School (18-30 classes)	720-1500	40-50	0.5-0.7	20-25%	2500 - 7000	750 - 1000m	5000-10000 (about3000 students distributed in 2 shift)	-1 or 2 storey building -Multipurpose sport field should be provided	-Outside kebele center -If possible along secondary road with good accessi bility -If possible in close connec-tion with open-space,green area or sport center
Community class IV/III (kefteqna/ kebele)	Junior secondary school (7-12 classes)	280 - 600	40-50	0.4-0.5	20-25%	2000 - 5000	750 - 1000	5000-10000	-The same as for elementary school	-As for elementary school -In the same plot of elementary school

SERVICE: EDUCATIONAL Standards

ANNEX VII

Level	Type of Service	Users by Unit	Students by class	Area (m^2/inhb.)	Built up Area(%)	Area (m^2) Catchment	Optimal Catchment	Served Population	Typology	Location
Community class IV (Keftegna)	Senior Secondary School (13.24 classes)	520 - 1200	40-50	0.4-1.0	45-55%	4000 - 15000	1000 - 1500m	by Unit 10000-15000	-2 or 3 storey building -Multipurpose sport field should be provided	-If possible along secondary road with good accessibility -If possible closely connected to sport center
District (Kefle-Ketema)	Specialized high school (technical commercial vocational medical..)	-	-	0.10-0.12	-	6000 - 12000	3000 - 5000m	60000 - 100000	-2 or 3 storey building -If possible different school should be built as one complex	-Near mass transport system and in well accessible site
	Institute, College, University	-	-	-	-	-	-	-	-According to detail plan or design.	-Peripheral(o of urban area

SERVICE: Educational Standards

ANNEX

Level	Service Included	Area (m^2/inhb.)	Area (m^2)	Optimal Catchment	Served Population	Typology	Location
Community class IV (keftegna)	-Cultural Center: (multipurpose hall, youth club, branch library)	0.06 - 0.10	1500 - 5000	1000 - 50000	25000 - 50000	- 1 or 2 storey building - Homogeneous architectural features for all centers.	- In a central well accessible area of the keftegna. -In close connection with Keftegna Adm. -In one complex if.poss.
District (kefle-ketema)	-Cultural Center: (Cinema/theatre, youth club, general library exhibition hall)	0.33 - 0.55	2000 - 5000	1500 - 2500m	60000 - 100000	- As for above	-In a central areas of the Kefle Ketema along main roads or in a nodal point. -Closely connected with kefle ketema administration center.
Town	-Cultural service: (Musieum,Library-specialized or main,...)	-	-	-	-	-	- City center

SERVICE: Cultural Standards

ANNEX VIII

Level	Type of Service	Area (m^2/inhb.)	Area (m^2)	Optimal Catchment	Served Population	Typology	Location
	Place of Worship (churches, mosques, religious institutions)	1ha/1000 membership	2000-3000 (optimal)	(5000-10000)	-	-	-Scattered within urban areas -Easily accessible on foot -In a quite area with sufficient space for land-scaping

SERVICE: RELIGIOUS STANDARDS

ANNEX IX

Level	Type of Service	Included Activity	Area (m^2/inhb.)	Area (m^2)	Optimal Catchment	Served Population	Typology	Location
Community Class III (Kebele)	Kebele center	-Kebele Administration -Multipurpose hall	0.1-0.15	750 - 1000	5000-1000	5000-10000	-Homogeneous architectural features in all centers	-Central area of the kebele -If possible integrated with central function and high density area
Community Class IV (Keftegna)	Keftegna	-Keftegna Administration	0.02-0.03	1000 - 1500	1000 - 1500	25000 - 50000	-As for above	-Central and well accessible area of the keftegna -In connection with cultural center at keftegna level
District (Kefle-Ketema)	Kefle Ketema Center	-Kefle Ketema Administration -Municipal service branch office	0.015 - 0.02	1200 - 1500	3000 - 5000	60000 - 100000	-Architectural features should create a significant element in the town.	-In central place of the Kefle Ketema. -Along main roads or in in a nodal point. -In close connection to cultural center.
Town	Municipality	-Town Administration -Municipal Service Offices	-	-	- -	-	-	-City Center

SERVICE:- Municipal Administration Service. Standards

ANNEX X

Level	Type of facility	Using Standard	Served Population	Typology	Location
-	Garbage Collection	-One drum for 25-50 -One can(8c) per HH (door to door service. -Door to Door Service	-People living in over crowded area -People living in flat block or in detached houses. -Commercial areas,industries hospitals,etc.	-Transportable drums (by 2 means -Morable big container	-drum distributed within residential area -One big container located in a Central accessible area for general collection
-	Garbage and Sewage Disposal	-Select Appropriate means of disposal with detail study	-	-	-Out of urban area
District (Kefle Ketena)	Municipal Cemetry	-About 7000 to 14000 m² scattered in different directions of the town.	-	-A strip of 100m buffer toward built-up areas	-Peripherial area

SERVICE: Municipal Service Standards

ANNEX XI

Level	Type of facility	Using Standard	Served Population	Typology	Location
District (Kefle-Ketema)	Fire brigade	-Additional fire brigade stations should be located near some specialized area (commercial, industrial, ...)	-	-	-Center place of Kefle ketema
Town	Abattoir	-	-	-	-Peripherial area -Along main roads

SERVICE: Municipal Service Standards

Level	Type of Activity	Included Activity	Area (m^2/inh.)	Total Area m^2	% Built up Area	Optimal Catchment	Served Population	Typology	Location
Community Class IV (Keftegna)	Administration	Police	0.04-0.06m^2	1000-1500m^2	30%-40%	900-1600m	25000-50000		Very identifable place (eg. central & well accessible area
District (Kifle Ketema)	Administration	-courts -awraja administration	0.01-0.02 0.01-0.02	250-500m^2 250-500m^2	50%-60%		60000-100000		As far as possible in the central area of the awraja
City-wide/ town	Administration	Branches of government offices -police -prison -court -regional Adm. -political orgniza-tion	24-36m^2/emp		30%-40%			According to detailed plan	on the existing Dire Dawa centre or on CBD.

SERVICE: Government Administration Service Standards

ANNEX XII

Level	Type of Service	Included activity-	A r e a (m^2/ inhb.)	Optimal Catchment	Served Population	Typology	Location
Community class I (Keye)	Contact area	- Children playing - Sitting down (for aged) - Communal space	2-4	100-200m	200-400	-Area covered with grass -Including tree shade	-Scattered within residential areas -If possible connect with playlot
Community class II (mender)	Playlot	- Children playing - Sitting down - Passive and active recreation	0.8-1.0	350-700	1000-2000	-Children game space on fixed, low maintenance and strong material	-Scattered in residential areas -If possible connect with playground
Community class III (kebele)	Play-ground	- 1 football field (90x45) - 1 volleyball field (22x13)	1-1.2	500-1000	5000-10000	-Optimum size 6000m^2	-If possible closely connected with elementary school or kebele center
Community class IV (keftegna)	Green area (park)	- playlot - Recreation(passive) - Walking	-	1000-1500		-All activities should be connected by pedestrian lane	-Exploit natural features as: rivers, slopy area,existing green etc.

SERVICE: Recreational Standards

ANNEX XIII

Level	Type of Service	Included activities	Area (m^2/inhb.)	Optimal Catchment	Served Population	Typology	Location
Community class IV (kefitegna)	Play field (sport center)	-Football field (100x50) -Volley ball field (22x13) -Basket ball field (20x40) -Changing + shower	0.24-0.3	1000 - 1500	25000 - 50000	-	-If possible adjoining to senior secondary school or to green area
District	Green area (Park)	-Different recreational activity -Maintaining the green aspect of the city	0.25-0.3 (formal green)	3000 - 5000	60000 - 100000	-Protection of informal (natural) green areas -Well designed for pedestrian lane	-Potentialy green areas or along rivers, slopy areas, etc. -Buffers
(Kefle-Ketema)	Sport Complex	-Football field with running tracks -Basket, volleyball, handball fields -Swimming pool -Gymnazem	0.16-0.2	3000 - 5000	60000 - 100000	-	-Near mass transport system and well accessible place
Town	Agriculture	-Holticulture -Botanic garden -Forest	-	-	-	-Protection of existing green as city lung	-In existing condition

SERVICE: RECREATIONAL Standards

ANNEX XIV

SERVICE: Commerce and Trade Standards

Level	Type of Activity	Included Activity	Area (m^2/inh.)	Total Area m^2	% Built up Area	Optimal Catchment	Served Population	Typology	Location
District (Kifle ketema)	Shopping Center	-Specialized* shops -Super markets -petrol station etc.	0.04-0.05	500-600m^2	60%-70%	2500-4000	(60,000-1000,000)		As far as possible in the central area
	Financial Institutions	-Bank -Inland Revenue	0.005-0.006 0.005-0.006	2400-6000m^2 2400-6000m^2			"	2-3 storey	Near Shopping Activities
	Hotels Restaurants	-high standard hotel with necessary activities	0.04-0.05	2400-5000m^2	"	2500-4000	"	3-4 storey	Central area
City wide/ town	Shopping Center	-super market, shops, department stores			-			In the lower part of a multi-storey building	CBD
	Financial institutions	banks, insurance custom & inland revenue	24-36m^2 /emp.		30-40%			According to detail plan	CBD
	Hotels	International hotel	--		30-40				Acc. to detail plan

*Shops with specific function e.g. Gold smith, Boutique, etc.

SERVICE: Commerce and Trade Standards

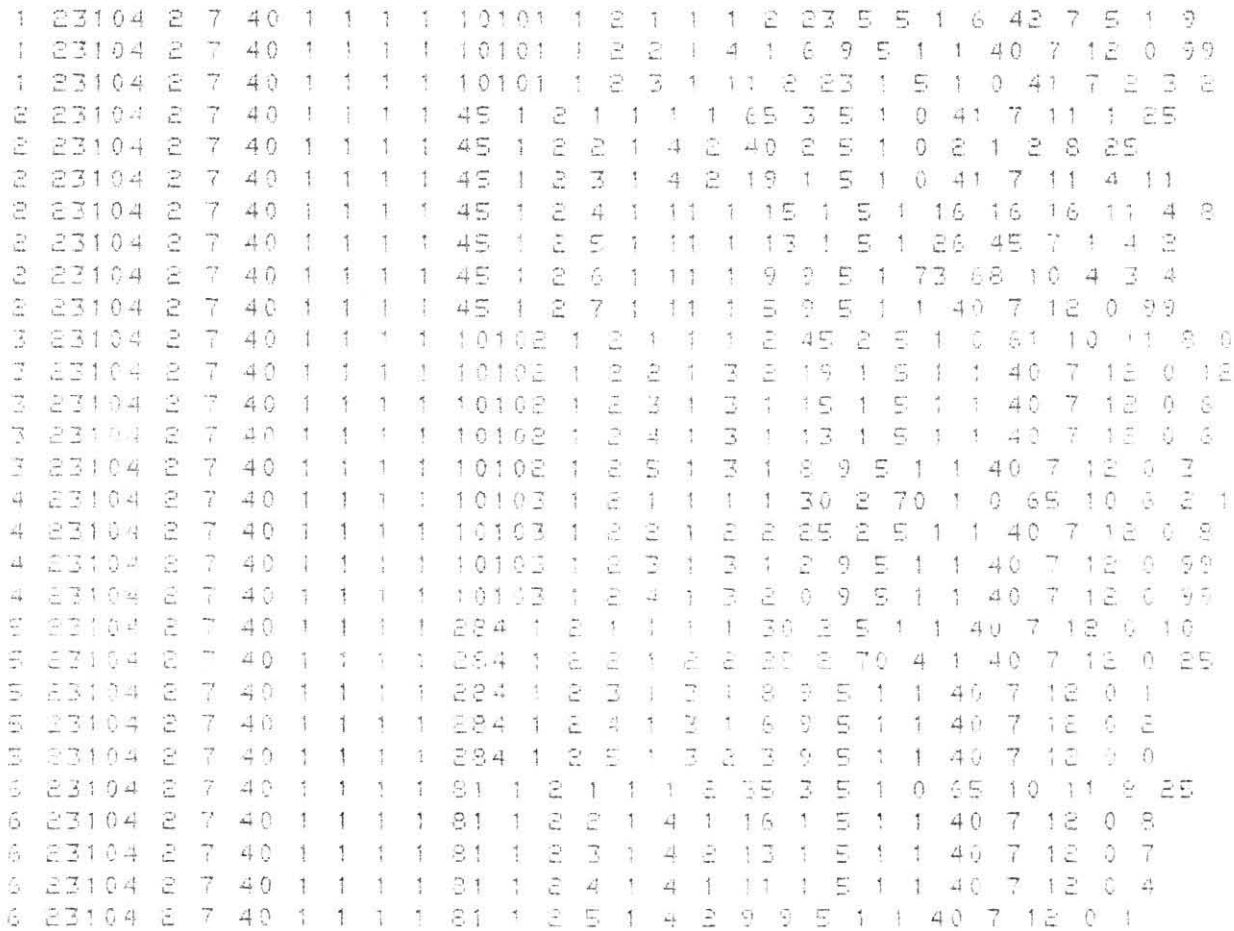
Level	Type of Activity	Included Activity	Area (m^2/inh.)	Total Area m^2	% Built up Area	Optimal Catchment	Served Population	Typology	Location
Community Class III (Kebele)	Shopping	-Gulit* -Flour mill -Bakery -Injera oven -grocery -Butchery -Kiosk -etc.	0.4-0.5	2000-5000		500-1000	5000-10000		-open market on very accessible area -shops scattered across roads
Community Class IV (Keftegna)	Shopping	-Market for daily shopping	0.02-0.03	500-1500m^2					-easily accessible -central area of the keftegna
		-Services (Barber tailor laundry etc.)	0.02-0.04	500-2000m^2	60%70%	900-1600	25000-50000		
		-Covered market	0.03-0.04	750-1000m^2	"				Central Area
	-Hotels -Restaurants	-Low of middle class standards	0.06-0.08 0.04-0.06	1500-4000m^2 1000-3000m^2	" "		25000-50000		With Commercial Activities

*10% of the commercial area to be assigned for Gulit.

ANNEX XV

Sample Records from Existing Data Files

Blocked Data File



Sample Records from Existing Data Files

Block3 Data File

```
1 23104 2 7 40 1 1 1 1 10101 1 2 1 1 1 2 23 5 5 1 6 42 7 5 1 9 15 7
0 0 0 0 0 0 0 0 0 0
2 23104 2 7 40 1 1 1 1 45 1 2 2 1 4 2 40 2 5 1 0 2 1 2 8 25 19 15 4
0 0 0 6 0 0 0 0 0
3 23104 2 7 40 1 1 1 1 10102 1 2 1 1 1 2 45 2 5 1 0 61 10 11 9 0 13
20 3 1 2 4 0 0 0 0 0 0 0
4 23104 2 7 40 1 1 1 1 10103 1 2 2 1 2 2 25 2 5 1 1 40 7 12 0 9 16 7
1 1 0 0 0 0 1 0 0 0 0
5 23104 2 7 40 1 1 1 1 284 1 2 2 1 2 2 28 2 70 4 1 40 7 12 0 25 19 5
2 1 0 0 0 0 0 0 0 0 0
6 23104 2 7 40 1 1 1 1 81 1 2 1 1 1 2 35 3 5 1 0 65 10 11 8 25 15 10
2 4 0 0 2 0 0 0 0 0 0
7 23104 2 7 40 1 1 1 1 13 1 2 2 1 2 2 39 2 5 1 0 30 7 11 8 35 10 27
1 1 0 1 0 0 0 0 0 0
7 23104 2 7 40 1 1 1 1 13 1 2 2 1 11 3 24-2 5 1 16 16 16 12 0 17 21
0 1 0 0 0 0 0 0 0 0 0
8 23104 2 7 40 1 1 1 1 67 1 2 2 1 1 2 54 2 5 1 0 41 7 11 8 0 13 20 1
1 0 4 0 2 0 0 0 0 0
9 23104 2 7 40 1 1 1 1 10104 1 2 1 1 1 2 20 1 5 1 42 30 7 7 3 5 0 0
0 0 1 0 0 0 0 0 0 0
10 23104 2 7 40 1 1 1 1 106 1 2 1 1 1 2 35 3 5 1 0 41 7 11 3 25 20 1
1 2 0 2 0 0 0 0 0 0 0
11 23104 2 7 40 1 1 1 1 90 1 2 1 1 1 2 40 3 5 1 0 39 7 11 7 0 15 17
0 3 1 0 0 0 0 0 0 0
12 23104 2 7 40 1 1 1 1 303 1 2 2 1 2 2 51 2 5 1 1 101 14 11 9 23 7 1
1 0 0 0 0 0 0 0 0 0 0
13 23104 2 7 40 1 1 1 1 209 1 2 1 1 1 2 22 2 5 1 0 63 10 0 1 4 18 1
0 1 0 0 0 1 0 0 0 0
```

Sample Records from Existing Data Files

Block4 Data File

```
1 23104 2 7 40 1 1 1 1 10101 1 2 1 1 1 2 23 5 5 1 6 42 7 5 1 9 1
0 2 30 164 250 1 1 4 1 4.00 2 1
2 23104 2 7 40 1 1 1 1 45 1 2 1 1 1 1 65 3 5 1 0 41 7 11 1 25 2 6
0 0 202 125 7 0 0 0 .00 0 0
2 23104 2 7 40 1 1 1 1 45 1 2 2 1 4 2 40 2 5 1 0 2 1 2 8 25 1 0 2
30 21 50 1 1 3 1 8.00 1 1
2 23104 2 7 40 1 1 1 1 45 1 2 3 1 4 2 19 1 5 1 0 41 7 11 4 11 2 3
0 0 187 0 6 0 0 0 .00 0 0
2 23104 2 7 40 1 1 1 1 45 1 2 4 1 11 1 15 1 5 1 16 16 16 11 4 8 2
3 0 0 187 0 6 0 0 0 .00 0 0
2 23104 2 7 40 1 1 1 1 45 1 2 5 1 11 1 13 1 5 1 26 45 7 1 4 2 2 3
0 0 187 0 6 0 0 0 .00 0 0
3 23104 2 7 40 1 1 1 1 10102 1 2 1 1 1 2 45 2 5 1 0 61 10 11 8 0 2
4 0 0 181 152 9 0 0 0 .00 0 0
3 23104 2 7 40 1 1 1 1 10102 1 2 2 1 3 2 19 1 5 1 1 40 7 12 0 12 1
0 2 30 21 90 1 2 14 1 2.00 1 1
3 23104 2 7 40 1 1 1 1 10102 1 2 3 1 3 1 15 1 5 1 1 40 7 12 0 0 2 1
0 0 187 0 6 0 0 0 .00 0 0
3 23104 2 7 40 1 1 1 1 10102 1 2 4 1 3 1 13 1 5 1 1 40 7 12 0 6 2 1
0 0 187 0 6 0 0 0 .00 0 0
4 23104 2 7 40 1 1 1 1 10103 1 2 1 1 1 1 30 2 70 1 0 65 10 8 2 11 1
0 1 30 89 135 1 1 11 1 2.00 1 1
4 23104 2 7 40 1 1 1 1 10103 1 2 2 1 2 2 85 2 5 1 1 40 7 12 0 0 1 0
1 30 10 100 1 1 3 1 5.00 2 1
5 23104 2 7 40 1 1 1 1 284 1 2 1 1 1 1 30 2 5 1 1 40 7 12 0 10 1 0 1
30 157 120 1 2 3 1 2.00 1 1
5 23104 2 7 40 1 1 1 1 284 1 2 2 1 2 2 26 2 70 4 1 40 7 12 0 25 2 1
0 186 0 5 0 0 0 .00 0 0
6 23104 2 7 40 1 1 1 1 81 1 2 1 1 1 2 35 3 5 1 0 65 10 11 8 25 1 0 1
30 11 90 1 1 3 1 5.00 2 1
```

Sample Records from Existing Data Files

Block5 Data File

```
3  23104  2  7  40  1  1  1  1  10102  1  5  1  3  2  17  1  11  0  0  0  1
11  23104  2  7  40  1  1  1  1  90  1  5  1  3  2  15  4  14  32  67  10  1
16  23104  2  7  40  1  1  1  1  171  1  5  1  3  1  15  13  8  16  16  16  1
21  23104  2  7  40  1  1  1  1  262  1  5  1  3  1  19  13  6  0  0  0  1
23  23104  2  7  40  1  1  1  1  358  1  5  1  2  2  32  5  25  16  16  16  5
28  23104  2  7  40  1  1  1  1  295  1  5  1  2  1  34  13  25  1  14  3  2
29  23104  2  7  40  1  1  1  1  67  1  5  1  2  1  32  13  25  1  14  3  2
30  23104  2  7  40  1  1  2  2  10200  1  5  1  2  1  36  13  14  1  83  12  2
30  23104  2  7  40  1  1  2  2  10200  1  5  2  9  2  15  3  6  13  39  7  1
31  23104  2  7  40  1  1  2  2  126  1  5  1  1  1  15  2  9  1  14  3  1
31  23104  2  7  40  1  1  2  2  128  1  5  2  1  2  25  8  7  1  40  7  2
36  23104  2  7  40  1  1  2  2  10201  1  5  1  11  2  15  3  5  16  16  16  1
36  23104  2  7  40  1  1  2  2  10201  1  5  2  11  2  13  3  7  16  16  16  1
42  23104  2  7  40  1  1  2  2  944  1  5  1  5  1  14  13  8  21  36  7  1
49  23104  2  7  40  1  1  2  2  10203  1  5  1  9  1  13  13  5  0  0  11  1
53  23104  2  7  40  1  1  2  2  1105  1  5  1  8  1  48  13  10  1  14  3  2
53  23104  2  7  40  1  1  2  2  1105  1  5  2  3  1  17  13  7  0  0  11  1
64  23104  2  7  40  1  1  2  2  10211  1  5  1  2  1  40  2  10  1  40  7  2
71  23104  2  7  40  1  1  2  2  1133  1  5  1  8  1  55  2  9  1  14  3  2
78  23104  2  7  40  1  1  2  2  10213  1  5  1  2  1  38  13  4  0  0  11  2
85  23104  2  7  40  1  1  2  2  33  1  5  1  3  1  16  13  8  3  68  10  1
91  23104  2  7  40  1  1  2  2  85  1  5  1  4  1  10  13  10  0  0  0  1
92  23104  2  7  40  1  1  2  2  42  1  5  1  11  1  16  3  16  16  16  16  1
101  23104  2  7  40  1  1  2  2  209  1  5  1  11  1  19  13  9  3  68  10  1
103  23104  2  7  40  1  1  2  2  229  1  5  2  11  1  17  13  6  16  16  16  1
106  23104  2  7  40  1  1  2  2  596  1  5  1  2  1  30  3  7  1  14  3  1
111  23104  2  7  40  1  1  2  2  10229  1  5  1  9  1  19  13  12  0  0  11  1
121  23104  2  7  40  1  1  2  2  128  1  5  1  1  1  15  2  9  1  14  3  1
121  23104  2  7  40  1  1  2  2  128  1  5  2  1  2  25  8  7  1  40  7  2
```

Sample Records from Existing Data Files

Block6 Data File

```
44 23104 2 7 40 1 1 2 2 2046 1 6 1 3 2 0 0 0 0 0 0 0
98 23104 2 7 40 1 1 2 2 1 1 6 1 2 2 50 0 0 0 0 0 0
108 23104 2 7 40 1 1 2 2 212 1 6 1 2 1 71 0 0 0 0 0 0
154 23104 2 7 40 1 1 2 2 54 1 6 1 3 1 -1 0 0 0 0 0 0
154 23104 2 7 40 1 1 2 2 54 1 6 2 3 1 -1 0 0 0 0 0 0
189 23104 2 7 40 1 1 2 2 10274 1 6 1 3 1 -1 0 0 0 0 0 0
191 23104 2 7 40 1 1 2 2 10276 1 6 1 3 1 2 0 0 0 0 0 0
191 23104 2 7 40 1 1 2 2 10276 1 6 1 3 1 1 0 0 0 0 0 0
191 23104 2 7 40 1 1 2 2 10276 1 6 2 3 1 2 0 0 0 0 0 0
206 23104 2 7 40 1 1 2 2 10287 1 6 1 3 2 1 0 0 0 0 0 0
213 23104 2 7 40 1 1 2 2 477 1 6 1 11 1 23 0 0 0 0 0 0
245 23104 2 7 40 1 1 3 4 577 1 6 1 3 2 6 0 0 0 0 0 0
260 23104 2 7 40 1 1 3 3 348 1 6 1 2 1 80 0 0 0 0 0 0
264 23104 2 7 40 1 1 3 3 10307 1 6 1 3 2 1 0 0 0 0 0 0
291 23104 2 7 40 1 1 3 3 10309 1 6 1 3 1 4 0 0 0 0 0 0
336 23104 2 7 40 1 1 3 4 345 1 6 1 2 1 82 0 0 0 0 0 0
380 23104 2 7 40 1 1 4 5 618 1 6 1 3 2 0 0 0 0 0 0 0
385 23104 2 7 40 1 1 4 5 101 1 6 1 9 2 24 0 0 0 0 0 0
392 23104 2 7 40 1 1 4 12 56 1 6 1 8 1 70 0 0 0 0 0 0
435 23104 2 7 40 1 1 6 9 228 1 6 1 7 2 82 0 0 0 0 0 0
461 23104 2 7 40 1 1 6 8 330 1 6 1 3 2 2 0 0 0 0 0 0
467 23104 2 7 40 1 1 6 9 1170 1 6 1 2 2 3 0 0 0 0 0 0
467 23104 2 7 40 1 1 6 9 1170 1 6 2 2 1 -1 0 0 0 0 0 0
493 23104 2 7 40 1 1 6 9 639 1 6 1 2 2 42 0 0 0 0 0 0
502 23104 2 7 40 1 1 6 9 300 1 6 1 11 2 89 0 0 0 0 0 0
507 23104 2 7 40 1 1 6 8 476 1 6 1 2 1 67 0 0 0 0 0 0
518 23104 2 7 40 1 2 7 11 30708 1 6 1 3 2 2 0 0 0 0 0 0
532 23104 2 7 40 1 2 7 11 689 1 6 1 3 2 14 0 0 0 0 0 0
541 23104 2 7 40 1 2 7 10 182 1 6 1 3 1 0 0 0 0 0 0 0
```

Sample Records from Existing Data Files

Block7 Data File

```
1  23104  2  7  40  1  1  1  1  10101  1  7  1  1300
1  23104  2  7  40  1  1  1  1  10101  1  7  2  380
1  23104  2  7  40  1  1  1  1  10101  1  7  3  450
1  23104  2  7  40  1  1  1  1  10101  1  7  8  840
2  23104  2  7  40  1  1  1  1  45  1  7  1  1200
2  23104  2  7  40  1  1  1  1  45  1  7  2  150
2  23104  2  7  40  1  1  1  1  45  1  7  5  1
2  23104  2  7  40  1  1  1  1  45  1  7  6  12
3  23104  2  7  40  1  1  1  1  10102  1  7  1  1890
3  23104  2  7  40  1  1  1  1  10102  1  7  2  300
3  23104  2  7  40  1  1  1  1  10102  1  7  3  400
3  23104  2  7  40  1  1  1  1  10102  1  7  5  1
3  23104  2  7  40  1  1  1  1  10102  1  7  6  24
4  23104  2  7  40  1  1  1  1  10103  1  7  1  1800
4  23104  2  7  40  1  1  1  1  10103  1  7  2  540
4  23104  2  7  40  1  1  1  1  10103  1  7  3  400
4  23104  2  7  40  1  1  1  1  10103  1  7  6  12
5  23104  2  7  40  1  1  1  1  284  1  7  1  960
5  23104  2  7  40  1  1  1  1  284  1  7  2  216
5  23104  2  7  40  1  1  1  1  284  1  7  3  200
5  23104  2  7  40  1  1  1  1  284  1  7  5  1
6  23104  2  7  40  1  1  1  1  81  1  7  1  840
6  23104  2  7  40  1  1  1  1  81  1  7  2  60
6  23104  2  7  40  1  1  1  1  81  1  7  3  150
6  23104  2  7  40  1  1  1  1  81  1  7  5  1
6  23104  2  7  40  1  1  1  1  81  1  7  6  12
6  23104  2  7  40  1  1  1  1  81  1  7  8  1
```

Sample Records from Existing Data Files

Block9 Data File

```
1  23104  2  7  40  1  1  1  1  10101  1  8  3  1  1  0  0  0  0  1  1  1  2  1  0  1  1  3  3  1
1  1  4  4  4  4  4  3  2  6  1  1  2  2  2  2  3  0  6  0  2  0  0  0  0  2  0  0
2  23104  2  7  40  1  1  1  1  45  1  8  7  1  1  0  1  0  0  1  1  1  1  1  2  2  0  1  5  1  1  1
3  3  0  4  3  3  8  1  4  4  2  5  2  3  0  1  0  2  0  0  0  0  0  2  0  0
3  23104  2  7  40  1  1  1  1  10102  1  8  7  1  1  0  0  0  1  1  1  1  1  1  2  2  0  3  5  1
1  4  4  2  0  4  3  3  6  1  4  4  2  9  3  3  0  1  0  2  0  0  0  0  0  2  0  0
4  23104  2  7  40  1  1  1  1  10103  1  8  2  1  1  0  0  0  0  1  2  2  2  1  0  2  0  1  5  1
1  3  3  1  0  1  3  1  7  1  1  4  2  6  2  3  0  2  0  2  0  0  0  0  0  2  0  0
5  23104  2  7  40  1  1  1  1  284  1  8  6  4  4  1  0  0  0  1  1  2  2  1  0  2  0  1  5  1  1
3  3  3  0  3  3  1  6  1  4  4  2  6  2  4  2  0  0  0  0  2  3  2  1  2  0  0
6  23104  2  7  40  1  1  1  1  81  1  8  4  1  1  0  1  0  1  1  1  1  1  1  2  2  0  1  5  1  1  3
3  3  0  4  3  3  7  1  4  4  2  7  3  3  0  2  0  2  0  0  0  0  0  0  2  0  0
7  23104  2  7  40  1  1  1  1  13  1  8  7  4  6  0  0  0  0  1  1  4  1  1  1  1  1  3  4  1  1  3
3  2  0  4  3  2  3  5  3  2  2  6  3  4  0  0  0  0  0  0  0  0  0  0  2  0  0
8  23104  2  7  40  1  1  1  1  67  1  8  7  1  1  0  1  0  1  1  1  2  1  1  2  2  0  1  5  1  1  3
3  3  0  3  3  3  7  1  4  4  2  7  2  3  0  2  0  2  0  0  0  0  0  0  2  0  0
9  23104  2  7  40  1  1  1  1  10104  1  8  4  1  1  0  0  0  0  1  1  2  2  1  0  2  0  3  3  1
1  4  4  4  0  4  4  1  6  1  1  4  2  9  3  3  0  3  0  2  0  0  0  0  0  2  0  0
10  23104  2  7  40  1  1  1  1  106  1  8  7  1  1  0  1  0  1  1  1  1  1  1  1  2  0  1  5  1  1
3  3  3  0  3  3  3  7  1  1  5  2  7  2  3  0  3  0  2  0  0  0  0  0  0  2  0  0
11  23104  2  7  40  1  1  1  1  90  1  8  6  1  1  0  1  0  1  1  1  2  1  1  2  2  0  1  5  1  1
3  2  3  0  3  3  3  7  1  1  4  2  9  2  3  0  3  0  2  0  0  0  0  0  0  2  0  0
12  23104  2  7  40  1  1  1  1  303  1  8  5  1  1  0  0  0  1  1  3  1  2  1  0  2  0  1  5  1  1
3  3  3  6  3  3  3  8  1  1  4  2  9  2  3  0  1  0  2  0  0  0  0  0  2  0  0
13  23104  2  7  40  1  1  1  1  209  1  8  6  3  5  1  0  0  0  1  3  1  2  1  0  2  0  1  5  1  1
3  3  2  0  3  3  1  6  1  1  5  2  9  2  4  2  0  0  0  0  2  3  2  1  2  0  0
14  23104  2  7  40  1  1  1  1  10105  1  8  4  1  1  0  0  0  0  1  2  1  1  1  1  1  3  3  1
1  4  4  4  0  3  3  3  6  1  4  4  2  6  2  2  0  1  0  2  0  0  0  0  0  2  0  0
15  23104  2  7  40  1  1  1  1  134  1  8  7  1  1  0  1  0  0  1  1  1  1  1  2  2  0  1  5  1  1
3  3  3  0  4  3  3  8  1  4  4  2  7  3  3  0  1  0  2  0  0  0  0  0  2  0  0
```

ANNEX XV

DOCUMENTATION FILE FOR EXITING DATA FILES

Block 2 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  HHM_serial_no   1  30
Var  HHM_resi_status   1  3
Var  HHM_relation_to_head  1  13
Var  HHM_sex  1  2
Var  HHM_age   0  99
Var  HHM_marital_status  1  5  9
Var  HHM_ethnic_group 1  93
Var  HHM_religion  1  6
```

```
Var  HHM_birth_place_town  0  148
Var  HHM_birth_place_awraja  0  102
Var  HHM_birth_place_region  0  16
Var  HHM_length_residence  0  12
Var  HHM_reason_coming  1  14
Var  HHM_educational_status  0  26  99
```

Block 3 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  HHM_serial_no   1  30
Var  HHM_resi_status   1  3
Var  HHM_relation_to_head  1  13
Var  HHM_sex  1  2
Var  HHM_age   0  99
Var  HHM_marital_status  1  5  9
Var  HHM_ethnic_group 1  93
Var  HHM_religion  1  6
Var  HHM_birth_place_town  0  148
Var  HHM_birth_place_awraja  0  102
Var  HHM_birth_place_region  0  16
Var  HHM_length_residence  0  12
Var  HHM_reason_coming  1  14
Var  HHM_educational_status  0  26  99
Var  First_marriage_age  0  70
Var  Duration_current_marriage 0  70
Var  Living_with_child_M   1  15  0
Var  Living_with_child_F   1  15  0
Var  Living_out_child_M   1  15  0
Var  Living_out_child_F   1  15  0
Var  Deceased_child_M   1  15  0
Var  Deceased_child_F   1  15  0
Var  Alive_birth_M   1  3 0
Var  Alive_birth_F  1  3 0
Var  Dead_birth_M   1  3 0
Var  Dead_birth_F  1  3 0
Var  One_Zero
```

Block 4 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  HHM_serial_no   1  30
Var  HHM_resi_status   1  3
Var  HHM_relation_to_head  1  13
Var  HHM_sex  1  2
Var  HHM_age   0  99
Var  HHM_marital_status  1  5  9
Var  HHM_ethnic_group 1  93
Var  HHM_religion  1  6
Var  HHM_birth_place_town  0  148
Var  HHM_birth_place_awraja  0  102
Var  HHM_birth_place_region  0  16
Var  HHM_length_residence  0  12
Var  HHM_reason_coming  1  14
Var  HHM_educational_status  0  26  99
Var  Engagement_last_year  0  3
Var  Non_engagement_reason 0  9
Var  Engagement_last_12_months  -1  40  999
Var  Engagement_job_type  0  300
Var  Income_month   -1  5400  9999
Var  Occupation_status  -1  10  99
Var  Engagement_sector  -1  5 99
Var  Engagement_activity  -1  15 99
Var  Engagement_place  -1  15  99
Var  Work_residence_distance  -1  750  999
Var  Transport_means  -1  4  99
```

Block 5 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  Out_migrant_serial_no 1  3
Var  Out_migrant_re_HHH  -1  13  99
Var  Out_migrant_sex  1  2
Var  Out_migrant_age -1  99
Var  Out_migrant_move_reason  1  14
Var  Out_migrant_educational  -1  26  99
Var  Out_migrant_town  1  148
Var  Out_migrant_awraja  0  102
Var  Out_migrant_region  1  16
Var  Out_migrant_marital_status  -1  5  9
```

Block 6 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  HHM_serial_no 1  30
Var  Deceased_re_HHH 1  13
Var  Deceased_sex 1  2
Var  Deceased_age  -1  98
Var  One_zero_1
Var  One_zero_2
Var  One_zero_3
Var  One_zero_4
Var  One_zero_5
Var  One_zero_6
```

Block 7 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  Expense_code 1  10
Var  Expense 0  100000
```

Block 8 documentation file

```
Var  Questionnaire_serial_number
Var  Job_number
Var  Planning_Region 0  10000
Var  Administrative_Region  0  10000
Var  Awraja  0  10000
Var  Town 0  10000
Var  Keftegna 1  4
Var  Kebele  1  23
Var  Enumeration_area 0  100
Var  House_no
Var  HHH_serial_no
Var  Block_number 2  8
Var  Housing_age  -1  7  99
Var  Housing_builder  0  4
Var  Housing_tenure    -1  7  99
Var  Housing_rent  0  1000
Var  Housing_tax_land  0  500
Var  Housing_tax_house  0  500
Var  Housing_tax_total 0  1000
Var  Housing_function  0  67  99
Var  Housing_type  0  5000
Var  Housing_building_type  -1  9  99
Var  Housing_service_quarter  0  2
Var  Housing_rooms_main  0  10
Var  Housing_rooms_sq   0  10
Var  Housing_foundation  0  2
Var  Housing_foundation_type  0  6
Var  Housing_flooring_material  0  9
Var  Housing_walling_material  -1  9  99
Var  Housing_ceiling_material  -1  9  99
Var  Housing_roofing_material  -1  9  99
Var  Housing_foundation_condition  0  4
Var  Housing_flooring_condition  0  4
```

```
Var  Housing_walling_condition  0  4
Var  Housing_ceiling_condition  0  4
Var  Housing_roofing_condition  0  4
Var  Housing_plastering_condition  0  4
Var  Housing_kitchen_type  0  8
Var  Housing_water_source  0  9
Var  Housing_bathing_facility   -1   8   99
Var  Housing_toilet_facility   -1  6  99
Var  Housing_light_type    -1  7  99
Var  Housing_telephone -1  2  99
Var  Housing_fuel_source   -1  13  99
Var  Housing_garbage_collection  0  4
Var  Housing_acquisition   0  5
Var  Housing_waiting_time   0  5
Var  Housing_building_time   -1  80  999
Var  Housing_reason_delay   -1  6  999
Var  Housing_intention_for_sell  0  2
Var  Housing_reason_for_sell     0  5
Var  Housing_intension_to_buy   0  2
Var  Housing_reason_to_buy      0  8
Var  Housing_intention_to_build    0  2
Var  Housing_reason_not_build         0  6
Var  Housing_length_looking_others   -1   200  999
```

A Sample Report Output from CROSS Program

cross t ing_age and housing_tenure
memory required
records

ge of housing unit by ownership (sample report output)

cross between housing_age and housing_tenure

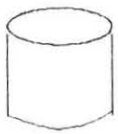
	1	2	4	5	6	7	tot.
0	1.00	1.00	0.00	0.00	0.00	0.00	2.00
	50.00	50.00	0.00	0.00	0.00	0.00	100.00
	100.00	33.33	0.00	0.00	0.00	0.00	11.76
1	0.00	1.00	3.00	1.00	2.00	3.00	10.00
	0.00	10.00	30.00	10.00	20.00	30.00	100.00
	0.00	33.33	100.00	100.00	40.00	75.00	58.82
2	0.00	1.00	0.00	0.00	0.00	0.00	1.00
	0.00	100.00	0.00	0.00	0.00	0.00	100.00
	0.00	33.33	0.00	0.00	0.00	0.00	5.88
4	0.00	0.00	0.00	0.00	2.00	0.00	2.00
	0.00	0.00	0.00	0.00	100.00	0.00	100.00
	0.00	0.00	0.00	0.00	40.00	0.00	11.76
5	0.00	0.00	0.00	0.00	1.00	0.00	1.00
	0.00	0.00	0.00	0.00	100.00	0.00	100.00
	0.00	0.00	0.00	0.00	20.00	0.00	5.88
6	0.00	0.00	0.00	0.00	0.00	1.00	1.00
	0.00	0.00	0.00	0.00	0.00	100.00	100.00
	0.00	0.00	0.00	0.00	0.00	25.00	5.88
tot	1.00	3.00	3.00	1.00	5.00	4.00	17.00
	5.88	17.65	17.65	5.88	29.41	23.53	100.00

ANNEX XVIII

SYSTEM FLOWCHART SYMBOLS

Manual input *- shows such as key-boarding operation*

Process *- shows automated processing*

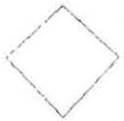


Magnetic disk

Document *- special output symbol to show creation of a printed document*

Manual operation *- shows manual processing step in the system*

Direction of flow



Decision

Off-line page connector