Information System 1

INFORMATION SYSTEM FOR PLANNING AND
DECISION MAKING IN THE AGRICULTURAL SECTOR
A FRAMEWORK FOR GUYANA
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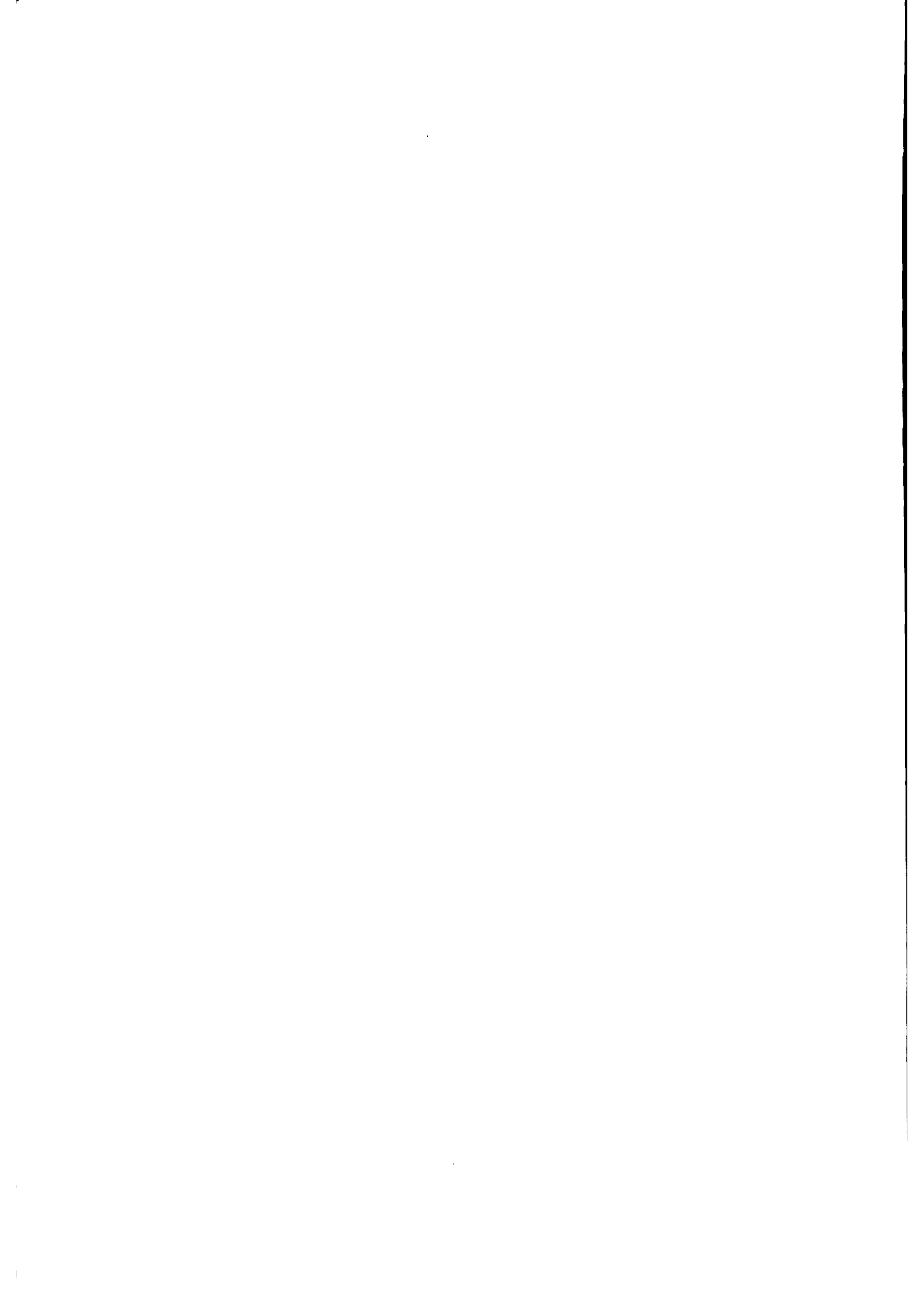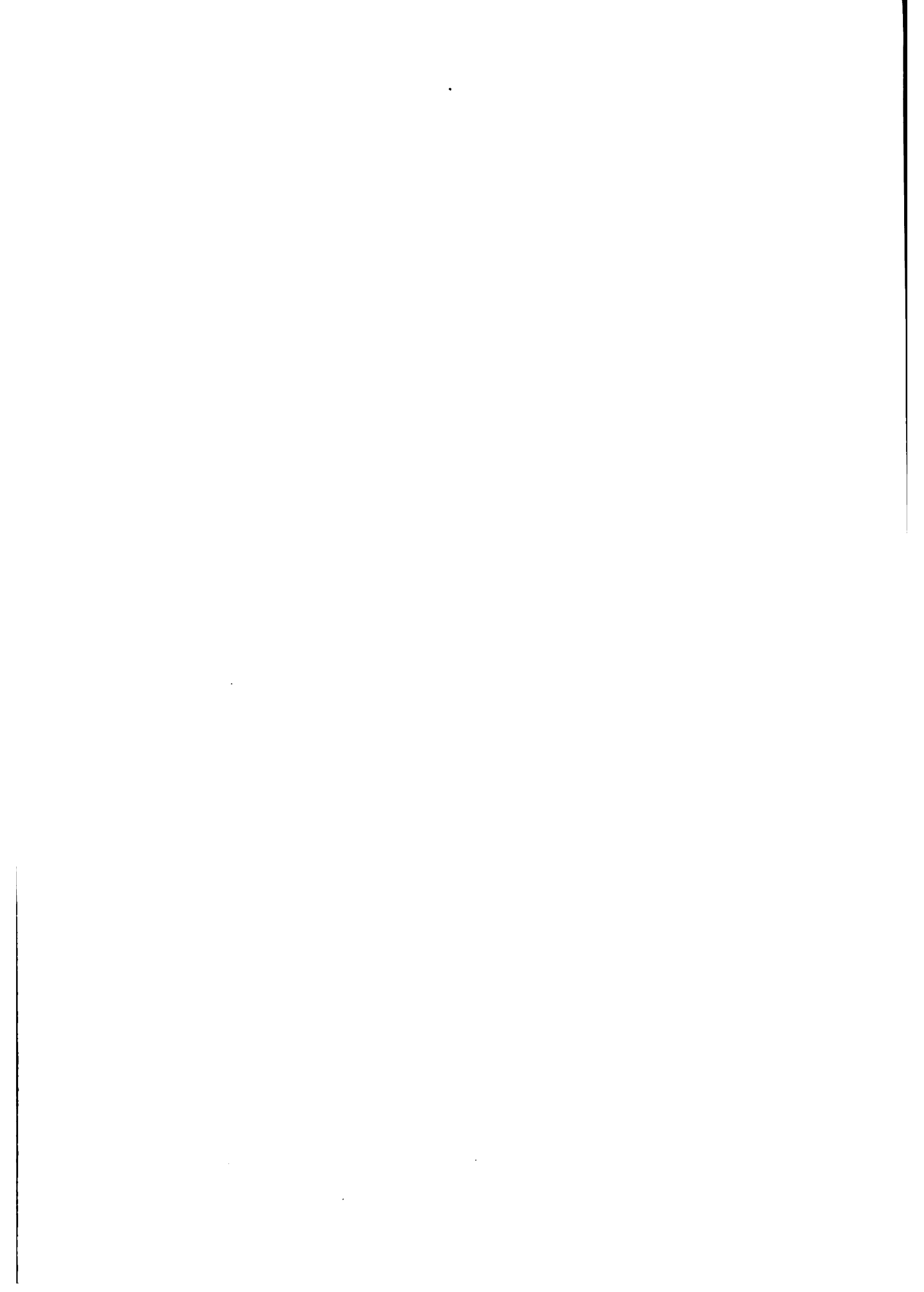
T A B L E   O F   C O N T E N T S

1. - INTRODUCTION

Governments engage at all levels of planning in the nation state. The increasing specialisation of human activities has increased the complexity of the planning process. This complexity is compounded by the process being multi-dimensional. There is often the interplay of various socio-economic, political and natural forces in the planning process. Planners need to take into account all the sides of the "coin" before successfully executing a plan.

Once the committment to planning has been made, there is the necessity for the institutional framework to be developed, resources to be made available and the necessary co-ordination to be done between participants to ensure success of the plan. These stages require that planners be well equipped with the necessary knowledge and ideas relevant to the plan. The quantum and flow of information is crucial for effective planning. In other words, effective planning requires an efficient information system to collect, process and disseminate the information to those engaged in the planning and policy-making process.

In this paper, an attempt will be made to analyse a feasible information system with special reference to the agricultural sector. Section 2 of the paper will give a background to our objective, outlining the important definitions, concepts and approach used. Section 3 deals with the system characteristics, while Section 4 outlines the operational aspects of the information system. Wherever possible,

appropriate references will be made for an information system
relevant to the agricultural sector in Guyana.

PLANNING AND SYSTEMS

2.1 Agricultural Sector Planning

The importance of the agricultural sector varies between countries. This is mainly due to the size of the sector relevant to other sectors in the economy. In the developing countries however, this sector is considered to be very important as the source of development for these economies. Agricultural sector planning is important to effect the required development.

2.1.1 Objectives

The general aim of agricultural sector planning is to obtain a continuous rate of development of the sector. Different economies have their respective level and rate of development needed. These are usually associated with the sector's objectives and the existing developmental problems that exist in the sector. In some economies, the sector may contain a large subsistent sub-sector and a small, modern, capital-intensive sub-sector. The nature of subsistence in the large sub-sector may be the major problem of that agricultural sector, and the objective of planners may be to reduce the level of subsistence by attempting to modernise that sub-sector. In other economies, the problem may be different. Many of the developing countries however, such as Guyana, have as their main problems the following :

1) Low incomes in agriculture.

2) Underproduction, underconsumption, and malnutrition.

3)   Rural unemployment and rural poverty.

In agricultural sector planning these problems are
incorporated into the specific objectives of the national
plans for the sector.   In Guyana, the main aims of
agricultural sector planning as outlined in the national
development plan are :

1)   Increased food production for self-sufficiency in fa

supplies.

2)   Increase employment and incomes in agriculture.

3)   Better prices and improved marketing and distribution

facilities.

4)   Maximise foreign exchange earnings from agricultural

exports.

5)   Improve the nutritional status of the population and

increase the quality of rural life.

To achieve the above objectives, sector planners and deci
makers need to be well-informed and equipped for effectiv
planning.   They must know of the existing potentials of
sector and the alternative courses of action that can be
taken.   The whole process of planning and decision-makin
from problem definition to plan execution and evaluation
be consistent and systematic.   Whatever the approaches o
models that are used, quantity and precision of qualitati
data is very much needed.

Agricultural sector planning however, is a highly co
process.   The agricultural sector is only a part of a bl

whole or system which contains many sectors and sub-sectors. It is therefore important for planners and decision-makers to conceptualize all the problems and interrelationships of this sector with the economy as a whole. Many plans have failed to achieve their desired objectives because planners have failed to take account of the complex functional relationships between one sector and the overall economy.

Another reason for failure perhaps is that the problem-solving approaches have been traditional; by this is meant that the approaches have been somewhat "narrow". Problems and solutions were considered in isolation of their related effects on other activities and institutions both within the sector and the overall economy. The approaches have not been "broad-based" and integrated for common objectives. Each institution or agency pursued its policy in an isolated manner. This has not worked in basic agriculture. To modernise and have a dynamic agricultural sector is a highly complex task and many governments have failed because of a particular system. This would have outlined a consistent and systematic policy set for planning and decision-making. Using a systems approach in sector analysis, one can identify the priority project areas. It also allows a policy set to be maintained within the sector and consistent with the objectives of the overall economy.

Systems approach to planning and decision-making, as will be shown later, emphasises the need for organised information

flows for effective planning. Planners often have to rely
on a wide variety of data sources ranging in quality from
fully controlled experiments to guesstimates in their prob
solution process. An organised system for collecting,
analysing and disseminating information to agricultural sec
planners is an important prequisite for successfully reachi
sector goals and targets. It is crucial to the whole pla
process.

2.2 Concepts and definitions

The development of the systems approach has contributed immen
ly to a more systematic and integrated approach to planning and de
sion-making. It provides an in-depth approach and a body of tool
overall problem solution. The system is basically a network of de
sion-making operations having a logical sequence of decisions. 3
sequential steps of the approach as outlined in figure 1, basically
are :

1) It defines the problem(s) or issues that exist.

2) It allows for observations and analysis of the proble
   This is concerned with data collection and its analysi

3) Formulation of alternative courses of action.

4) Makes a final decision, i.e., it selects the optimum
   solution and evaluation of results.

2.2.1 Systems Outline

a) System — It is a set of entities and attributes whi
   are bound together by a definite set of interrelatios

Figure 1 - Decision - Making Process
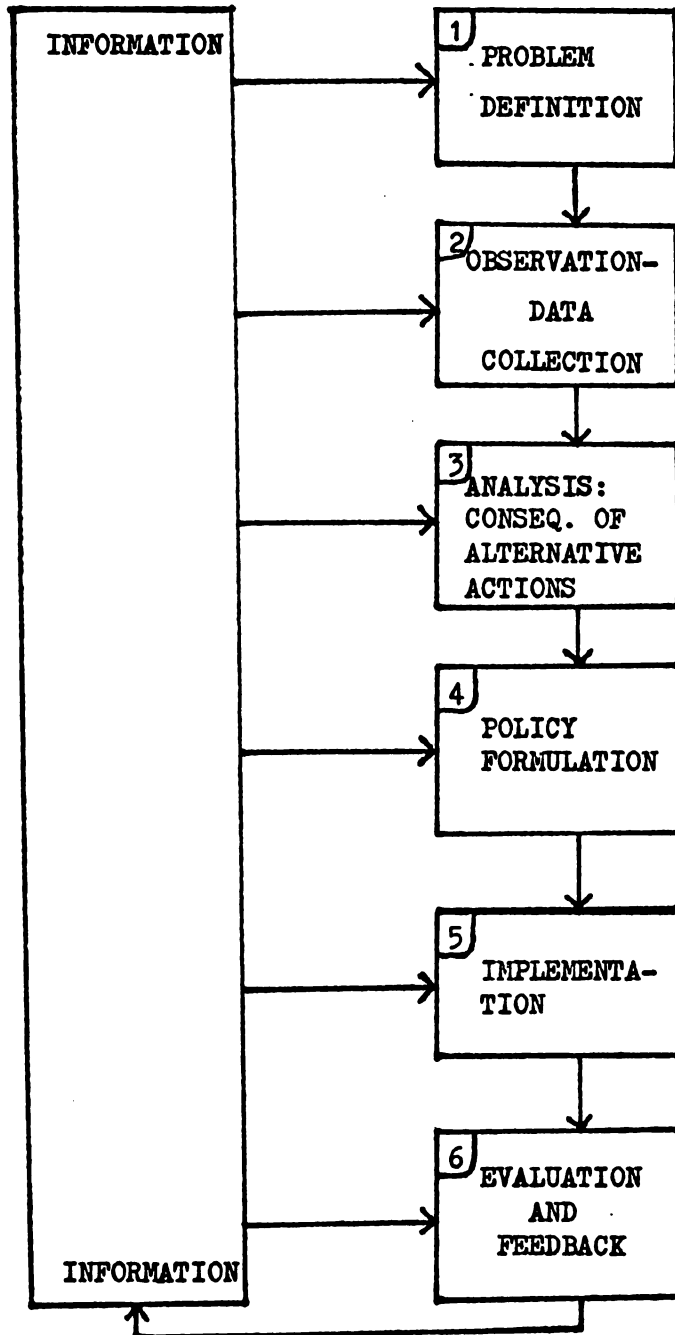
b) Entities - These are events or activities when taken collectively constitute a group or a sub-system, having a set of objectives consistent with those of the overall system.

c) Attributes - These are a set of numeral or logical values that are relevant to the objectives of the system

d) Objectives - The set of criteria for which the whole system operates. The types of objectives often determine the size and complexity of the system.

e) Environment - These are areas outside the boundary of the system whose attributes may effect changes in the system or may be affected by changes in the system.

f) Inputs - These are primary external variables that effect changes within the system.

g) Output - Changes in external variables caused by changes in the system.

INFORMATION SYSTEM FOR AGRICULTURAL PLANNING

An information system can be referred to as the methods, materials, media, producers and recipients involved in an organised way to effect information transfer within a specific area, activity or organisation. It is concerned with all the processes involved from collection of both quantitative and non-numerical data, analysis, storage into an integrated system, which serves many application requirements to retrieval of such information for satisfying the needs of users. It consists of a complex collection of information "messages" of the persons who produce and use them and a set of behaviour patterns of their interrelationships.

The information system exists at the centre of many other systems, each having its respective behaviour patterns and interrelationships. However, it transcends all other systems and understanding the functional relationships with the other systems is extremely important if the information transfer is to improve. But of more importance are those that are related to the needs for and uses of information. One should take into account the potential users of the system, identifying or predicting the uses to which the information will be put, design a structure to meet such requirements, and then evaluate and revaluate the resulting system.

3.1 Objectives

The general aim of the information system is to provide information or data, i.e. knowledge, news or facts needed by the user in conducting his business. The system must provide information in a usable form and at the time when needed. In the information management system, the objective is to provide information for management

decision-making.

The agricultural sector can be looked upon as a business community where planning and management take place as in all other business units. The specific objectives of the information system for the sector would be :

1) To supply information regularly to management in order that they be aware of developments in all fields related to the agricultural sector.

2) To guide planners and policy-makers to achieve the goals and targets of the agricultural sector.

3) To plan for more optimal/rational use of agricultural resources.

4) To compliment the activities of other departments, institutions and agencies to obtain both sectoral and national planning objectives.

5) To acquire, organise, and exploit all documentary and other sources of information required for the above purposes.

3.2 System Characteristics

The complex nature of information systems creates a challenge in their design and evaluation. The system exists within a more superior system, and this must be considered in its design and evaluation since it may pose several constraints for the system.

There are several approaches in designing an information

system, which depends on type, needs, and uses of the system. The

a) Spatial distribution - Region, Sub-Region, District, Village, Rural/Urban.

most important step is to study the type of information needed by

b) Types and contents of programs.

planners and the information flow of the sector, and then build a

c) Resource availability and needs :

system that brings the basic information together and makes it

i) Manpower and personnel - skilled and unskilled.

accessible to all functional groups. This approach allows the informa-

ii) Financial

originating from various sources to be brought to a central point

so that a data base can be built, and information needed by all users

Data availability **Subsystem 1 - Basic Farm Data**

Elements:

The agricultural sector contains a multiplicity of activities,

i) Crops - Acreage and farm size of holding/plot.

all of which are interrelated in the process of agricultural produc-

ii) Livestock.

tion. Each activity produces a chain set of reactions, each genera-

iii) Potential agricultural land - high/medium/low. This

ting its own set of information. It is important to study all the

relates to monoculture/polyculture/pasture/forage (use).

activities of the sector, the objectives of such activities and the

iv) Tenure system.

information flows relevant to these activities. The systems approach

v) Population:

reduces all the complex interrelated flows into distinct components

a) Composition - racial/sex/age.

or entities, each constituting a subsystem in the information system.

b) Distribution.

On the basis of disaggregation, five main components or subsystems of

vi) Geography - topography, climate and ecology.

the entire system may be identified. These are :

1) Farm subsystem.

3.2.2 **Subsystem 2 - Institutional or Input Subsystem**

2) Institutional or input subsystem.

Elements:

3) Production subsystem.

i) Financial or Credit:

4) Marketing and trade subsystem.

a) Nos. and types of institutions.

5) Research subsystem.

b) Credit programs.

Each subsystem consists of a number of elements, many of them

c) Financial resources.

having the same types of attributes. These can be identified as :

ii)   Extension/Education.

iii)   Technology - Types.

    a)   Available - Technology.

    b)   Technology demand and supply.

    c)   Research oriented/transfer.

iv)   Soil/Animal/Plant protection - programmes.

v)   Land Development - programmes.

    a)   Irrigation.

    b)   Water management.

    c)   Conservation.

vi)   Public utilities - rural/urban availability

    a)   Roads and transport.

    b)   Communication.

    c)   Health and education.

    d)   Water and electricity.

    e)   Energy demand and supply.

vii) Other infrastructures.
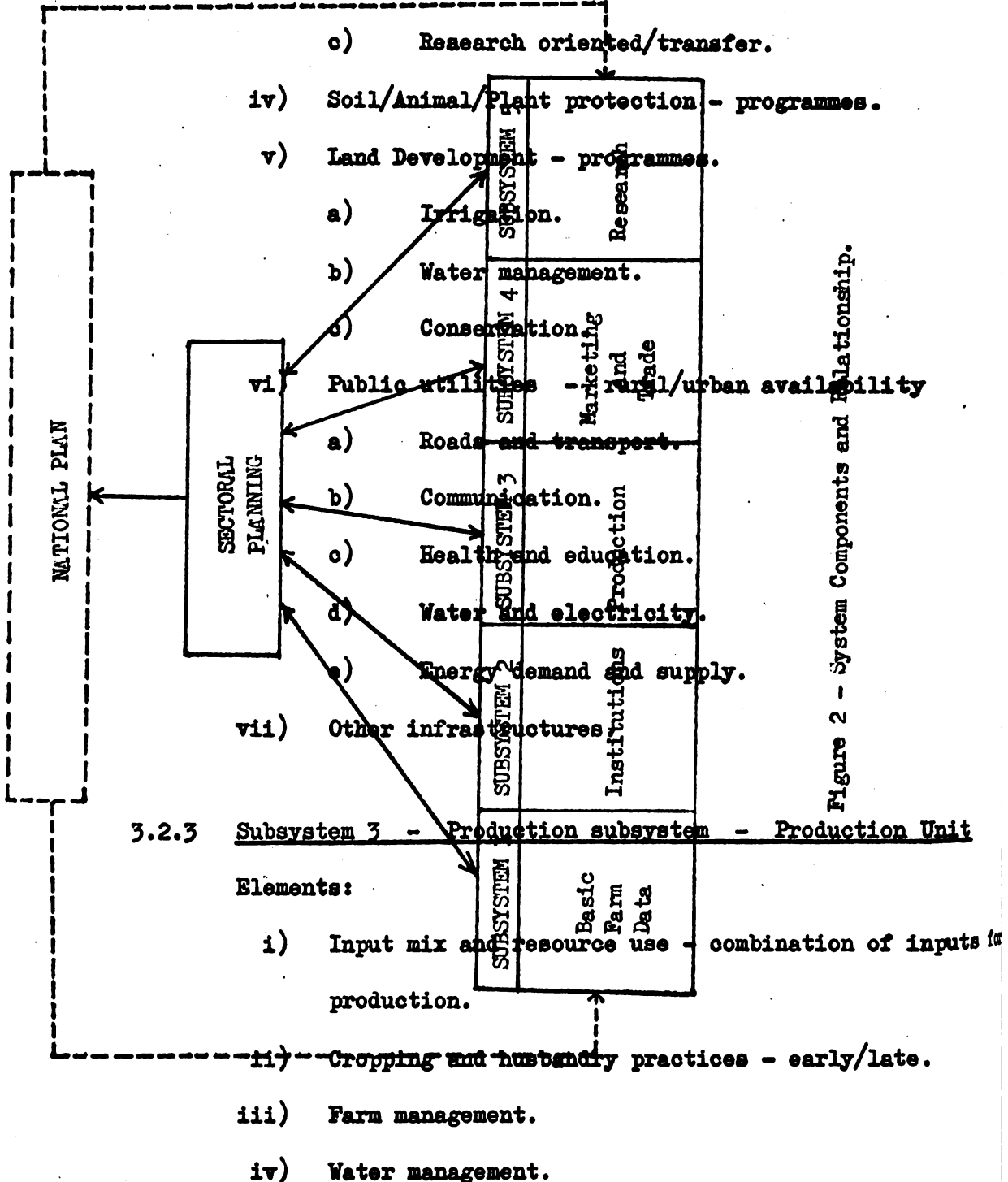
Figure 2 - System Components and Relationship.

3.2.3   Subsystem 3 - Production subsystem - Production Unit

Elements:

    i)   Input mix and resource use - combination of inputs in

        production.

    ii)   Cropping and husbandry practices - early/late.

    iii) Farm management.

    iv) Water management.

v) Harvesting methods.

vi) Yields and income.

vii) Costs.

3.2.4. <u>Subsystem 4 - Marketing and Trade subsystem</u>

<u>Elements</u>:

i) Transport.

ii) Processing.

iii) Storage.

iv) Distribution.

v) Consumption.

vi) Stocks.

vii) Markets.

a) Internal - wholesale/retail.

b) External - imports/exports.

viii) Volume and prices.

ix) Costs - related to transport, etc.

3.2.5 <u>Research subsystem</u>

<u>Elements</u>:

i) Sectoral - economic, technical, etc.

ii) Complimentary - inter-sectoral (joint).

iii) Special projects/Feasibility studies etc.

3.3 <u>System Relationship</u>

These are two main levels of system relationships:

i) Internal relationship of the components to each other and,

ii) Relationship of the system to its environment.

3.3.1 Internal Relationship

This level of relationship is primarily concerned with the relationship of the components with and to the system as a whole. To understand this relationship, a brief outline of the logical steps involved is important.

1) The information system has been reduced to a number of components of subsystems.

2) Each component:

   i) Has a set of elements within a boundary.

   ii) Has a number of objective functions related to the overall objectives of the system.

Each component in the system generates a set of facts and information. It is important that the users of the system develop understanding of the system through a detailed examination of it. This would aid the planning process, for users of the system would then understand that the components complement rather than compete with each other. This complementary relationship is directed towards achievement of the goals of the system (outlined earlier).

3.3.2 The System and the Environment

Figure 2 shows the components of the system and its relationship with its objective. This objective, however,

is part of a bigger objective of the socio-economic system. This is an important aspect of the system's environmental relationship. The system complements other systems in the wider environment towards the achievement of the national planning objectives.

The environment poses several constraints for the system (see systems operation). Our information system must compete in an efficient manner with other systems (including other information systems) if it is to prolong its life cycle. Over time, it must adjust to the various environmental changes and still consistently operate towards its goals and objectives. This depends on the internal flexibility of the system to adjust to such environmental changes. This is an important aspect for consideration when designing the system at the operational level. The design must also take into account the market-like environment including all the economic, marketing, and competitive ramifications of the system.

Section 4. - SYSTEMS OPERATION

Having laid the basic framework of the informati
system, we now turn to its operational aspects. The
important guide for all its operations is that they must
related to the overall objectives of the system. The
system's performance is based on its operations which ai
at maximising its contributions to achieving planning's
goals and targets. Two important considerations must
underline all its activities - efficiency and effectivea
These two criteria will in the final analysis determine
the life cycle of the system.

The operations of the information system can be
classified into four main areas. These are:-

1)   Organisational considerations.

2)   System's Development.

3)   Services.

4)   System's Maintainance.

4.1   -   Organisational Considerations

The organisational structure of the system is an
important aspect for consideration in the design stage.
This is the fundamental aspect upon which all operations
are determined, for a strong and efficient structure goes
a long way to achieve the objectives desired of the syst

The design of the system's structure ought to be as objective as possible to achieve the purposes for which it was set up. It is thus necessary that the structure be related to the following :-

a) The mission of the system.

b) The goals of the system.

c) The required resources that are needed for both the present and anticipated goals.

In addition to the above, there are a number of considerations to be taken into account when designing the system's structure.

Each ministry, institution, or organisation has its own unique organisational structure that has evolved over a long period. The structures have been moulded and conditioned by the respective country's historical development. It is important to consider this factor when designing the structure. It would be wise that the structure designed conform to existing patterns in government institutions. For example, organisational structures of government departments in many developing countries are patterned after the structure of the British Civil Service. Deviations from such a pattern may however be a constraint for the efficient functioning of the system. This can be remedied by minor modifications in the operational functions of the structure so as to achieve the desired level of efficiency. In addition, as part of the wider organisational environment, the structure may facilitate easier administration for its parent organisation.

Understanding the environment and the nature of the system's activities is a prerequisite for designing its structure. The agricultural sector has always been looked upon as having greater risk and uncertainty for predicting the outcome of the sector's activities. It is thus necessary that the structure be efficient organisationally to minimise such risks and uncertainty for planners.

Many information systems are part of an institution or a department, i.e., the system has a parent organisation. Planning for a large sector like the agricultural sector in which many agencies and institutions operate, would necessarily require a separate department to handle such a large volume of information for its information system. The department must be comprehensively organised to handle the volume of information flow; it must also have greater autonomy rather than too much of organisational loyalties. This would give the system greater flexibility both for internal adjustments and adjusting to the environment over time. To a large extent also, there would be less institutional and administrative constraints for satisfying the needs of its users.

Finally, there is the important question of centralisation or decentralisation of the system. Each has its advantages and disadvantages. Centralisation allows for greater efficiency, economy and

availability of resources.   It increases effectiveness especially

for management control.   Decentralisation on the other hand permits

greater convenience for usage, but may entail "weak" administrative

control and direct supervision.   Designing a system only for planning

purposes may require a centralised system.   Where consideration is

being given for an information system of the agricultural sector,

then many institutions and individuals would be directly or indirectly

involved in its usage.   Such a system can be decentralised at the

operational level by having centres of information, each involved

with the information flow of a particular component, while at the

same time, a comprehensive network exists interlinking these centres

into a component whole.   While decentralisation may be permitted, it

should not allow fragmentation of resources and duplication of activities

for the same information.

Given a large agricultural sector as that existing in Guyana, with

so many institutions and agencies, we can attempt to decentralise an

agricultural information system by having a central agency being

responsible for each of the components earlier described.   This is

shown in figures 3 and 4.   For example, all information for subsystem 2,

the production subsystem can be under the responsibility of the Resource

Development and Planning Division of the Ministry of Agriculture.   The

sub-components of this subsystem are those such as the Crop Reporting

Staff, Guyana Rice Board, Guysuco etc,.   In figure 4, the Marketing

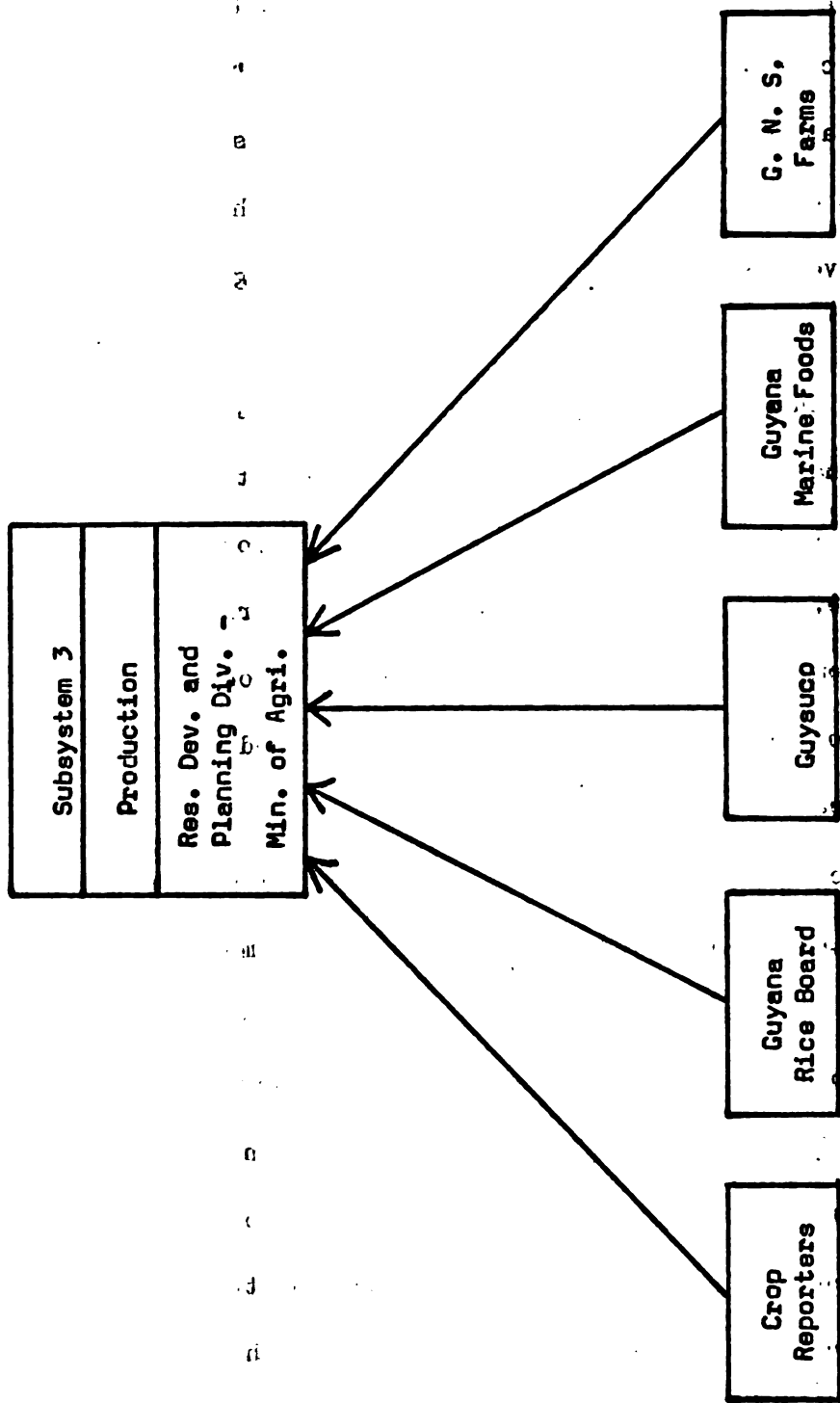and Trade subsystem is disaggregated into two sub-components.   The
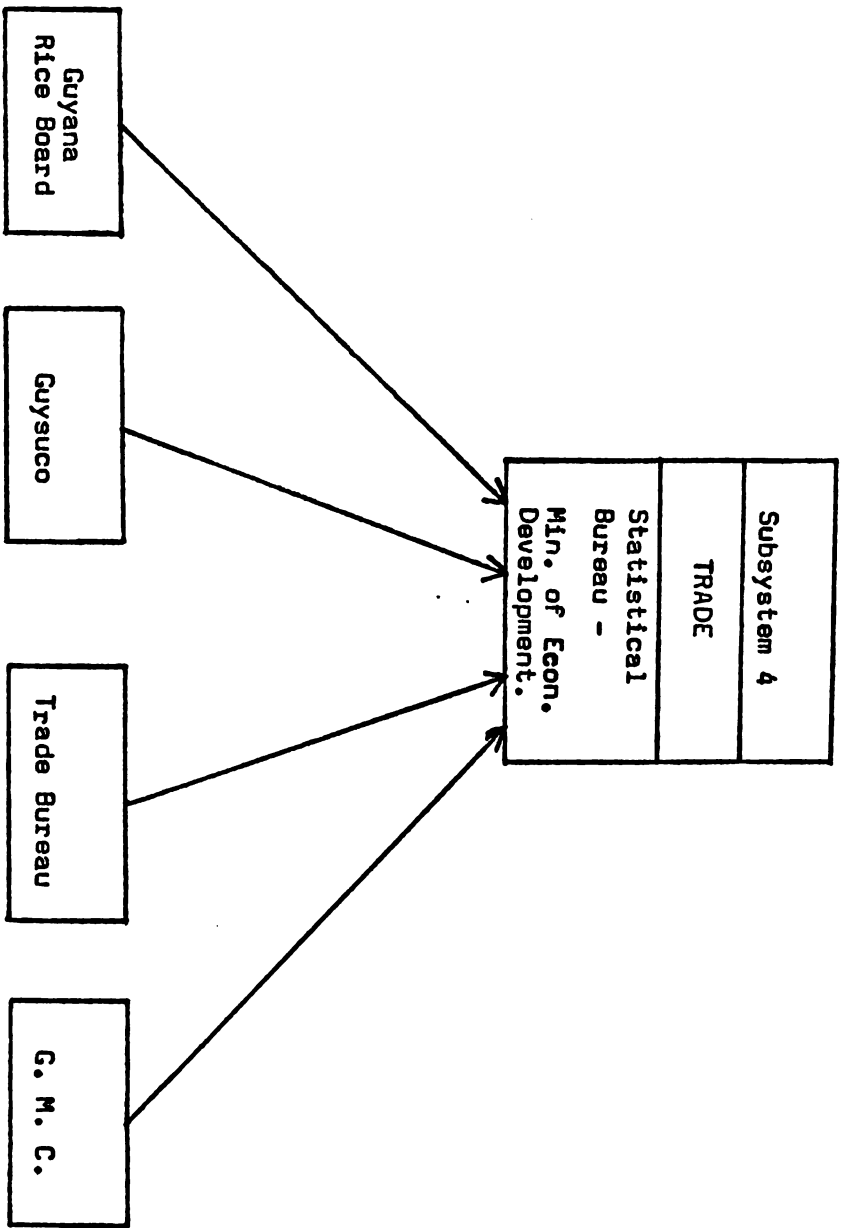
Figure 3. — Information Centre for Production.

Figure 4. — Information Centre for Trade.

Statistical Bureau can be the central agency for the trade information sub-somponent. These are merely examples to show how the system can be designed to reflect a particular level of disaggregation.

Figures 5 and 6 represent a conceptual framework of the organisational structure. Figure 5 shows that the activities of the system are divided into a number of groups, each constituting a unit or a division. Each division is concerned with a specific set of activities or operations, and under direct supervision of a divisional head. For example, there is a head of the finance division, head of the processing division and so on. Figure 6 shows the management control of the system. All activities related to information flow from acquisition to user must be efficiently supervised to achieve its direct objectives.

The structure is linked both vertically with management and horizontally between the various units. It is rather flat than too "hierarchical". The objective is to minimize its "bureacratic" organisation and to have an effective communication flow between management and the lower levels. This increases the integration and efficiency of operations for achieving the system's overall objectives. Mutual communication between the upper and lower levels caters also for the users of the system to interact and participate in the system's planning, development and growth.

The locus of control of the system remains with management (fig. Besides overall administration and supervision, management has the following important functions :-

1)   To develop feasible goals, policies and plans consistent
with the overall objectives of the system.

2)   Establishing and maintaining effective operations and
equipment facilities to implement the above.

3)   Establishing both professional and non-professional
personnel requirements for operations and services.

4)   Evaluating and revising operations to meet changes in
objectives and requirements.

5)   Developing effective programs to meet overall needs.

Before going on to systems development, it would be important to
briefly discuss three important areas of organisational control -
staffing, equipment and finance.

(a)   Staffing and equipment facilities are functions of both the
financial resources, complexity of the systems operations and the
degree of centralisation/decentralisation of the system.   While
information science is a relatively new field in the developing
countries, it is a highly specialised discipline that requires
professional and specialised staff.

Table 1.   shows the staff requirements for an agricultural
information system for Guyana, given an information structure such as
that in figure 5.
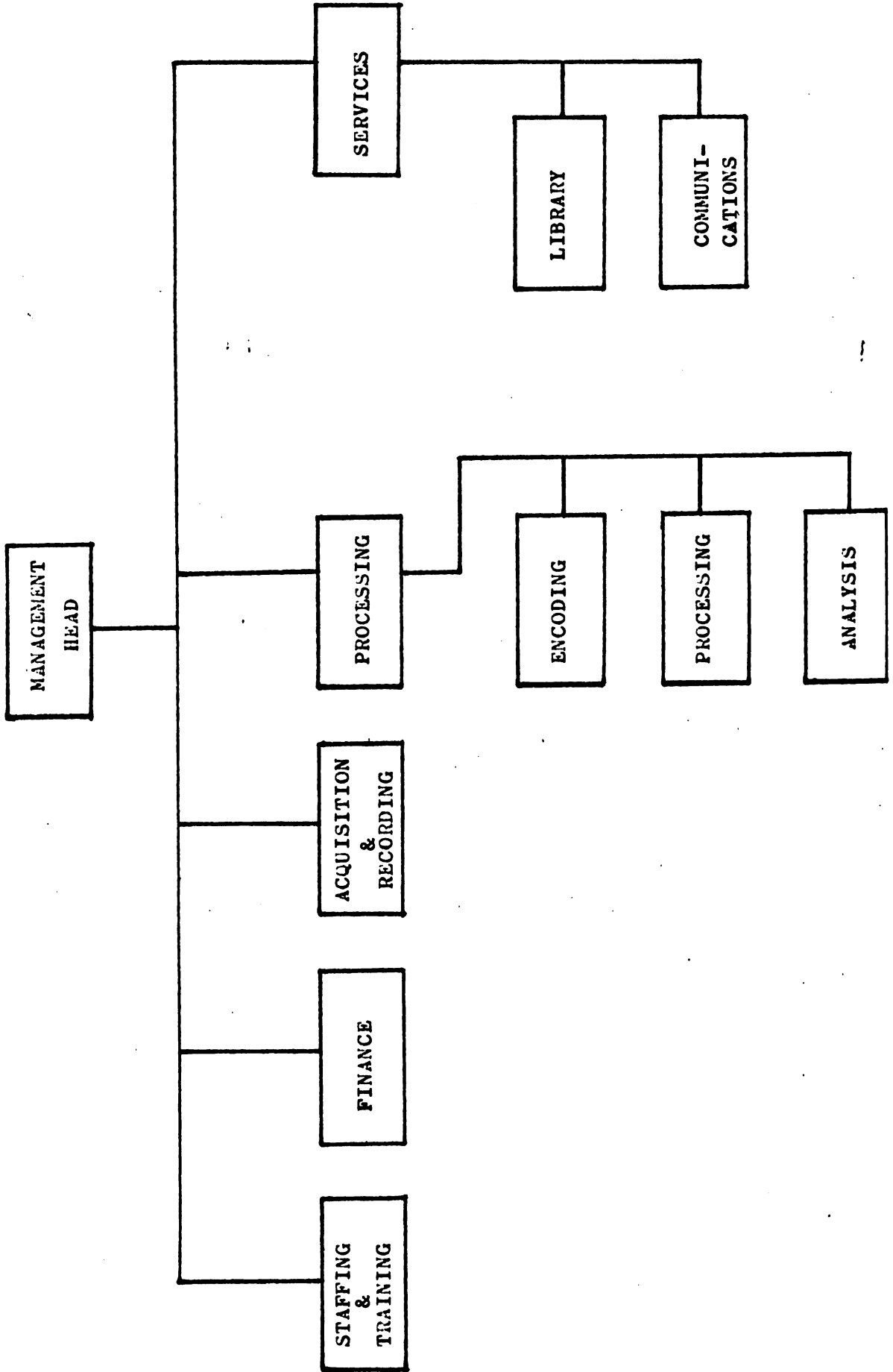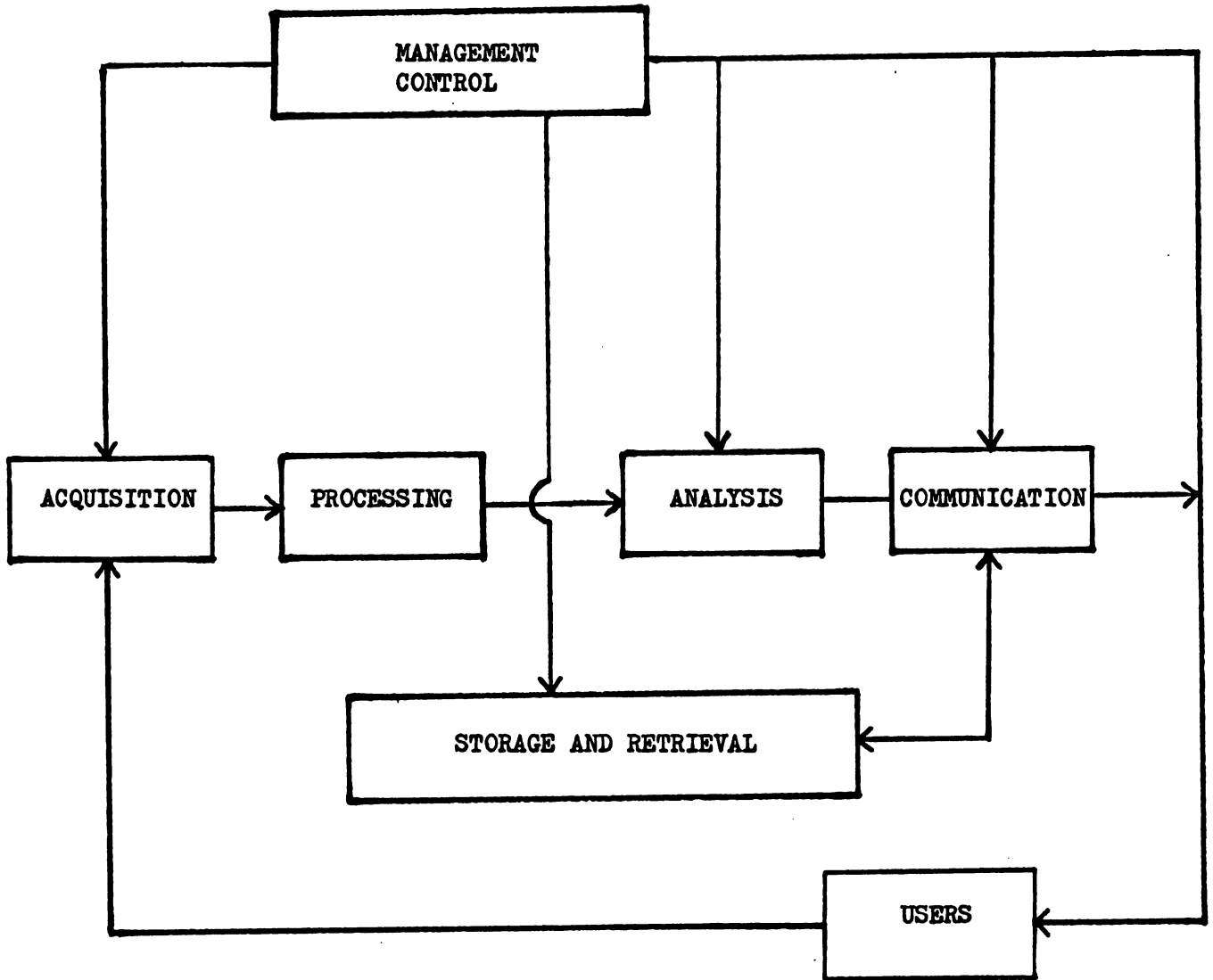
Figure 6. - Organisational Control of the System

Table 1. - <u>Staff Requirements</u>.

Units		Personnel
Management	-	2
Staffing & Training	-	3
Finance	-	3
Acquisition & Recording	-	5
Processing	-	5
Services	-	5
TOTAL	-	23

Each unit or division in the organisational structure requires highly competent and trained staff for managing its operations. The personnel requirements per unit would vary depending on its activities, but basically, a 1:4 ratio is most appropriate - i.e. one divisional head supervising four persons.   As time goes on, the complexity of the operations would increase.   This would necessitate increases in both the quantum and quality of the system's personnel if it is to efficiently achieve its objectives and survive. Management

must be very selective of its personnel in order to sustain and increase the level of efficiency of the system. It would be wiser in the absence of the required technical staff that personnel selected be functional in several areas.

The system's mission and operations determine the equipment and the facilities needed. These range from buildings to filing cabinets and computers. The type of facilities should always be selected for needs, applicability and economy. While these determine selection, there are certain minimum requirements that should be met to implement and operate the system at some minimum level.

The required equipment and facilities are directly related to the life cycle of the system. Information sources and volume increase everyday. Over time, the small simple systems would become uneconomical and inefficient to handle the increasing volume of information for users needs and purposes. The (input-output) operations become more complex especially when manual operations give way to computer and electronic processing facilities. Such requirements would then become inevitable and basic for the system's operations.

(b) The activities of the system and achievement of overall objectives depend on its financial resources. Financing an information system is often a burdensome activity for many governments and institutions. While it can be argued that the importance of the system

will certainly permit funding it, financial pressures in the parent organisation will adversely affect its performance and survival. This is especially so when the system becomes the easiest target for any budget cuts. Many systems are implemented, often stagnate and decay due to this reason. It is very important both in the design stage and at the operational level to estimate the required finances and identify the sources of such finance, both in the short and long terms.

There are three main areas of funding the system - initial costs, operating and maintainance costs and future requirements. Table 2. shows a summary of budgeting for the system.

When financial resources are very limited, expenditure should always be kept to the minimum. The initial and operating costs are the more important considerations in the design stage. After implementation, as the system develops, budgeting for the systems future requirements becomes increasingly important, as this would affect the future survival of the system.

4. 2. - Systems Development

It is often impossible for information to flow directly from producer to the user. There are many factors responsible for this. Information flows across several disciplines, barriers, distance language and boundaries before it is actually used. Though the direct communication between the producer and user is desirable and effective,

ITEM	INITIAL COSTS	OPERATING COSTS	FUTURE NEEDS
Facilities	Buildings, Offices, etc.,	Renovations from time to time.	Extensions
Equipment & Materials	Purchases - cabinets, files, paper, computer, etc.,	Repairs and re-placements as needed	New and Impro-ved equipment
Salaries & Wages	Consultants, etc.	Professional, non-Non-professional, clerical, etc.,	Promotions, Increments and additions.
Collection	Purchases of basic documents, books, journals	Document collection, subscriptions	New collections
Miscellaneous	Start-up costs - travel, etc.,	Services, training	Research, expansion of services, etc.,

Table 2. — Planning the Budget.

the direct channel is generally impractical. In addition, the flow process becomes more complex due to the increase volume of information and the increased number of potential users. Any very often, users do not require the information in the form or content in which it has been produced. As such, it becomes the primary function of the information system to acquire the information and reproduce it in the form and content needed by the user and at the time he needs it. This process is often a highly complexed one and depends on the development of the system. Between the input or acquired information, there are several basic processes through which the information flows (fig. 6).

4.2.1. — Acquisition

Information flow is a continuous process over time in the form of both inputs and output. It is important that the system acquire all the required information for its needs and objectives. The sources of such information flow must be arrested for the system's users. This policy of acquisition is determined by the system's mission and user needs. The selection policy should be stringent or else the system would be acquiring unwanted information at uneconomical cost. What must be established is a criteria for selection of relevant information for the system's needs. These criteria would

serve also as a source of control for relevant information acquisition. Some important guidelines for selective acquisition of information are established by answering the following questions :-

1. Who are the producers and potential users of the information ?

2. What do the users do with the information ?

3. Which are the sources of the required information ?

4. How often can the information be acquired from these sources ?

For agricultural planning purposes, the components of our system have established the relevant information the system needs. Yet, that itself is not precise for selection purposes, but merely gives a picture of the area to be covered for information collection. Detailed selection and classification is the responsibility of a particular unit.

Information flows mainly in unorganized and semi-organized forms. Most of this however is unorganized for user needs. The acquired data has to be organized into a package for effective and efficient utilization. The methods of data collection need to be emphasised here. In unorganized information systems, information is usually obtained in an ad hoc manner. An organized system requires

that the methods of collection be uniform and systematic.
Uniformity does not mean that the same procedures be
applied to all data collected.   Different types of data
require different approaches for collection.   Some
information may be obtained from sample surveys, some will
have to be extracted from documents and so on.
All the information needs of the system must be categorise
and methods of collection for each group worked out.

Once the sources of the information have been identi-
fied, a scheme must be drawn up identifying the type of
information and the time when such information is availabl
or to be collected.   For example, production figures shou
be collected weekly/monthly or by crop.   Some information
will be sent into the system.   These are often periodic
and are in the form of reports, journals and other publish
documents.   The scheme would thus be important so as to
outline the methodology for information acquisition by the
system.

4.2.2.   Documentation

As information is acquired, it has to be organized i
some manner for use.   Different types of information are
acquired in different forms.   The methods of collection
vary and it becomes essential that the large bundle of
information acquired be organized in some scheme based on

certain characteristics.   The process of storing the acquired information in an organized manner is referred to as documentation.

Two main considerations underlie this process-consistency and accuracy.   These are the essential guidelines of this process.   All documentation methods must be done in a consistent and accurate manner for they facilitate easy storage and retrieval.

The important aspects of documentation are classification and indexing.   In essence, these aim at designing a scheme such that any item or piece of information can be placed or fitted into a group by virtue of its role within the scheme.   Classification allows the acquired information to be logically arranged into a concenient form.   Indexing, on the other hand, serves as a locator of wanted documents and information.   It guides the user as to where a particular document is located.

In the acquisition process, it is extremely important for the following elements of information to be acquired with respect to any document or piece of information :

a)   Bibliographic details such as Title of document, Journal's title, volume, issue number, pages, publisher, date, document category: book, memo, letter, report, etc.

b)   Names of author(s) or producer(s)

c)   Subject

As information is acquired, they are placed under certain subject headings. The placement of the particular information however, depends on the classification scheme that is designed. For example, there can be subject headings such as rice, sugar, bananas, etc. Any piece of information that is acquired on any of the subject headings will be placed into its respective category. A format of this is shown below :

SUBJECT   -   <u>RICE</u>

1. <u>Acreage</u> - a) Harvested - years.

                   b) Sown.

                   c) Distribution

                       i) District

                      ii) Region

                     iii) District

2. <u>Price</u>   - a) Domestic

                       i) Consumer

                      ii) Wholesale

                  b) Export

                  c) Import.

3. Production - a) Annual

                       i) District.

ii) Region.

iii) Village.

b) Cost.

Or the classification scheme can be designed such that cost of production be one subject area, exports be one, imports, etc,. Whatever scheme is used, it must be consistent and accurate. The scheme must also be economical, both in terms of cost and time for its classification.

An accession number index tells the user where the information is located - in the library, on which shelf or in which file. In an open system, it is not essential for the user to state his requirements since he can interact with the files themselves. This is not so in a closed system such as those of government where the user has little access to the files. The operators of the system must clarify, define or translate the users requirements in terms of the index file to retrieve the wanted information. There is thus need to be greater precision in the closed system in indexing stored information. In addition, where users can be categorized in terms of their specific needs, the index plays a crucial role.

It is important that these functions be performed by

skilled and qualified people.   Since the basic objective
of classification and indexing is for convenient storage
and retrieval purposes, these functions must be performed
by qualified individuals or by those very familiar with
the system's retrieval requirements and procedures.

4.2.3.   <u>Processing and analysis</u>

Information processing and analysis is an organized
system for transferring to the user timely, authoritative
and evaluative information in a convenient form.   Often,
the acquired data is of little use to the user.

Some users would need raw data;   some would require
semi-processed and analysed data, while others still requ
highly processed information.   The degree to which the
data is processed and analysed depends upon the particula
use of it.   Also, processing and analysis transform inf
tion into a very convenient form for economical storage
retrieval.   Some prerequisite conditions must be fulfil
however before these processes are possible.

Editing is an important aspect of data processing.
permits the information or data to be carefully scrutini
to detect any error or omission and allows correction be
the next stage of tabulation is proceeded with.   Editi
gives accuracy and reliability to the data obtained and
ensures uniformity and completeness which facilitates e

coding and tabulation.

Coding transforms data into a machine readable format.
It is the reduction of information from long sentences and
words into smaller indices that are more convenient for
processing purposes.

There are many ways of processing information. The
type used depends on the available data, facilities and
uses to which the data is put. Very often for decision-
making purposes, information has to be processed and re-
processed before they are used by planners and decision-
makers. The complex relationship in the agricultural
sector would necessitate use of machines for processing
acquired information. A further advantage is that
computers give greater dimensions and usage for any
particular piece of data.

Through various programs, the computer is instructed
to perform its task. These programs are written in various
languages and it is important to understand these languages
before the system can attempt to use such processing
facilities.

Data analysis and processing operations are very
intertwined. Processing facilitates easy analysis of a
large bulk of data. The key activities in analysis is to
interpret, synthesize and evaluate the information for

assimilation by users.   This function is highly specialis

and requires such personnel as statisticians and econome-

tricians if there is to be effective information analysis.

A highly specialised unit is required for synthesizing

information in a specially defined area or any particular

field.   The unit must provide new and evaluative informa-

tion for decision-makers.   It must be mission-oriented

and for it to be very effective, it must work closely with

planners, decision-makers and also those engaged in resea

4.2.4.   <u>Storage and Retrieval</u>

The key to easy storage and retrieval of information

is efficient documentation - coding, indexing and classif

tion.   Once the documentation procedures have been logic

performed, easy retrieval becomes possible.   Also, when

same persons engage in documentation and retrieval, there

are less problems of retrieving any given stored piece of

information.   This is permitted easily in a closed infor

tion system.

Information can be stored in a raw form or in a high

processed form.   Whenever a particular piece of informa

is used for a variety of purposes, it is often more econ

that it be stored in a raw or semi-organized form.

Information storage is related to the data base.

data base can be considered as the set of primary information acquired and available to any user or group.   Establishing a data base is the primary objective of the system after its implementation, and it then becomes crucial for the functioning of the system.   The data base also indicates the weaknesses and gaps in the stored information.

The data base is often designed in a hierarchical structure, divided into a series of files.   These files are usually related to the characteristics of the classification scheme.   A piece of data is assigned into one or more portions into this structure.   Some of the files may be used very often and these should be readily accessible. Once the data has been stored, whether in files, folders or magnetic tapes, their positions must be located before they can be retrieved.   If there has been consistency and accuracy in the classification scheme, accession problems would be few.

As the data base grows, the storage capacity of the system must increase.   In the manual labour-intensive system, it means more files, more clerks and cabinets.   In the automated system, there will be need for larger files and additional computer tapes.

An important aspect of the data storage system is the continual updating of the data base, and this depends very much on the acquisition unit.   Updating can be divided into two parts - updating of the record file and updating

of the service files.   Updating of the records is the

main form of operation of the system.   It is mainly

concerned with updating records already known or informa-

on new subjects.

For retrieval purposes, there are two modes for

identifying the stored data - explicitly labelling

and positionally tagging them.   Labelling allows the dat

to be identified and is commonly used in narrative types

of data.   Automated systems use the position tag for

storing a piece of information.   Each piece of datum is

placed in a position on a magnetic tape or punched card

which minimizes wastage of space.

Retrieval of the stored information depends essentia

on the index file.   The crux of the retrieval operation

is to match an inquiry whose index terms corresponds to

the index term of the document or required information.

Searching can also be done by computer where the storage

tape file is consulted for a particular piece of informa-

tion.   Retrieving the required information with a query

can be represented by a matrix as shown in Table 3. below

DOCUMENTS

	1	2	3	4	5	6	7	8	9
A	X					X			X
B	X		X						X
C						X			
D		X			X				X
E				X			X	X	
F			X			X		X	
G		X							X

TERMS OF QUERY

Table 3. - Matrix for Retrieval

The numerals 1 through 9 represents index documents while A through G represents vocabulary terms that are indexed. Term A can be found in documents 1, 6 and 9. Document 9 contains terms A, B, D, and G. The matrix shows the indexed location of particular pieces of data or information.

The objective of retrieval is to get the maximum number of elements out of a file for a query while keeping the number of irrelevant records to a minimum. This depends on the efficiency of the earlier stages of the information flow in the system. The operating efficiency of the retrieval system can be ascertained by such criteria as relevance, precision and recall. The cost factor must also be taken into account when evaluating the retrieval system, because storing information

is one thing, and retrieving such information can be very costl
both to the user and the system as a whole.

4.3. - Services

The fundamental parameter of the system is services.   Wha
are the kinds of services the system will provide ?   The main
factors affecting these are :-

1.   The goals of the system and its users.

2.   The size of the community.

3.   Character and resources of the "parent" organisation.

4.   Priority of services to be offered.

5. ᵉ The implications of information use - productivity.

Having outlined the goals of the system earlier, it would
be important to identify the users of the system, since the
services the system offers are related to information usage.
The main groups of users are :-

1.   Important officials - Ministers, Permanent Secretaries,
      etc,.

2.   Planners, decision-makers, etc.,

3.   Other users directly related to the system.

4.   Others.

Identifying the main groups of users usually influence
priorities in dissemination policy and the appropriate methods

for disseminating the information. This is especially so when the system is "very" closed and under various economic and political pressures, and there is a deliberate policy to keep information under "cover". This policy, however, poses a danger to the very existence of the system in the longer run. This situation exists with many information systems in the developing countries and the tendency is for many of them to outlive their usefulness in a very short time. There is need to be reminded that the system exists to perform services and these are related to user needs. The user then must be integrated into the system as an active participant, whose needs direct the design of the system while the information base responds to his requirements.

Services can be grouped into four main areas :-

(a)   Inquiry.

(b)   Documentation.

(c)   Dissemination.

(d)   Special activities.

(A).   Inquiries - These are requests for information and may be both general and specific. Each request should be analytically processed since some tend to be clear and well defined while others are ambiguous and poorly articulated.

(B).   Documentation - The system generates information also

through its own publications.   One important aspect of
publications is for the system to publish periodically
selective information that are regularly required, such
as for example, A Quarterly Digest of Agricultural
Statistics.   This can be an assignment by the parent
organisation.   The system can also be called upon to
assist in the preparation and production of certain
output documents.   The tasks include writing, editing,
duplicating and publishing, and much of this involves
manipulative information.   A special publications unit
would be needed to disseminate such information.   The
various publications the unit can publish are :-

1.   Brochures - describing and promoting activities,
       announcements, etc,.

2.   Newsletters - information and news.

3.   Current bulletins - information for current awareness

4.   Periodicals - journals of statistics, research, etc,

5.   Reprints and photocopies.

       The periodical publication is perhaps the most
important, especially for those individuals and insti-
tutions directly involved in the sector's activities.
This is a very important service.   There can also be
descriptive and informative abstracts.   These help to
keep individuals abreast of current developments and it

is an extremely important service especially to those
engaged in research.

(B). Dissemination - There can be selective dissemination
of information to various users. In fact, most informa-
tion systems practice selective dissemination of informa-
to various extent. In a closed system, selective
dissemination is of greater importance. For example,
"high-powered" officials usually need certain types of
information very regular, such as production figures, or
market prices of a particular crop or commodity every week.
Other officials related to the system will need certain
types of data less regularly. The periodical can fulfill
this need. And there can be selective dissemination of
publications.

(D). Special activities - Part of the service must be related
to surveillance and research in order to understand present
and future requirements of actual and potential users.
The user is the most important element in the cycle, and
face-to-face contact produces the most effective user
relations. Such activities help the system to adjust
continually to the needs of the user.

4.4. Systems Maintainance

Sustainance and survival requires that the system
be maintained on a continuous basis. Maintaining informa-

tion systems is often a very costly activity.   Over time
the system has acquired more information than it can
presently handle.   There is need for more physical
facilities - files, cabinets and so on.   Then there is
the need for more skilled and qualified personnel.   Ther
is also the need to increase the methods of dissemination
of information - more documents and reports, regular
newsletters, etc,.   These represents various areas of
maintaining the system.   Costs saving and cost avoiding
instances should be important guidelines, and anticipatic
and regular planning for the future should be priorities
in day-to-day management of the system.

An efficient information system usually keeps op-
erating costs to a minimum and avoid unnecessary costs
from time to time.   This depends on management perform-
ance.   The system must perform like any other enterprise
Costs and benefits must be evaluated at each level of
operation.   Efficiency and effectiveness will justify a
given level of maintainance.

Two other aspects of maintainance need mentioning
are adjusting to the environment and improving the data
base.   The latter has already been stressed upon.   The
ability of the system to give to its immediate users cur
information when they need it is an important area for

data management.   Adjusting to its environment is also

a must for the system.   Many systems are unable to

adjust over time, resulting in stagnation and decay in

a short time.   To extend its life cycle, the system

must be competitive with other systems in the environment.

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