A FRAMEWORK FOR QUANTITATIVE MICRO-LEVEL RESEARCH IN DEVELOPING COUNTRIES USING DATA BASE MANAGEMENT SYSTEMS

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ABSTRACT

A FRAMEWORK FOR QUANTITATIVE MICRO-LEVEL RESEARCH IN DEVELOPING COUNTRIES USING DATA BASE MANAGEMENT SYSTEMS

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Agriculture plays a vital role in the economy of developing countries. These countries face two fundamental problems; a rapid increase in population growth and a severe shortage in cultivable land. Also, there is a void of reliable micro and macro economic data. Insufficient economic data is being collected, analyzed, and fed into the decision-making process. These factors led to the failure of the current systems to generate the economic data and analysis needed for the development of sound plans and rational agricultural policies in developing countries. Therefore, it is essential to have reliable and adequate data set to establish a basis for farm management information system to support the operation, management, and decision making functions in developing countries.

The purpose of this study is to design a framework for quantitative micro-level data collection and analysis using database management systems such as FARMAP and dBASE III

PLUS and establish a basis for farm management information system with its four components: descriptive, diagnostic, prescriptive, and predictive information. A set of comparison criteria was identified to study the usefulness of both programs to carry out micro-level research in developing countries.

Due to limited funds and time constraints, secondary data was chosen from another farm survey project of a developing country (Indonesia, West Java). A modest sample size of ten farms was used to accomplish the objectives of the study.

Both FARMAP and dBASE III PLUS are very powerful and excellent tools for carrying out micro level research in developing countries. They provide a unified system for data collection and analysis and a basis for farm management information system which is highly needed in developing countries to correctly evaluate policy alternatives. They also provide means of interfacing data with other statistical and economic planning tools needed for further processing.

Dedicated to my wife, Eman.

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CHAPTER 1

INTRODUCTION

1.1 Agriculture and the Economy of Egypt

Agriculture plays a vital role in the economy of Egypt. It is the basic and most important sector, and the back-bone of the economy of the country. Egypt has one of the richest endowments of agricultural resources on the African continent, which include unusually favorable land, water, and climatic resources. The total area of Egypt is about one million square kilometers, or nearly 238 million feddans[1] of which only 6 million feddans are cultivated. This represents only 3 percent of the total area and deserts cover the remaining 97 percent (Figure 1.1). This nation's farmland, the Nile Valley, is a strip of 600 miles long and up to 10 miles wide before broadening out into the fertile Delta region lying between Cairo (the nation's capital) and the coast. The total area under cultivation in Lower Egypt is 3.67 million feddans, 1.2 million feddans in Middle Egypt, and 1.06 million feddans in Upper Egypt. However, the total area cultivated is about 10 million feddans with the use of multiple cropping practices. This accomplished with the assistance of perennial irrigation after the completion of the first phase of the High Dam in 1965.

The population of Egypt was 45.2 million in (1983)[2],

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[1] one feddan = 1.038 acres = 4200 square meters

[2] World Bank, World Development Report 1985, 1985.

represents about 3% of total area

Figure 1.1 THE CULTIVATED AREA IN EGYPT AS A PERCENT OF TOTAL AREA

and thus the man/land ratio equals to about 0.14 cultivated feddans per capita. The average annual population growth rate is about 2.5 percent which adds over one million newborns each year. Egypt's total GDP equals US $27.92 billion of which 20 percent is produced by the agricultural sector. The GDP average annual growth rate for the agricultural sector was approximately 2.5 percent for 1973-83. The value added in agriculture was $4.7 billion in 1983. The GNP per capita amounted to $700 per year with an average annual growth rate of 4.2 percent during 1973-83. About 50 percent of the total labor force (i.e. the population between the age of 15-64) is engaged in agriculture.

The agricultural sector consists mainly of two major sub-sectors (Table 1.1):

1. The Plant Production Sub-Sector: includes crops, vegetables, and horticulture. This sub-sector represents more than 70 percent of the total value of the agricultural production.

2. The Animal Production Sub-Sector : includes meat, milk and dairy products, wool, eggs, poultry, and honey and wax. This sub-sector represents 30 percent of the total value of agricultural production.

Table 1.1 VALUE OF AGRICULTURAL PRODUCTION FOR EGYPT, Years 1978-81.

Item	1978	1979	1980	1981
	(Current prices in millions LE[1])			
Crop production				
Field crops	1800	1799	2201	2534
Vegetables	411	518	547	622
Fruits	172	224	255	294
Aromatic and medicinal	22	19	18	16
Subtotal	2405	2560	3021	3466
Animal production				
Meat	365	409	549	565
Poultry	112	120	166	214
Milk and dairy products	304	346	408	517
Eggs	68	78	96	137
Wool	3	4	4	4
Honey and wax	5	5	6	8
Subtotal	852	962	1229	1441
Total	3257	3522	4250	4907
Requisites	1056	887	1064	1456
Grand total	2201	2635	3186	3451

[1]One LE = Egyptian Pound = US $ 1.19 in 1983
= US $ 0.74 in 1986 after the government devalued local currency by more than 50 %.

Source: Ministry of Agriculture, 1983.

1.2 Statement of the Problem

Egypt's agriculture has been limited to a narrow strip of land along the banks of the Nile River in Upper Egypt and the fan-shaped Delta in Lower Egypt. The country faces two fundamental problems; a rapid growth in population and a severe shortage of cultivable land. While the cultivated area remains almost unchanged, the population has more than quadrupled from 11 million in 1907 to 45.2 million in 1983 with an average annual growth rate of 2.5 percent.

As late as 1960 Egypt was essentially self-sufficient in food production. However, in the last two decades Egyptian food production has failed to keep pace with utilization (i. e. human and animal consumption, industrial use, and waste), and the country has become increasingly dependent upon food imports to meet its needs. In 1981 Egypt imported US $4 billion of agricultural commodities while exporting only US $700 million of agricultural commodities[1]. Until the early 1970's, Egypt's agricultural sector was a major contributor to the national economy and a major source of foreign exchange earnings. Since the October War of 1973, however, the economic situation of Egypt has changed dramatically. Petroleum exports, remittances from Egyptians working abroad, tolls from the Suez Canal, and tourism have become the major sources of foreign exchange (Table 1.2).

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[1]International Agricultural Development Services, Increasing Egyptian Agricultural Production Through Strengthened Research and Extension Programs, 1984.

Table 1.2 BALANCE OF PAYMENTS IN GOODS AND SERVICES OF EGYPT Selected Years 1952-80, Egypt.

Item	1952-58	1959-66	1973	1978	1980
			(US $ million)		
Exports (f.o.b.)					
Cotton	+345	+362	+688	+558	+620
Petroleum	0	0	+113	+688	+2,730
Other	+98	+152	+323	+886	+1,342
Total	+443	+514	+1,124	+2,132	+4,692
Services					
Sues Canal	+88	+164	0	+541	+650
Remittances	0	0	+86	+1,760	+2,545
Other net	-26	-58	+79	+1,145	+1,460
Total (net)	+62	+106	+165	+3,446	+4,675
Imports (c.i.f.)					
Food	-52	-201	-208	-1,355	-2,590
Other	-506	-703	-1,456	-5,496	-7,457
Total	-558	-904	-1,664	-6,851	-10,047
Net balance on goods and services	-73	-202	-654	-1,273	-608
Debt payment	-8	-56	-407	-899	-1,313
Foreign exchange deficit	-81	-258	-1,061	-2,172	-1,921
Supply of funds	+11	+203	+945	+2,113	+1,397
Change in reserves	-70	-53	-116	-59	-524

Sources: The figures for 1952-73 are from K. Ikram, Egypt: Economic Management in a Period of Transition, 1981. The later years are from Egypt, Central Bank of Egypt, Economic Bulletin, various issues.

Compared with the other sectors, the agriculture sector has shown the slowest growth, about 2.5 percent per year between 1975 and 1980.

Several factors have contributed to the agricultural sector's current situation of a rapidly widening gap between the production and consumption of agricultural commodities. These factors include:

1. A relatively low level of investment in agricultural research and extension programs to develop and make available improved technology to the farmer.

2. Production of food and agricultural products has grown slowly .

3. A dramatic lack of reliable micro and macro economic data to carry out microlevel research. The absence of quantitative analyses, microcomputer applications, database management systems, and modern analytical techniques led to a very poor and unreliable data on which to base policy decisions.

With regard to the data situation, Robert Mabro (1974), argues that,

> "There is a wealth of statistical material on the Egyptian economy, but little is usable without much processing and elaboration".

Difficulties with validity, and consistency of Egyptian data have confronted most researchers. Scobie (1981) expressed typical frustration as illustrated by the statement:

> "One cannot help express grave concern about the permanent damage done to the import data as officially reported by Egyptian authorities. A researcher who may be interested in this type of economic activity will have to check the official data against the world's commodity exports to Egypt."

The current system fails to generate data and analyses needed to develop sound plans and rational policies. Decision-makers do not have the information necessary for sound decision-making. Data currently available do not provide the basis for economic and financial policy analyses. Therefore, decision makers are tempted to institute policies which are politically popular because they do not comprehend the economic costs.

The data collection and analysis problem has four inter-related aspects: (1) insufficient economic data is being collected, analyzed and fed into the decision-making process; (2) the capacity to utilize whatever data and analyses available is not sufficiently developed; (3) links which integrate the research and analysis process into the decision-making process are weak or missing; and (4) the data has limited value because delays and errors related to the manual checking and tabulation of the collected data.

4. The demand for food has been rising sharply as a result of rapid population growth, and substantial increases in per capita food consumption due to increasing incomes and substantial government subsidies for food.

5. The agricultural land resources are scarce. They represent only about 3% of the total area. Moreover, a

complete soil survey of the present cultivated land has revealed that the productivity of fully one-half of its area has deteriorated to the extent that it is now classified as medium or poor soils, as a result of perennial irrigation without adequate accommodation for proper drainage (El-Tobgy, 1976).

6. The influence of the government policies, such as setting of prices for inputs and outputs, subsidies, planting quotas, and resource allocations, on agricultural production and cropping patterns. These policies, especially price polices and subsidies, encouraged consumption and discouraged production.

The effect of the previously discussed factors has caused a rapidly widening gap between the levels of production and food consumption (Figure 1.2). This gap will continue to widen unless something substantial is done to expand production and reduce the rate of growth in domestic consumption.

Even with the utilization of high crop yielding varieties, based on the world standards or the U.S. average yields for comparable field crops Egypt has enormous potentials to further increase its agricultural output on existing arable lands (Egypt: Strategies for Accelerating Agricultural Development, MOA/USAID in cooperation with IADS/USDA, 1982). The failure to develop and use improved production technology is one of the most important factors preventing the realization of the nation's agricultural

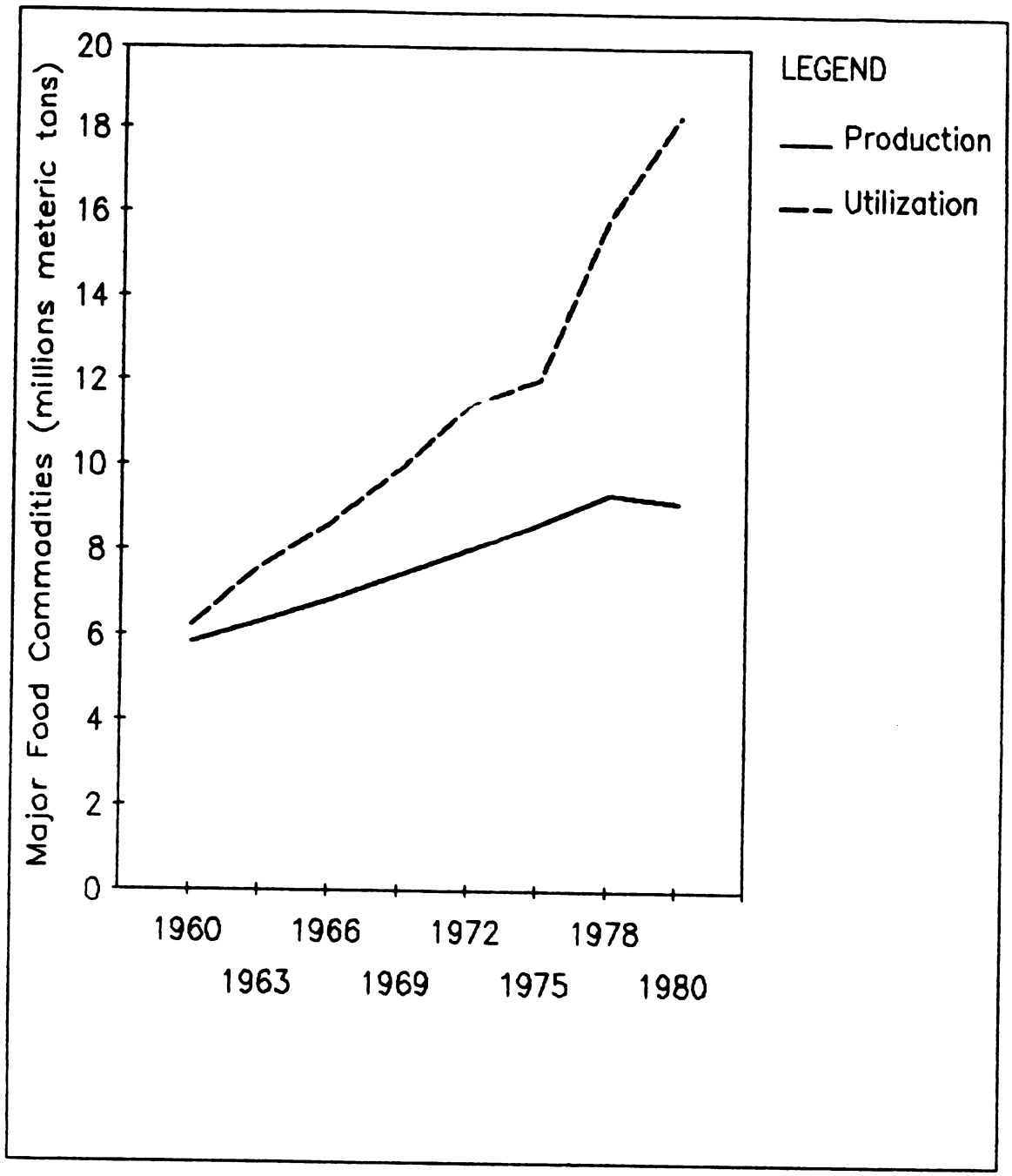

Figure 1.2 PRODUCTION AND UTILIZATION OF MAJOR FOOD STABLES OF EGYPT, Years 1960-1980.

Source: adapted from Wally, Y., Strategies for Agricultural Development in the Eighties, 1982.

development potentials. Priority should be given to investigating economic aspects of the Egyptian agricultural systems because of the enormous influence of government policies.

There are numerous constraints facing the full development of agriculture in Egypt and problems lying ahead which are far greater than the problems that have been solved. It is true that a concerted effort has been made during the last two decades and that the results have been gratifying, but there still remain several serious problems which are awaiting future solutions and actions (El-Tobgy, 1974).

1.3 Purpose of the Study

This study has as its focus subsistence and semi-subsistence smallholder agriculture with strong linkages between farm production and household consumption. The agricultural sector of Egypt will be descirbed as an example of the subsistence smallholder agriculture in developing countries. The study addresses potential of the usefulness of using some database management systems such as FARMAP and DBASE III as economic research tools. The purpose of the study is to design a framework for quantitative data collection and analysis, using FARMAP and dBASE III and thus create a unified system of rural data collection and analysis. A system of this nature will strengthen planning and policy decision because better information will be

available on resource use and production technologies employed.

1.4 Objectives of the Study

The objectives of the study are as follows:

1. To describe the Egyptian agricultural sector and the constraints which limit agricultural development.
2. To develop an analytical model which can help economic analysts better utilize Database Management Systems (DBMS's) through evaluating and describing FARMAP and dBASE III PLUS structures and techniques.
3. To study the usefulness of using DBMS's in the quantitative analysis and to develop a database structure appropriate for farm management and production research in a farming systems context. Also, to evaluate the impact of using microcomputers in data processing and analyses.
4. To review how DBMS's can be interfaced with economic analysis techniques such as statistical methods and planning techniques.
5. To develop data management policy recommendations for the Ministry of Agriculture in Egypt.

1.5 Organisation of the Study

Chapter 2 describes the Egyptian agricultural sector, its development, and its policy problems. It also reviews major studies on database management systems (DBMS's), and data types and structures.

Chapter 3 contains the methodology, describes data sources and steps employed in designing data structures. In Chapter 4, the model is presented with a description of the structure of FARMAP and dBASE III PLUS. Chapter 5 describes the results of the application of FARMAP and dBASE-III PLUS, their limitations and operational difficulties, and a brief discussion of other complementary techniques which can be interfaced with both programs to conduct economic analysis.

A summary, policy implications, limitations of the study, and suggestions for future research are presented in Chapter 6.

CHAPTER 2

BACKGROUND TO THE STUDY

2.1 The Agricultural Sector in Egypt

In this section, the agricultural sector of Egypt is described as an example of the subsistence smallholder agriculture in developing countries. The emphasis is given to describe the constraints which limit agricultural development.

2.1.1 The Country : Basic Information

1. Location

Egypt occupies the north eastern corner of Africa. It is located between latitudes 22 and 32 north and longitudes 24 and 37 east, and bordered by the Mediterranean Sea to the north, Sudan to the south, the Red Sea to the east, and Libya to the west Figure 2.1. The total area of the country is 1,001,450 square kilometers and the country is divided in to three geographic regions:

a. The Nile Valley and Delta

b. The Eastern Desert and Sinai

c. The Western Desert

Only about three percent of the total area is cultivated which represents the narrow strip of land along the banks of the Nile in Upper Egypt and the Nile Delta.

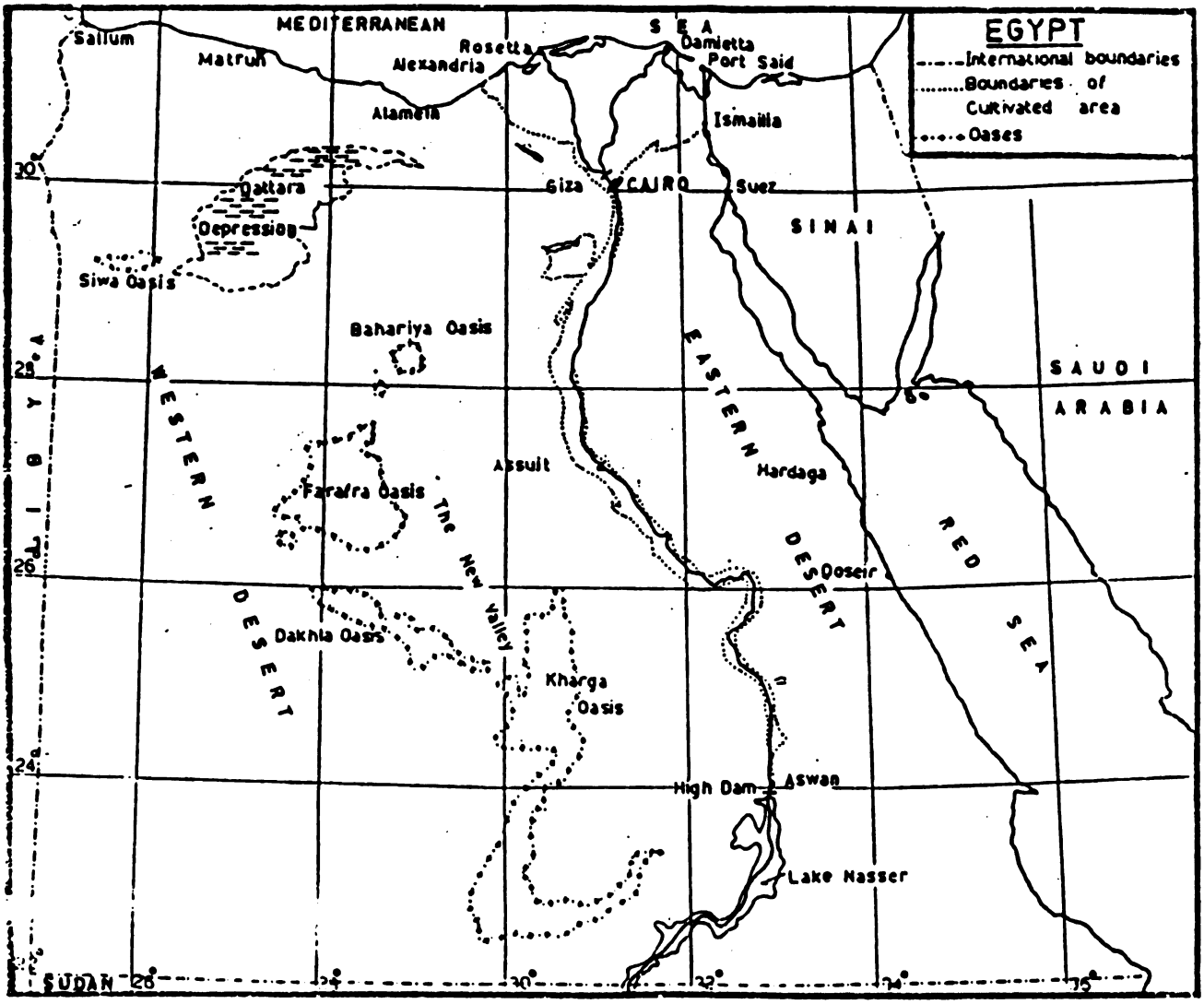

Figure 2.1 GEOGRAPHICAL MAP OF EGYPT.

2. Climate

Egypt has a moderate climate the year around. Table 2.1 gives the seasonal and annual averages of temperature, relative humidity and rainfall for selected locations. The climate can basically be divided into two climatic zones. The first comprises the Delta and the Mediterranean coast which is characterized by a mild and somewhat rainy winter and warm rainless summer. The second covers the rest of Egypt south of Cairo and has a mild, almost rainless winter and a dry hot summer.

In general rainfall is negligible and Egypt totally depends on irrigation for its agriculture except for a very small area in the northern desert coast, where rainfed barley, castor bean, figs, olives, and almonds are grown. This limits the cultivated area to only three percent of the total area irrigated from the Nile River.

3. Population

The population of Egypt is 45.2 million. Its average annual growth rate for the 1963/73 period was 2.3 percent. It increased to 2.5 percent for the period from 1973 to 1983. Several population projections estimate that Egypt's population will reach 52 millions in 1990 and 63 million in year 2000 (World Bank, 1985). The majority of population is rural, but the ratio of rural / urban population has been declining during the last three decades (Table 2.2).

Table 2.1 CLIMATOLOGICAL NORMALS OF EGYPT

Locality	January Ave. Temp. max.	January Ave. Temp. min.	January Ave. Humid. %	July Ave. Temp. max.	July Ave. Temp. min.	July Ave. Humid. %	Annual Ave. Temp. max.	Annual Ave. Temp. min.	Annual Ave. Humid. %	Rain m m
Mediterranean Coast:	18.1	9.6	70	29.7	22.3	73	24.6	16.2	70	134.2
Delta	19.8	6.9	79	34.5	20.2	71	27.9	14.0	74	46.7
Cairo	19.4	8.6	59	35.4	21.5	52	28.1	15.4	55	23.8
Upper Egypt	21.4	6.0	61	37.8	21.8	43	30.8	14.9	49	6.4

1) Temperature in Celsius

Source: adapted from EL-Tobgy, H. A.," Contemporary Egyptian Agriculture." 1976.

Table 2.2 URBAN AND RURAL DISTRIBUTION OF EGYPT

Year	Urban	Rural	Total
	Thousands		
1937	3,981	11,940	15,921
1947	5,880	13,087	18,967
1960	9,834	16,251	26,085
1966	12,385	17,691	30,076
1976	16,098	20,589	36,687
1983	20,340	24,860	45,200

Sources: data for the period from 1937 to 1976 is adapted from CAPMAS, " Population Census of Egypt", 1983, and for the year 1983 from , World Bank "World Development Report", 1985.

About 50 percent of the total labor force, which is 57 percent of the total population, is engaged in agriculture. With the limited amount of cultivated land available, the population density per square kilometer of inhabited land exceeds 1290. Therefore, unless progress is made, food demand will substantially and continuously exceed food supply.

4. Soil

The soil of Egypt may be classified in the following groups:

1. Alluvial: level, deep, black, heavy to medium in texture, constituting about 75 percent of the cultivated area in the Nile Valley and the Delta.
2. Marine alluvial: recent, level, heavy in texture, black in color, and mostly saline. It is located around northern lakes.
3. Residual calcareous (Brown Calcy): light to medium in texture and undulated. It extends along the Mediterranean Coast.
4. Sandy soils and sand dunes: located mostly in Sinai and the Oases.
5. Gravely sandy soils: undulating, mostly in the eastern and western deserts.

Before the construction of the High Dam, the amount of suspended matter carried by the Nile river from its sources in Ethiopian and Victorian plateaus used to reach its

maximum during the flood season. This suspended matter contained 55 to 64 percent clay, 25 to 30 percent silt, 6 to 17 percent fine sand, and negligible amount of coarse sand. However, these amounts have been decreased substantially after the construction of the High Dam.

In general, the Egyptian cultivated area can be graded mostly as excellent, with respect to soil quality.

Despite the large land area (238 million feddans), land suitable for development and cultivation is a great constraint. Only about six million feddans are under cultivation with a cropping intensity of about 1.9 crop/season.

5. Water Resources

Egyptian agriculture is confined to the Nile Valley and Delta and is totally dependent on irrigation from the Nile River, as the country is practically rainless. Two exceptions are the groundwater irrigated land in many depressions in the Western Desert and the small rainfed area along the Mediterranean Coast and Sinai. After the construction of the High Dam in 1965, the perennial irrigation system was introduced, it has been possible to obtain two or three crops a year from the cultivable land, However, imperfect water management is a serious constraint. Conveyance losses in on-farm channels are high because of poor design. Poor land-leveling, and low flow-rates cause uneven field distribution and total water applications that

greatly exceed actual crop needs. Inadequate drainage results from poor maintenance of field drains and/or main drains. These imperfections results in reduced yields, and restrict crop intensification. In addition, waterlogging and secondary salinisation are by-products of heavy irrigation.

2.1.2 General Features of Egyptian Agriculture

1. Cropping Seasons

The agricultural year is divided into three seasons. It starts with the winter season on the first of September. The main winter crops include wheat, barley, clover (Egyptian berseem), broad beans, lentils, fenugreek, chickpeas, lupine, onion, flax, and winter vegetables. Planting starts in October and harvesting starts in April. The second season is the summer season. Summer crops include: cotton, rice, maize, sorghum, summer onion, groundnuts, sugar cane, sesame, millet, and summer vegetables. These are usually planted in March to June and harvested between August and November. The last season is the nili season, named after the Nile flood season. The nili crops include maize, sorghum, rice, and vegetables. These are planted in July and August and harvested in October and November.

2. Cropping Patterns and Cropping Rotations

Due to the availability of water all year round, continuous cropping is the general feature of Egyptian agriculture. Crop rotations relate to the sequence of crops

during the cropping season of the year and/or successive years, depending on the area cultivated by the main crop in the rotation. Crop cultivation usually follows a two or three year rotation. Crop rotations also vary according to the crops involved and the soil fertility. The most common one is a 3-year cotton rotation, in which the area is divided into approximately three equal plots. The first is planted with a temporary cover (catch) crop of clover in winter, followed by cotton which is planted in March as the summer crop. The second plot is planted with clover or winter legumes and the third plot is planted with wheat in winter. Both the second and third plots are followed by either maize, rice, or sorghum as summer crops. The sequence is rotated among the three blocks during the second and third year, and so on.

The second common rotation is a 2-year cotton rotation, where the area is divided into two equal plots. The first is sown by temporary clover in winter followed by cotton as the summer crop. The second plot is divided into two sub-plots, one for clover or legumes and the other for wheat or barley, both are followed by maize, rice, or sorghum. The sequence is alternated in the second year between the two plots. In addition, there are 3 to 6-year sugar cane rotations with the inclusion of other crops and vegetables in different rotations . Inter-cropping, where a secondary crop is grown simultaneously with the main crop, is recently adapted and is becoming more commonly used.

These special features of the Egyptian cropping system are related to the severe pressure on the limited cultivated land. In addition, pricing policies, required planting area regulations, delivery quotas and other sorts of government interventions, affect the cropping patterns and cropping rotations dramatically as will be explained in sub-consequence sections.

3. Land Tenure

One of the problems which has hampered the application of modern technology in Egyptian agriculture is the severe fragmentation of land holdings occurring throughout Egypt. Many farms have become so small that they are no longer able to support the farm families living on the farm. This fragmentation is mainly a result of Egyptian Government's policies. These policies are related identified desirable sociopolitical results. In addition, it is also a result of the traditional Muslim pattern of inheritance (i.e. when a farmer dies, holdings are distributed among all the farmer's children).

Three major Agrarian Reform Acts have been issued. The 1952 Act lowered the maximum holding to 200 feddans (1 feddan = 1.038 acres = 4200 square meters). After the 1961 and 1969 Acts, the limit of maximum holdings was lowered to 50 feddans per individual owner and 100 feddans per family (i.e. family includes husband, wife, and minor children) (see Table 2.3).

Table 2.3 DISTRIBUTION OF LAND OWNERSHIP IN EGYPT. Years 1952-1961.

Holding Size (feddans)	Landowners ('000)	Area owned (1000fd.)	Percent of landlords	Percent of area owned
	(1) Before 1952 Land Reform Law			
Less than 5	5,642	2,122	94.3	35.4
5-10	79	526	2.8	8.8
10-20	47	638	1.7	10.7
20-50	22	654	0.8	10.9
50-100	6	430	0.3	14.3
More than 200	2	1,177	0.1	19.9
Total	2,801	5,984	100.0	100.0
	(2) After 1952 Land Reform Law			
Less than 5	2,841	2,781	94.4	46.5
5-10	79	526	3.6	8.8
10-20	47	638	1.6	10.7
20-50	30	818	1.0	13.7
50-100	6	430	0.2	7.2
100-200	3	437	0.1	7.2
More than 200	2	354	0.1	5.9
Total	3,008	5,984	100.0	100.0
	(3) After 1961 Land Reform Law			
Less than 5	2,919	3,173	94.1	52.1
1-10	80	526	2.6	8.6
10-20	65	938	2.1	10.5
20-50	26	818	0.8	13.5
50-100	6	430	0.2	7.1
100	5	500	0.2	8.2
More than 100	0	0	0	0
Total	3,101	6,385	100.0	100.0

Source: adapted from El-Tobgy, H. A., Contemporary Egyptian Agriculture, 1982.

As the farm size decreases, the livelihood it provides also decreases unless farmed with greater intensity. This situation has led to a questionable economic viability of these small farms with a rapid increase in their rental values (i.e. the gross and net margin are very small).

A project was started in 1961 for consolidating small holdings by regrouping them into larger blocks at the village level without affecting private ownership rights. The consolidated plots range from 20 to 300 feddans. The consolidation program has enabled the country to plan and control areas to be planted by crops every year. However, there exist many limitations facing the full application of this program.

4. Agricultural Inputs

This section reviews and assesses the status of the major agricultural inputs affecting crop production. The inputs considered include improved seed production, hired agricultural labor, equipment and machinery resources, agricultural chemicals, and agricultural credit. Irrigation water supplies was considered earlier.

a. Improved Seed Production

Availability of quality certified seed has been identified consistently as a major bottleneck for achieving higher yields. Certified seed growers are paid a premium over the current price of the commercial crop. This premium

is used to defray part of the cost of seed cleaning, bagging, transportation, certification, etc.

Because of the high seeding rates used by Egyptian farmers (which are 3 to 5 times those of the international level) and because of poor seedbed preparation and hand sowing operation there is never enough certified seeds to meet the farmers' need. Therefore, the farmer uses his own seeds to supplement to good seeds. Also, the introduction of better machinery for seedbed preparation and fungicidal seed dressing would reduce the quantity of certified seeds required.

b. Hired Agricultural Labor

The issues of labor availability are important because they are basic considerations in the selection of appropriate mechanization strategies, cropping patterns, and improvements in the general rural welfare. Recent increases in wage rates and occasional shortages of hired labor are due principally to supply constraints due to migration of agricultural laborers. Other reasons for occasional shortages include military service, increase enrollment in school, and increased farm fragmentation (Goueli, 1981). Yet, no precise measurement of supply/demand variables affecting agricultural labor markets exists. Currently, there is a need for inducing selective mechanization and the adoption of technologies without large labor-displacing effects (Taylor, 1983).

c. Agricultural Mechanization

Mechanization of agriculture in Egypt is limited in scope. Most of the farm operations are still done by manpower and draft animals. The data on the amounts, capacity and condition of various types of farm equipment are subject to controversy. However, a substantial proportion of plowing, water pumping, spraying, and threshing are now partly mechanized.

The need to expand research and development regarding machinery and equipment utilization for Egyptian farming conditions is crucial.

d. Agricultural Chemicals

Farmers are supplied with subsidized fertilizers and pesticides through Agricultural Cooperative and Credit Banks. Allocations and availability of fertilizers are currently a major problem. However, serious problems and losses exist in handling, storage and delivery of fertilizer supplies. In addition, fertilizer is wasted due to over-irrigation, and broadcasting by hand which leads to volatilization of ammonia nitrogen. More research and development are needed with respect to appropriate fertilizing levels and application methods.

e. Agricultural Credit

The availability of agricultural credit, both in cash and in kind, to farmers plays an important part in the

Egyptian Agriculture. The Principal Bank For Development and Agricultural Credit (PBDAC) is the only source of institutional agricultural credit. It provides subsidized, in-kind and cash loans, and also subsidized basic crop inputs such as fertilizer, seed, and pesticides. Production inputs are subsidized both in terms of input prices and interest rates. However, the bank conservative policies (i.e. loans for farm equipment require 5 feddans security for tractor and 3 feddans for water pumps) limit the ability of small farmers and tenants to obtain medium and long term credit.

5. Field Crop Production

Egypt's total crop production has increased from 21.317 million metric ton in 1971 to 25.524 million metric ton in 1981. This represents a total increase of 19.7 percent or an average annual increase of 1.9 percent. During this same period the rate of population increase has risen by 2.9 percent annually. (Table 2.4)

In comparison to world agriculture, Egypt ranks among the leaders in average production per unit area (see Table 2.5). Considering the unique nature of Egyptian agriculture -- the completely irrigation-based agricultural system with high quality water, the deep alluvial rich soils of the Nile River and Delta, and the optimum climatic conditions for agriculture,-- there is great potential for increasing productivity in all crops by a minimum of 50 percent as

Table 2.4 PRODUCTION BY COMMODITY OF EGYPT, 1971/81.

Commodity	1971	1974	1978	1980	1981
	'000 metric tons				
Wheat	1,732	1,884	1,933	1,796	1,938
Rice, paddy	2,507	2,242	2,351	2,384	2,236
Corn	2,342	2,641	3,117	3,230	3,307
Barley	76	89	132	107	103
Sorghum	854	824	656	643	653
Broad beans	256	234	231	213	208
Lentils	50	51	16	7	5
Potatoes	451	709	772	1,214	1,210
Sweet potatoes	84	75	63	86	86
Onions	571	550	599	568	654
Sugarcane	7,496	7,918	8,296	6,616	8,618
Cotton	510	441	438	520	508
Cotton seed	886	819	736	844	800
Flaxseed	10	23	31	34	27
Soybeans	1	2	79	72	130
Peanuts	33	25	33	32	33
Sesame seed	21	14	9	16	17
Sunflower seed	33	11	7	9	6
Cabbage	275	299	348	353	374
Tomatoes	1,637	1,729	2,198	2,571	2,453
Oranges	707	819	843	921	895
Tangerines	101	90	85	70	73
Lemons	70	51	58	72	60
Apples	35	35	32	27	35
Pears	15	20	30	52	55
Bananas	95	110	113	133	137
Grapes	121	221	274	299	298
Olives	6	6	5	4	5
Dates	340	396	377	446	391
Meats	330	360	436	472	493
Milk	1,651	1,759	1,801	1,865	1,902
Wool, greasy	3	3	4	4	4
Total (million US $)	1,868	1,891	2,070	2,205	2,260

Source: adapted from MOA/USAID/IADS/USDA Egypt: Strategies for Accelerating Agricultural Development, 1982.

illustrated in Tables 2.5 and 2.6, and Figures 2.2 and 2.3. Farmers are constrained from producing at optimum levels because of current government policies and practices (e. g. lack of facilities and/or resources for scientists to carry out yield increasing research and low prices for farmers' product). In addition, lack of effective credit, extension services, input delivery, and other needs hampered the level of production.

6. Animal Production

Domestic animals in Egypt supply meat, milk, eggs, wool, hides and manure and are used as draft animals. In Table 4.7, estimated livestock numbers are illustrated. Egypt has one of the most dense livestock populations in the world--about one animal unit (cow equivalent) per feddan for the agricultural production area. Current policies favor the expansion in the production of meat and animal products at the expense of crops needed for human consumption or export crops. Additionally, price policies made it more profitable for farmers to shift from growing stable food crops to the production of livestock feed. Egypt imports substantial quantities of poultry, red meat and dairy products. Many factors limit achieving optimum production including unstable feed supply, lack of reliable information on livestock systems, low productivity of work cattle, and fragmentation of farms. Less information exists regarding potential improvement in animal production.

Table 2.5 COMPARISON OF EGYPTIAN AND WORLD YIELDS OF 13 FIELD CROPS ON THE BASIS OF 3-Year (1978-80) AVERAGES.

Crop	World Yield tons/ha	Egyptian Yield tons/ha	Egyptian Yield as % of World Yield
Maize	3.126	3.884	124
Barley	1.977	2.682	136
Onion	12.431	26.517	213
Sugarcane	56.533	82.661	146
Wheat	1.906	3.241	170
Broadbean	1.001	2.190	219
Flax(Fibre)	0.417	1.000	240
(seed)	0.468	1.219	260
Rice	2.723	5.643	207
Groundnut	0.964	1.683	175
Lentil	0.611	1.046	171
Sesame	0.294	0.898	305
Potatoes	12.294	15.295	107
Tomatoes	20.955	17.262	82

Source: FAO, FAO Production Yearbook, 1980, and MOA, Egyptian Agricultural Statistics, various issues.

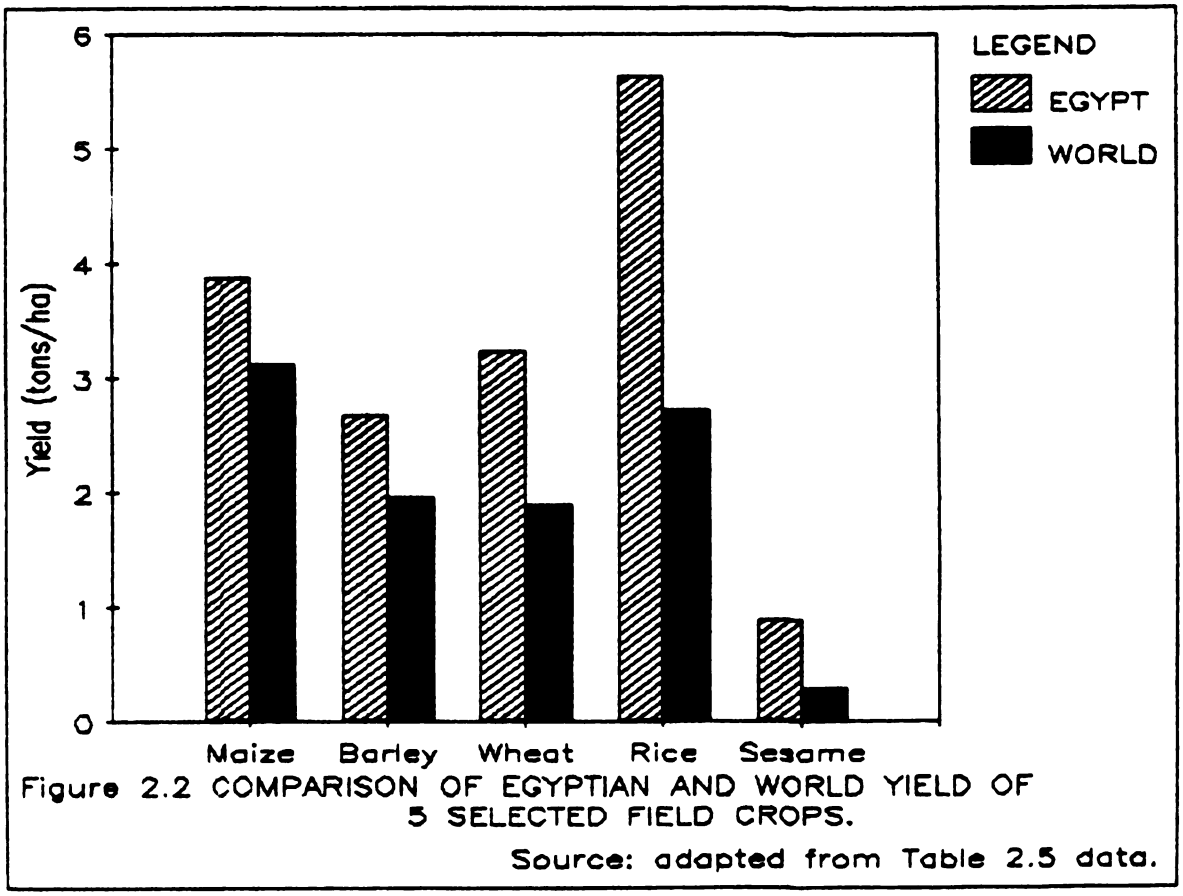

Figure 2.2 COMPARISON OF EGYPTIAN AND WORLD YIELD OF 5 SELECTED FIELD CROPS.

Source: adapted from Table 2.5 data.

Table 2.6 COMPARISON OF AVERAGE U.S. AND EGYPTIAN CROP YIELDS UNDER IRRIGATED CONDITIONS.

Crop	Average Yields (MT/ha)	
	Egypt	U.S.
Maize	4.0	9.6
Sorghum	3.8	6.5
Rice	5.6	5.5
Barley	2.7	5.7
Soybeans	1.1	3.4
Sesame	0.8	2.0
Groundnuts	2.4	3.4

Source: MOA/USAID/IADS/USDA, Egypt: Strategies for Accelerating Agricultural Development, 1982.

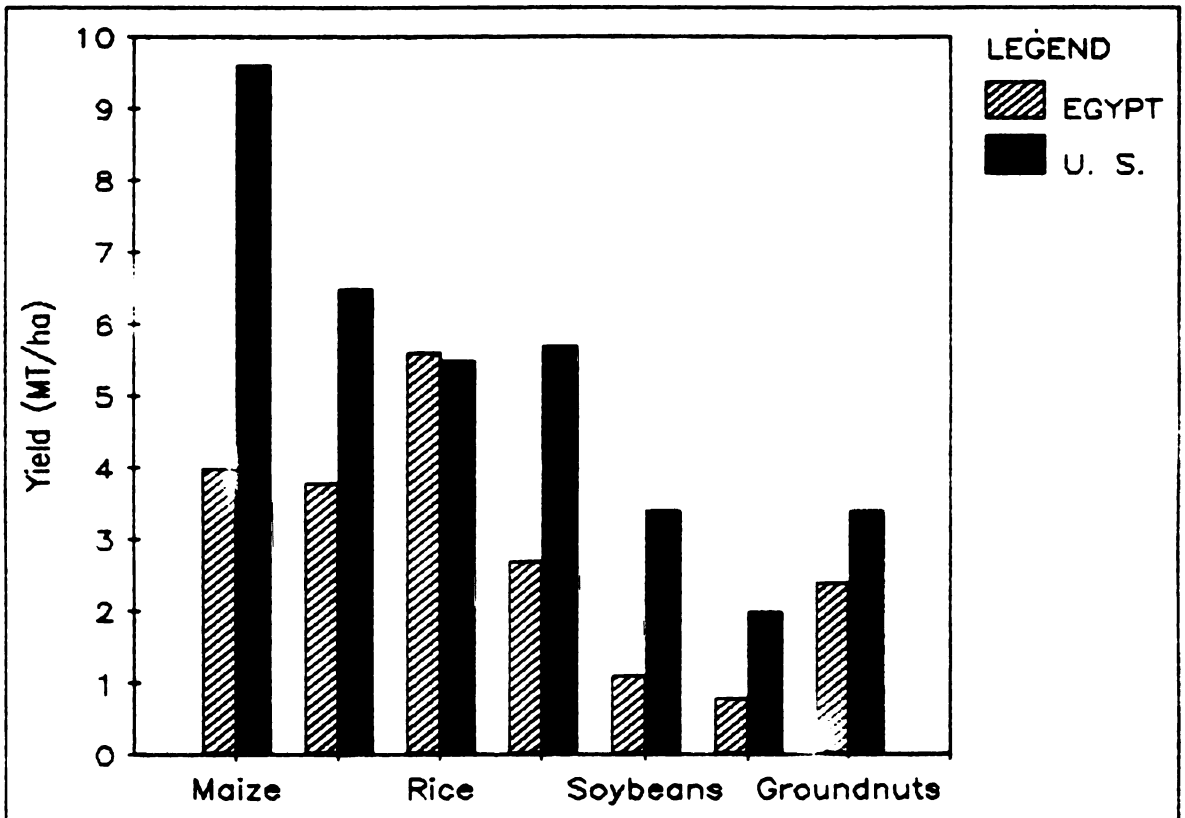

Figure 2.3 COMPARISON OF AVERAGE U. S. AND EGYPTIAN CROP YIELDS.

Source: adapted from Table 2.5 data.

Table 2.7 ESTIMATED LIVESTOCK NUMBERS IN EGYPT, selected years.

	Cattle	Buffalo	Sheep	Goats	Camels	Pigs
	('000)					
1960	1,867	1,781	2,220	1,588	154	22
1970	2,115	2,009	2,066	1,155	127	15
1978	2,589	2,512	2,554	1,440	43	15
	average annual rate of growth (percent)					
1960-70	1.3	1.2	-.7	-3.1	-3.6	-3.8
1970-78	2.5	3.0	2.7	2.8	-3.8	NA

Source: Fitch, J. and I. Soliman. " Livestock Economy in Egypt". Economics Working Paper 29, ARE/MOA, University of California, 1981.

2.1.3 The Policy Environment

1. Price Policy

Since Egypt's Revolution in 1952 the government has continuously imposed a high degree of control on agricultural prices. Government-set low producer prices act as disincentives to increase domestic agricultural production, and government-subsidized low consumer prices act as incentives to encourage consumption. Accordingly, inefficient allocation of resources and inequitable sectoral income distribution are the results of those intervention. The government's policy of procuring major crops (such as cotton, rice, and wheat) at a price below world prices makes it relatively unprofitable for farmers to produce these crops. As a result, farmers transfer resources to the production of those commodities which are relatively more profitable (i.e. those with free market prices such as fruits, vegetables and berseem). Because of those shifts in agricultural production, a system of forced delivery or quotas, allotments were imposed and subsidized inputs offered. Input subsidies on fertilizers, seeds and chemicals--intended to partially offset low produce prices--, also contributed to the misallocations of resources.

Allowing prices to reflect opportunity costs will produce incentives for farmers to reallocate resources and will also provide incentives to adopt yield-increasing technologies. In addition, a better understanding of all the

interconnections--via sets of more reliable data and better analysis--is called for in order to determine the actual effect of any proposed policy changes and also to assist policy-makers in setting their decisions.

2. Extension and Research

The extension service is reported to suffer from a variety of problems generally encountered in developing countries: inadequate funding, lack of equipment, very weak linkage between research and extension, and low salaries.

Research tends to be fragmented and compartmentalized with relatively little collaboration among researchers in different sections working on related problems. Other problems include: lack of laboratories, equipment and supplies, and absence of interdisciplinary research teams. There exists a relatively low level of public investment in agricultural research and extension programs to develop and make available improved technology to farmers.

The vital roles that research and extension must play in the development of the agricultural sector and the importance of agriculture to the national economy point to the need for careful, and comprehensive planning of the national research and extension effort.

3. Agricultural Marketing

Marketing of agricultural products in Egypt represents a bleak picture. Handling, storing, transporting,

processing, and marketing agricultural output are recognized as potentially serious constraints to agricultural development. Additionally, there exist serious lack of marketing data available to researchers and policy makers. Large quantities of food and agricultural products are never consumed because of spoilage and other losses. On the other hand, prices set by the government on most food products generally take the form of price ceilings and are applied without consideration of quality or condition of the product. High import tariffs charged on such items as refrigeration equipment (100%), small trucks (200%), and household refrigerators (250%) constrain improvements in marketing system.

Conducting marketing and economic research regarding alternative marketing methods, the functioning of marketing channels, and efficiency are badly needed.

2.3 Review of Major Studies of Database Management Systems and Data Types and Structures

In this section, a review of related studies on data base management systems (DBMS), and data types and structures will be presented.

Dill and Spahr (1984) defined a data base management system (DBMS) as an application tool used to develop an information system--a system that accepts raw data as inputs, performs certain processes, and produces meaningful information as an output from the system. The principle

purpose of a DBMS is to provide controlled, integrated storage of data in order to reduce, if not eliminate, data redundancy. They described redundant data as the same data field being found in two or more places within the data base which results in poor utilization of storage space and degrades the performance of the system. Other reasons for having integrated storage of data include: avoiding inconsistency, sharing of data, enforcing standards, applying security standards, maintaining integrity, and balancing conflicting requirements.

There are three common storage structures used by DBMS's--hierarchical, network, and relational. A hierarchical data base refers to a tree structure relationship between the records, i.e., a family tree is a good example of this system. A network data base can also refer to a tree structure relationship, however, a "child" in a network structure is not limited to one immediate "parent" as in the hierarchical structure but rather can have many parents. The third type, the relational structure, is the most popular and is the easiest to utilize for most problems. With this type of storage structure, the data are stored as two dimensional tables each table is stored in a separate file. Each column represents a particular data field and each row, comprised of several fields, is a record. The relationships between the data are made at the file level rather than at the record level as in the hierarchical and network structures.

Gotlieb and Gotlieb (1978) reviewed DBMS concepts. A data base contains two types of information: descriptions of entities and representations of relationships. An entity is an object that has independent existence, in the context of the application for which the data base is intended and is described by a set of characteristics, or attributes. A relationship is a named association among sets of entities. Relationship kinds include: hierarchical or 1:n (which are one to many relationships), m:n, or many to many , and 1:1 binary relationships. A data-base management system maintains a data structure representation of entities and relationships. The logical structure, or data model, with its operation set, constitutes the interface through which the data base is accessed. Data-base management systems (DBMS's) employ the basic techniques for mapping information into storage, and for providing retrieval to it. Entities are represented by grouping attribute values together to form records and relationships are expressed through proximity, or records are related in the same block, position, or records related in different files, and pointer mechanisms (e.g. pointer values and hash tables). The data model characterizes DBMS.

There are two main approaches to data modeling, network and relational. In the network model, entities and relationships appear explicitly. Entities are represented by records, and relationships by links which are m:n mappings connecting sets of records together. A hierarchical model is

a special case of network model which occurs when all links are 1:n and directed away from a root type record. In the relational model, there is no distinction between entities and relationships. The relation appears as a table in which the rows represent entities, and the columns, attributes.

Dill and Spahr also stated that the data should be normalized to be properly stored in a relational data base. A data set is said to be in a particular normal form if it satisfies certain constraints. These constraints are first to fifth normal forms, where a key (field or group of fields), is used to identify a record. For example, in second normal form every non-key field must be fully dependent on the primary key field. In third normal form every non-key field must be fully dependent on the primary key and that all non-key fields be mutually independent.

In addition, prior to using a DBMS, every input, all processes and all outputs must be completely defined through structured system analysis. This technique uses a procedure called "top down analysis". The application is first defined at its highest level of abstraction (level 0). The inputs, outputs, and processes are all defined in very general terms. The next step is to analyze the process defined at level 0, i.e. identify the source and destination entities, the function of the process, and the inputs and outputs. Finally validate the model. Once the data base is fully designed and the information system is completely analyzed, the system is ready for implementation using a data base

management system.

The major points to consider when selecting a DBMS include whether its features are suitable for the specific information system being developed, hardware constraints, capacity, and efficiency, the user friendliness and degree of programming expertise required.

Barnnstrom (1983) defined a data base as a collection of interrelated data organized for ease of update and retrieval. Electronic data bases can be manipulated and updated with much less difficulty than with traditional methods. Choosing a DBMS for the microcomputer depends on the skills and aptitude of the user, the planned use of the data base, and the budget constraint.

Most DBMS software uses the concepts of fields and records to reference specific data in a data base. Each field must have a declared maximum length and a declared data type. The data in a data base can be conceptually visualized as a large table with field headings across the top of the columns and record numbers or names at the left edge of the rows. The most common tasks of data base management software include:

1. Accessing specific information at random.
2. Generating reports on a routine basis.
3. Sorting and indexing the information on a variety of fields and conditions.
4. Creating electronic forms for ease of data entry and verification.

5. Updating and modifying selected records in a data base easily.

6. Creating new data bases from existing files and appending data into the data base from other sources.

There are two common types of microcomputer data base managers: 1) file manager, and 2) relational managers. With the file manager all data are contained in a single file and special routines are used to update and manipulate the files. With relational data base managers (RDBMS) the data are stored in the forms of tables with rows and columns and new tables can be created consisting of fields of two or more existing tables. Not all relationships need be anticipated before the data base is created which is one of the most powerful features of the relational scheme.

Harsh, et al., (1981) described the role of information in decision making and referred to Davis statements:

> In general, the value of information is the value of the change in decision behavior caused by the information less the cost of the information. In other words, given a set of possible decisions, a decision maker will select one on the basis of the information at hand. If new information causes a different decision to be made, the value of the new information is the difference in value between the outcome of the old decision and that of the new decision, less the cost of obtaining the information.

They distinguished between raw data and usable information and explained how the transformation of raw data into usable information took place. They stated, since the major purpose of a management information system is to assist the manager in performing his functions, therefore

the components of a management information system should have a close relationship to these functions of a problem definition, observation, analysis, planning, and decision making. They also discussed the four major components of a farm management information system: descriptive, diagnostic, predictive, and prescriptive. Descriptive information portrays the "what is" condition and describes the state of the farm, or some physical, biological, sociological, or economic aspect of the farm at a specified point in time. It includes financial (e.g. net worth, income statements, tax reports, and enterprise accounts), physical, biological, and engineering descriptive information (e.g. dairy production, records, soil tests, and so forth).

The second component, diagnostic information, describes "what is wrong" condition and has two major uses: to define problems that develop in the farm business, and to exploit any opportunities that should arise in the farm business, through the use of "management by exception" i.e. a management tool whereby a farm's performance levels are compared with those of other farms with similar resources and technology.

Predictive information concerns with "what if...?" and is generated from an analysis of possible future events. It is valuable to the farm manager in weighing his expectations of future outcomes in order to define or avoid problems in advance. It is needed by farm managers to reduce risk and uncertainty. With the increasing use of computers, linear

programming, and more sophisticated techniques are being used. The final component, prescriptive information, portrays the "what should be done" question. It requires the utilization of the predictive information together with the assumptions and conditions a farm manager wishes to impose upon a decision. Thus, the basis for making a decision is provided by an evaluation of the predicted outcomes together with the goals and values of the manager.

CHAPTER 3

DATA SOURCES AND METHODOLOGY

3.1 Data Requirements and Selection of Data Sources

Due to lack of reliable data along with limited funds and time constraints, secondary data were used to carry out the research. In addition, no reliable micro-level economic data of the Egyptian agricultural sector were available to satisfy the data requirements to carry out the research. Therefore, an effort was made to select data which represent the same features of the agricultural sector of Egypt and, more generally, the subsistence or semi-subsistence agricultural sectors in developing countries. Additional factors taken into consideration include: 1) data must be sufficient enough to establish a basis for management information system, with its four components: descriptive, diagnostic, predictive, and prescriptive information, to support the operations and decision making functions, 2) data must be reliable, adequate, and applicable for processing and use by FARMAP and dBASE III PLUS to accomplish the research objectives. Thus, enough and good data were essential to cover different aspects such as resource availability, the level of assets and liabilities, and cost and return information. For example, farm data must provide most of the descriptive information needed by farm managers including financial (net worth, income, and cash

flow statements, tax records, depreciation schedules, and enterprise accounts), resource (soil tests, machinery, and labor records, and farm map), production (crops yield, and meat production), and other technical data. Production data including crop population and animal conditions were also required. These data requirements are essential for a thorough farming systems research analysis.

Accordingly, data were chosen from a farm survey project, Consequences of Small Rice Farm Mechanization Project (IRRI/USAID Contract No. tac 1466). This project was a cross-country study begun in early 1978. The data gathering component of the study consisted of two parts: 1) a series of cross-sectional surveys, and 2) a complementary daily recordkeeping system on selected farms. The survey assembled all basic information on farm operations. The study was conducted in three Asian countries, the Philippines, Thailand, and Indonesia.

A sample size of 10 households was chosen from the larger survey project to carry out the research. This modest size sample was considered large enough to fulfill the objectives of the research project. Also, because of the manual task of codes interpretation and transfer to FARMAP and dBASE III PLUS, time available did not permit more farms to be included in the study. The sample was randomly selected from the data of West Java site (Indonesia).

Data stored on magnetic tapes were retrieved with the assistance of Agricultural Economics Computer Laboratory

Staff at Michigan State University and a printout (i.e. paper copy) was obtained of the related sample size for the wet season. These data were originally stored in the magnetic tapes using the appended FAO/FMDCAS (Food and Agriculture Organization/Farm Management and Data Collection Analysis System, which is an electronic data processing, storage and retrieval system). They were stored on 80 column records, each column or group of columns represent specific data fields. Each data field comprised 1 to 8 characters width. Data for each farm consisted of about 50-70 records. Also, data for the wet season were transferred from the magnetic tapes into floppy disks for microcomputer processing.

3.2 Data Preparation, Transformation and Modification

Pre-coded data were stored in appended FAO/FMDCAS forms. These forms included: resource utilization, disposal of products, marketing of the product, household and farm labor, farm land, crops grown, animals, buildings, farm implements and tools, other assets, financial liabilities, farm machinery, inventory change, home consumer durables, extension services, actual and ideal dates of crucial farm activities, cropping pattern history, and demographic information forms.

Data interpretation was done manually using the FAO coding system and Consequences of Small Rice Farm Mechanization questionnaire. The codes were numeric and

ranged from one to three digits. A check was done to ensure the validity of data for each farm used. Errors were eliminated by two ways. The first method was accomplished by checking the consistency of the data codes with the standard FAO coding system and the codes list appeared on the original questionnaire. The second used range checking procedures. This was done manually within and among records of different households. In addition, data transformation was made twice and a comparison was made between the two results.

Whenever errors occurred, corrections of codes were made based on the best information available. For example, some data codes were not found in the FAO coding list due to data entry errors (e. g. power input code 145 was not found in the coding list, however, from the related plant operation code, i.e. sprayer, it was estimated that this power input code might represent sprayer, and so on). After performing manual interpretation, data were coded using FAO/FARMAP (Food and Agriculture Organization of the United Nation/Farm Analysis Package) coding system.

3.3 Methodology

It was hoped that the study could:

1. develop appropriate pre-coded data forms required for farming system research analysis;

2. develop appropriate procedures for processing these forms; and

3. demonstrate the usefulness of using FARMAP and dBASE III PLUS and compare the advantages and disadvantages of each of them relative to the comparison criteria which will be discussed later.

To meet the above mentioned objectives of the study, the same coding system was used in processing FARMAP and dBASE III PLUS programs. Data forms and structures were intentionally designed in similar fashion in both cases. However, when using dBASE III PLUS some simple modifications were done on FARMAP records type formats to create new database forms which simplified the data entry process for the users. These newly designed dBASE forms and structures can be used in other farming systems surveys and studies. However, some modification might be needed to better meet the requirements and objectives of these projects.

The data forms were grouped into the following major components:

1- General Survey Information Forms:

There are several general survey forms including survey title, data sources, sampling procedures, sample size, conversion rates of local units, and national and regional information. The latter includes the role of agricultural sector, agricultural policies, government policies, and demographic and sociological information. Other local information such as location, soil catena, climatic characteristics, seasons, production hazards, and user-defined codes definition was included on separate forms.

2. Resource Descriptive and Quantitative Data Forms:

Household members, permanent labor, temporary labor, off-farm work, education, health status, and demographic data were covered under this section. Also farm data including land characteristics, crop characteristics, animals, physical and financial assets, and credit and liabilities were coded and recorded separately. These data will be used in the socio-economic analysis context.

3. Resource Flow Data Forms:

These forms include all resource flow data required for farming system analysis including net income, cash and kind flow, human power use, machine power use, and animal power use. Additionally, farm operations, input use, yields and other forms of output, household consumption, and other fixed and variable expenses, are all included in this context.

To study the usefulness of using database management systems (DBMS's), to carry out micro-level research in developing countries, two packages were used. These are FARMAP (Food and Agriculture Organization/Farm Analysis Package) and dBASE III PLUS (a commercial data base manger). FARMAP was chosen because of its applicability and its widespread usage in developing countries. While dBASE III PLUS (by Ashton Tate) was selected because it represents one of the most sophisticated and integrated relational data base managers among the commercial software packages, and one of best selling particularly in developing countries.

The same data will be employed for both FARMAP and dBASE III. The structures of both databases will be shown in the next chapter. FARMAP will be used for data storage, validation, and tabulation and each usage will be discussed in detail in the next chapter. Unique data structures will be created for processing the data by dBASE III. The results of using dBASE III and FARMAP will be presented in chapter 5.

Two types of microcomputers were used in data storage, processing and retrieval. The first was an ITT XTRA without a hard (fixed) disk. The second was a Zenith model Z-200 (IBM AT compatible) with a hard disk for faster processing and manipulation of data. The reason for that was to demonstrate two different versions of FARMAP. One version is non-menu-driven and does not require a microcomputer with hard disk for data processing. The other version, the menu-driven, requires a hard disk.

FARMAP coding system was employed in processing FARMAP as well as dBASE III PLUS. Some modifications in coding and recording data were applied to dBASE III data structures. However, the procedures for processing with both programs were made as consistent as possible to make the comparison of the two systems more meaningful (e.g. the advantages and disadvantages of each program could be noted).

Most data base management systems are able to perform a common set of tasks. Among those tasks are: access specific information at random, generate reports, sort and

index information, create forms for ease of data entry and validation, update and modify selected records and/or fields, create new data bases from existing files, append data from other sources, and export data to statistical and planning tools for further analysis. Therefore, the comparison criteria between FARMAP and dBASE III will be mainly based on the above mentioned factors. In addition to those mentioned above, other factors which will also be used include: software cost, hardware requirements, user-friendliness, level of support by other software packages and by the developer, maximum number of records allowed, online help, and level of user control. The results will be discussed in detail in the next chapters.

CHAPTER 4

THE MODEL

4.1 The Structure of FARMAP

4.1.1 Introduction

FARMAP is the Farm Analysis Package, developed by the Farm Management and Production Economics Service (AGSP) of the Food and Agriculture Organization (FAO) of the United Nations. It was developed, following its predecessor FMDCAS (Farm Management Data Collection Analysis System), in response to the need for computerized tools for the rapid and flexible processing of rural household survey data. FARMAP can also be used for the storage of survey data in a standard form for future retrieval and multipurpose analyses. It offers a basis for a unified system of rural data collection, analysis, storage, and retrieval.

FARMAP is written in FORTRAN IV (FORmula TRANslator) computer language. The package can be installed on micro, mini or mainframe computers. These versions are consistent in terms of the command files, coding system, programs, and technical manuals; however, they vary in processing speed, memory and disk space, file's names conventions, and installation procedures. The following procedures utilize programs from the package

* data transfer to computer
* data validation and correction
* processing of group of farms, parcels, and activities

data

* comparative analysis of selected observations

* generation of cross tabulation tables

FARMAP focuses on the farm-household. The interviews of household members are the major source of information. Also, it was designed for the application of farming system approach to smallholder of subsistence and semi-subsistence agricultural production in developing countries. These sectors are mainly characterized by:[1] 1) humans or animals are the main sources of power, 2) low capitalization of the farms, 3) absence of records of production, income and expenditures, 4) large quantities of production consumed on-farm or given in kind, and 5) on-farm production of many inputs.

Therefore, emphasis is given to labor analysis, input and output coefficients, farm economics, income, and relative proportions of cash and kind. However, small scale cash farming and data from large scale mechanized farming can also be analyzed using FARMAP.

The level of detail in data sets can vary considerably. For example, FARMAP can handle a few or several thousand items of data information per household. It also can be employed in single interview surveys or in multiple visit surveys. Likewise, topics covered can be restricted to one aspect of production or can encompass the whole production

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[1] adapted from FAO Farm Analysis Package, vol. 1, FAO, Rome 1983.

and consumption system.

The standard output tables generated by the package include information on household composition, labor, land, assets, liabilities, net worth, economics, power use, and so forth. Furthermore, additional tables can be designed by the user according to any particular needs of the survey.

4.1.2 Computer Requirements

FARMAP can be used on a wide range of computers, e.g. micro, mini, or mainframe. The programs are written in FORTRAN IV and for microcomputers which are the focus of the study, both MS-DOS and CP/M operating systems can be used.

The minimum hardware requirements differ depending on the size of data sets, single or multiple visits, the level of output required. For instance, for only data storage and validation a 64 K bytes of RAM (Random Access Memory) and one or two floppy drives will be sufficient. However, for a full package utilization the amount of RAM must be larger (e.g. 512 K bytes) and at least two floppy drives should be available. For the menu-driven version of FARMAP a hard disk of 10 mega bytes, and at least one floppy drive, is essential. Other software complementary packages are also required, for example, statistical, and linear programming packages, since FARMAP does not provide statistical and planning tool capabilities needed for a thorough farm management analysis and a complete micro level research.

In addition to the above mentioned hardware and

software requirements, system analysts or programmers are required for initial installation and maintenance of FARMAP (as recommended in the technical manuals, especially for installing the package on mini and mainframe computers). These requirements vary depending on the level of processing and tabulation. For example, advanced validation as well as advanced tabulation require programming experiences to design the command files required to generate user-defined tables. However, basic validation and tabulation require minimum knowledge of computer programming especially when using the menu-driven version of FARMAP.

4.1.3 FARMAP Data Structure and Record Type Groups

4.1.3.1 FARMAP Data Structure

1. Nature of FARMAP Data

Data are stored in FARMAP using the related FARMAP coding system (i.e., all item names have been assigned code numbers). The code numbers, as they are compact and easily handled by programs, are replaced by labels or abbreviated names for each item in the processing of reports.

Data stored may appear in two forms

* 80 column records (one line)
* standard FARMAP records of 27 data fields all of which are numeric (decimal numbers) on six lines.

2. Data Organization

The standard formats allow up to 980 record types of which 900 record types remain free for the user to specify the format for recording special purpose information. All the 980 possible record types have a record type code indicating the information contained on that record. FARMAP categorizes information according to certain levels, including national, regional and farm (Table 4.1).

Table 4.1 FARMAP STANDARD RECORD TYPE CONTENT AND DATA SOURCE

Record type	Data source	Content
010--099	national, regional local	general survey description
100-109	farm, activity, plot	interviews
110-199	farm, activity, plot	household
200-299	farm, activity, plot	land-crops
300-399	farm, activity plot	livestock
400-499	farm, activity, plot	fixed and liquid assets
500-599	farm, activity, plot	liabilities
600-699	farm, activity, plot	general farms and stocks
700-799	farm, activity, plot	resource flow

Source: adapted from FAO, FAO Farm Analysis Package, volume 1, Rome 1983.

The order of the records of each farm data determines the sequence of subtables in a farm table during data processing. Due to the sorting capability of FARMAP programs, questionnaires may contain record types in any order.

Additional user-defined record types can be used to store information not included in standard records and required for specific analysis. They have codes in the range 100-980, excluding standard record codes and certain prohibited codes (see FARMAP user's manual for more details).

3. Record Structure

Each standard record contains 27 data fields. The number of essential data fields, i.e., which must be filled out, depends on the survey. However, there are minimum number of data fields required for basic FARMAP processing.

FARMAP standard records are designed with a common structure (i.e., many data fields have the same use in some or all record types). Table 4.2 below lists data fields which have common usage for the three different group of records, which are:

1) general survey description data (record types 20-99)
2) resource description data (record types 100-699), and
3) resource flow data (record types 700-799).

Table 4.2 CONTENT OF COMMON DATA FIELDS BY DATA TYPES FOR FARMAP.

Data Field Number	80 column General Survey	27 field record Resource Description	27 field record Resource Flow
1	not used	farm number code	farm number code
2	record type 020-099	record type 100-699	record type 700-799
3	not used	(activity)*	(activity)
4	not used	component for mixed activity	component for mixed activity
5	(sequence number)	compound code: (parcel-plot-season)	compound code: parcel-plot-season
6	user-defined	user-defined code	user-defined code
12	variable	quantity	quantity
13	variable	conversion code	conversion code
15	variable	current value	value
24	variable	cash or kind code	---
25	variable	inventory(change)	---
26	variable	date	years ago
27	variable	consumer groups code	consumer groups code

*the bracketed items are optional.

Source: adapted from FAO Farm Analysis Package, volume 1, FAO, Rome 1983.

Data field 1 contains the farm code for resource description data and resource flow data. Data field 2 contains the record type code on every record. The activity and component codes appear in data field 3 and 4 respectively, on both resource utilization and resource description records. Data fields 3 and 4 are not employed in general survey description data. In general survey description, data field 5 contains the sequence number when more than one record are used with the same type of information. While, in resource utilization and resource description data records it is used to store the reference code identifying a parcel, plot and season. Data field 6 is left free for user-defined codes during processing. Data fields 12, 13, 15, and 27 contain quantity, quantity conversion code, value and consumer group respectively on all resource description and resource utilization records. Data fields 12-27 are used for defining variables on general survey records. Data fields 24,25 and 26 store cash-kind information, type of inventory or inventory change and dates respectively, in all farm description data. Finally, data field 26 contains dates on resource flow records.

4. Data Field Content

Each data field stores either a code (qualitative information) or quantitative information. The codes cover a wide variety of qualitative information (e.g. activity, type of input/output, and dates). Quantitative information

include area, value, quantity of input, yield and so forth.

The coding used in FARMAP is numeric not alphabetic, since, the package is language independent designed for worldwide application. Numeric codes are also used to speed up recording, transfer information to computer readable form and structure information for easier calculation.

The coding system comprise the following several principles (see Table 4.3)

1) FARMAP programs work on code ranges rather than individual codes,

2) all codes are numeric, from 1 to 5 digits in size,

3) a particular code has a unique meaning on any one record type and in any one data field,

4) on diverse record types or in different data fields, the same code can have various meanings,

5) codes have been chosen in meaningful ranges to facilitate easy combination of similar categories of data,

6) codes have been organized logically in groups of 10, 100 or 1000 codes (decimal grouping) where analysis is likely to proceed at different levels of aggregation,

7) the figure 9 is used to mean 'undetermined', e.g. 9, 90-99 or 900-999, which is convenient when missing data occur,

8) codes numbers have been selected so that, after arrangement in ascending order, the information is in the correct sequence for the output tables,

9) there are free codes in any given range for definition by the user, also the final digit of the four digit FARMAP codes is left free for user specification,

10) activity, output, material inputs and operation codes have unique ranges for plant, animal and special activities, and

11) all power input (human, animal or machine), implements, tools, share-rent and other fixed costs have the same codes for plant, animal and special activities.

Table 4.3 INPUT-OUTPUT AND OPERATION CODES SUMMARY FOR FARMAP

	Activities		
	Plant	Animal	Special
Activity	10-3999	5000-5999	1000-8999
Operation	10-1999	2000-3999	4000-4999
Outputs(income)	10-299	300-599	600-899
Variable Costs:			
material inputs	1000-1999	2000-2999	3000-3999
human power	4000-4999	4000-4999	4000-4999
animal power	5000-5999	5000-5999	5000-5999
machine power	6000-6999	6000-6999	6000-6999
implements-tools	7000-8999	7000-8999	7000-8999
Fixed Costs:			
share-rent	9000-9199	9000-9199	9000-9199
other fixed costs	9200-9799	9200-9799	9200-9799
taxes	9800-9899	9800-9899	9800-9899

Source: adapted from FAO Farm Analysis Package, volume 1, FAO, Rome 1983.

4.1.3.2 Record Type Groups

As mentioned earlier, FARMAP record groups can be divided into three main categories. These are:

1. General Survey Description Data

The general survey description data contain information which documents the background and relevant environmental data of the survey, conversion factors to standardize weights and measures, sample design information and farming system utilized. These data records (see table 4.4) are separately stored from the farm information.

All general data are stored in a separate file, therefore, there exist two data files per survey

1) general data file which contains general data and stores numeric and alphabetic information for Record types '10-100', and

2) farm data file which stores farm data and numeric general data and contains only quantitative information (Record type '10', '51', '52', '88', '100-989').

Table 4.4 GENERAL DATA RECORD TYPE FOR FARMAP*

Record Type	Content
010-019	Data identification and data status.
020-029	Survey information.
020	Location (country, region, administrative areas, longitude, latitude,...etc.)
021	Survey objectives, organizations...etc.
022	author, date, duration, presurvey design.
023	Survey design, sample design,...and so on.
024	techniques used for assessing weights and measures
025-029	free for user definition
030-039	National-regional information
030	agricultural sector role
031	land tenure policy
032	price, marketing and credit policy
033	settlement patterns, demography, education
034	ethnic groups, languages, religions...
035	leadership patterns
036-039	free for user definition
040-049	Local information
040	location, altitude
041	demography, soil catena, depth, drainage,...
042	soil erosion
043	ecology, vegetation, seasons.
044	government and other services available
045	farming system, technology
046	prices of major inputs and products
047-049	free for user definition
050-059	climate and production hazards
050	general description of microclimate, trends.
051	precipitation, temperature, humidity, and others
052	production hazards (e.g. frost, drought, pest, disease, animal attack, predation)
053-059	free for user definition
060-069	New code definitions, plus free records

Table 4.4 (Cont'd)

Record Type	Content
070-079	Community economics, structure
070	village size, district size, spatial distribution of settlements, connections and relationship of settlements,...etc.
071	emigration and immigration, causes thereof
072	dominant economy of the community, source of income
073	leadership and decision making,distribution of political power, role of women
074-079	free for user definition
080-089	Conversions
081	conversions of weights and measures to user designated non standard metric units
082	conversion of weight and measures to standard metric system and currency to US dollars
083	uniform code conversions
084	uniform amount, price and value modification or substitution
088	seasons
080,85-87,089	free for user definition
090-099	All of them are left free for definition by the user

* See FARMAP User's Manual, vol. 3, for more details.

Source: adapted from FAO FARMAP USER's Manual, vol. 1-3, FAO, Rome 1985.

Most of the general survey description data record types are used for storing text describing different aspects of the survey background. An example of the free format for general data record types appears below in Table 4.5.

Table 4.5 FARMAP FREE FORMAT RECORD TYPE '20' FORMAT

Starting column number	Width of field	Data field number	Content	Status*
1	1	--	batch (for mini and mainframe computers)	R
2	4	1	not used	
6	3	2	record type	E
--	--	3-4	not used	
9	3	5	sequence number	R
--	--	6	not used	
12	68	7-23	description	
80	1	24-27	not used	

* Status codes used as follows:
R: highly recommended
E: essential for basic processing, use only as specified

Source: adapted from FAO Farm Analysis Package, vol. 1, FAO, Rome 1983.

Data fields 7-23 are used to record information on the design and conduct of the survey, and any other local and regional information. Each record is repeated as necessary to record all the desired information. The sequence number (in data field 5) ensures that the order of records is maintained.

2. Resource Description Information

Farm level data are divided into resource description and resource flow or utilization data. Resource description are grouped as shown in Table 4.6.

Table 4.6 FARMAP RESOURCE DESCRIPTION RECORD TYPE GROUPS*

Group	Record Type	Content
Interview	100	interview
Household	110	household
(110-199)	120	permanent labor
	130	off-farm work
	140	anthropometry
	150	health situation
	160	education-literacy
	170	agricultural knowledge
Land-crops	200	farm
(200-299)	210	land characteristics
	230	crop characteristics
Animals	310	livestock
(300-399)		
Fixed and liquid assets	410	fixed assets
(400-499)	420	structure characteristics
	430	financial assets
Liabilities	510	credits and debts
(500-599)		
Stocks	610	stocks
(600-699)		

* See FARMAP User's Manuals for more details.

Source: adapted from FAO Farm Analysis Package, volume 1, FAO, Rome 1983.

In all of the above mentioned record types, data fields 1 and 2 are used to record farm code and record type respectively. Data fields 3, 4 and 5 can be used to store activity, component and parcel-plot-season, respectively, when survey objectives require that.

The interview record '100' is the first record filled in during interviews. It includes sample number, zone-stratum, length of interview, the estimated data quality and identity of the interview, the estimated data quality and identity of the interviewer, interview location, and so on. The record is completed once per interview in single visit or several visit survey. However, it should be filled in as necessary in multiple visit surveys.

The household records group is the second record type in the resource description information group. This group includes all relevant information about household members, permanent laborers, off-farm work, anthropometric measurements, health status, literacy and education, and agricultural knowledge.

Table 4.7 illustrates an example of the household record types group (i.e., record type '110' format). It is used to record descriptive information concerning individual members or groups of person in the household. All family members, permanent laborers, servants and relatives in the same residence are recorded in this record type.

Table 4.7 FARMAP HOUSEHOLD RECORD TYPE '110' FORMAT

Starting column number	Width of field	Data field number	Content of data field	Status*
1	1	--	batch (for mini and computers)	E
2	3	1	farm number	E
5	1	27	consumer group	
6	3	2	record type	E
-	-	3-5	not used	R
-	-	6	not used	
9	4	7	serial number	
13	2	8	relationship to read of household	R
15	3	9	Age-sex category	
18	2	10	civil status	
20	4 (2+2)	11	age, year-months	
24	2	12	number of persons	E
26	2	13	years in district	A
28	2	14	years farming	A
30	2	15	education	
32	2	16	mother tongue	A
34	3	17	time in residence, percent	E
37	3	18	time available for work, percent	E
40	6	19	type of off-farm work	
46	6+	20	height	
52	6+	21	weight	
58	6	22	number of other languages spoken	A
64	6	23	distance of birth place, KM	A
70	6	24	user defined	
76	2	25	type of inventory(change)	E
78	3 (2+1)	26	month-week of inventory (change)	R

*Status code used as follows:
E essential for basic processing, use only as specified
R highly recommended
A suggested

+decimal assumed between the 3rd and 4th digits

Source: adapted from FAO Farm Analysis Package, volume 1, FAO, Rome 1983.

Land resources record group, record numbers 200-299, covers information related to the quantity, quality and utilization of the land. It includes general farm information, land characteristics and crop characteristics. The farm record '200' contains a summary of farm value and areas devoted to crop, pasture and forest. Whereas, land characteristics record '210' is normally used for individual parcels and contains information on the location, area, value, and physical characteristics of each parcel. Crop characteristics record '230' is used to record plant arrangements and all other information relevant to cropping patterns.

Animal record '310' contains general information concerning livestock. For example, management practice, values, age, cost, condition score, weight and purpose for keeping are stored in this record type.

Fixed and liquid assets, other than land, crops and livestock, are described in assets records group '410-499'. Standard FARMAP record types are '410' (fixed assets), '420' (structural characteristics) and '430' (financial assets). The rest of the record types are free for user definition.

Physical assets record '410' describes information about permanent structures, land improvements, machinery, implements, tools and consumer durables. The structure characteristics record '420' provide descriptive information concerning physical assets as a measure of standard of living. Information about financial assets, the present

status of cash holdings and credit granted by the farmer are recorded on record type '430'. Liabilities are all recorded on credit record '510' and stocks on record '610'.

3. Resource Flow Records Group

Resource flow records contain two main record types. They are:

* resource utilization record type '700'

* household consumption-expenditure record type '750'

Resource utilization records (type '700') are the largest number of records in most surveys. They contain all resource flow quantitative information used in net income and power use analyses. Details of all resources used on parcels and animals which form part of the farm are recorded in these records. All farm activities and income are also described.

An example of resource utilization record type '700' format is shown in Table 4.8. It contains farm number, component (i. e. for whenever a mixed activity comprised more than one component, one record should be filled for each component), combination code for parcel-plot-season, kind of input-output, farm operations, date, quantities, price or value, and so forth.

Table 4.8 FARMAP RESOURCE UTILIZATION RECORD TYPE '700' FORMAT

Starting column number	Width of field	Data field number	Content of data field	Status*
1	1	--	batch(for mini and main-frame computers)	E
2	3	1	farm number	E
5	1	27	consumer group	
6	3	2	record type	E
9	4	3	activity	
13	4	4	component	R
17	5 (2+2+1)	5	parcel-plot-season	E
-	-	6	not used	
22	4	7	input-output	E
26	4	8	operation	E
30	1	9	frequency	
31	2	10	month	E
33	1	11	week	
34	9+	12	quantity	E
43	2	13	quantity conversion code	
45	2	14	source-destination	E
47	10+	15	price or value	E
57	1	16++	cash-kind	E
58	1	17++	price-value	
59	4	18	receiving activity	A
63	4	19	component	A
67	5 (2+2+1)	20	parcel-plot-season	A
72	4	21	input-output	A
76	2	22	serial number	A
--	-	23-24	not used	
78	1	25	user defined	
79	2	26	years ago	A

*Status code used as follows:
E essential for basic processing, use only as specified
R highly recommended
A suggested

+decimal assumed between the 3rd and 4th digits

++data fields 17-21 are only used when recording transfers between activities or plots (i. e. when an output of an activity is also an input to a second activity, data fields 17-21 show information about that second activity, for example maize activity as an input to dairy cattle activity)

Source: adapted from FAO Farm Analysis Package, volume 1, FAO, Rome 1983.

Consumption and expenditure information are recorded on household consumption-expenditure record '750'. Record '750' contains information like the general consumption item, form of consumption, frequency, quantity, price and value, and other user defined fields.

In general, the user can define additional record types other than those mentioned above which are standard FARMAP record types. Also, within standard FARMAP record types there exist many data fields which are left free for definition by the user. However, there are some prohibited record types and codes that the user cannot use (see FARMAP User's Manual, vol. 3).

4.1.4 Data Processing Stages

4.1.4.1 Data Storage Stage (ST01)

In this stage, data are transferred from the coding sheets (precoded questionnaire) into the computer. For microcomputers, there exist two ways for data entry. The first one is done using MS-DOS line editor (EDLIN). This method was not appropriate for alphanumeric data entry. Therefore, an advanced word processor was used.

The second method of data entry is through the use of program ENTERD which allows only numeric data entry. Individual farm data for resource description information and resource flow data records are entered interactively. Record type, farm number and all other relevant data fields

must be included in a command file which will be activated when running program ENTERD.

Figure 4.1 shows a flowchart for FARMAP storage step. The keyboard data entry is the input with the command file ENTST.CMF. The outputs are two file: the primary output file (ST01. BIN) and the massage file (ST01. MES)

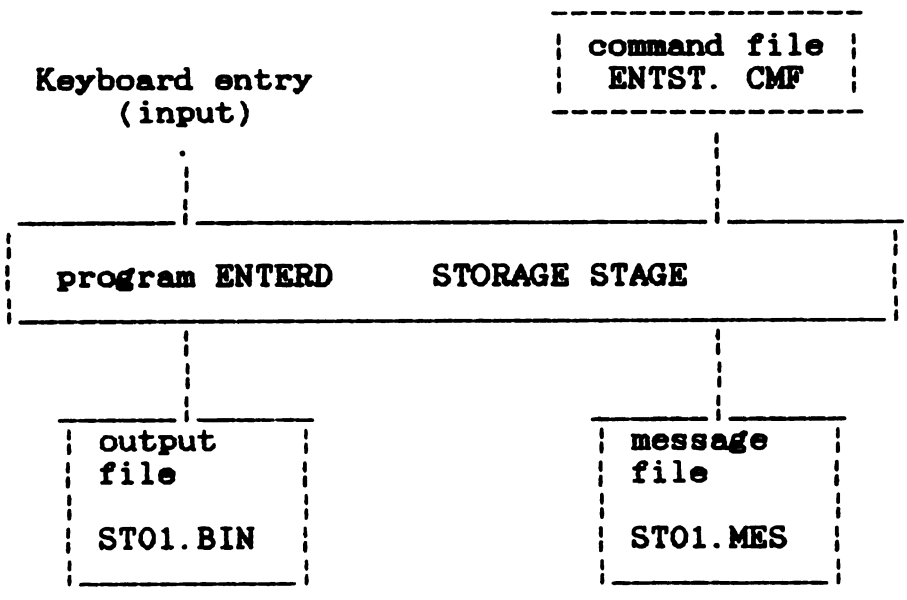

Figure 4.1 FLOWCHART OF FARMAP STORAGE STEP 1 (ST01).
Source: adapted from FARMAP, Primer for MS-DOS microcomputers, FAO, provisional edition.

The output file might be formatted or unformatted. The unformatted binary files occupies less disk space and are faster in processing. The formatted output file contains the standard FARMAP records of 27 data fields on six lines. The unformatted file is a binary file which is only readable using FARMAP programs DISPLAYB or CORREC. The latter is used to correct errors in data fields and/or records.

4.1.4.2 Validation Stage

Checking and modification of data occur during the validation process. There are three steps of the data validation process. These steps are:

(1) Validation Step 1 (VAL1): program MODCON and command file VAL1.CMF are used to check on information on a single record. The following tasks are performed in this step:

* adding missing component codes for mixed activities (e.g. maize in the maize-beans mixture);
* calculating the values for unpriced power inputs such as family labor;
* calculating total quantities or areas according to the specified conversion factors;
* calculating total quantities and values of consumption; and
* duplicating of record type '700' for inter-plot or inter-activity.
* performing within-record validation to check that codes and quantities lie within accepted ranges.

(2) Validation Step 2 (VAL2): various programs and command files perform the following six tasks to perform range checks on the magnitude of inputs and outputs:

i. program SORT and command file VAL21.CMF are used to sort data records in appropriate order.

ii. program EXTRAC and command file VAL22.CMF are used to prepare livestock inventory data.

iii. program MODCON and command file VAL23.CMF are used to select from the database existing data items and generate new data items such as making monthly totals from daily data.

iv. program SORT and command file VAL24.CMF are used to sort data records in appropriate order.

v. program UNIT and command file VAL25.CMF are used to aggregate material input quantities and values, to divide by area or number of animals, and to store the results in artificial records (type '1700').

vi. program MODCON and command file VAL26.CMF are used to perform range checking.

(3) Validation Step 3 (VAL3): four programs and their associated command files are used to perform multi-record consistency checks which comprise the following four tasks:

i. program MODCON and command file VAL31.CMF are used to select records for which multi-record consistency checks are desired.

ii. program SORT and command file VAL32.CMF are used to sort data records in appropriate order.

iii. program EXTRAC and command file VAL33.CMF are used to create artificial records containing summary of selected records.

iv. program MODCON and command file VAL34.CMF are used to perform consistency checks on artificial records according to specified range values.

The required input, command, message, and primary and secondary output files are shown in Figure 4.2. The command and the message files appear with the extensions '.CMF' and '.MES' respectively.

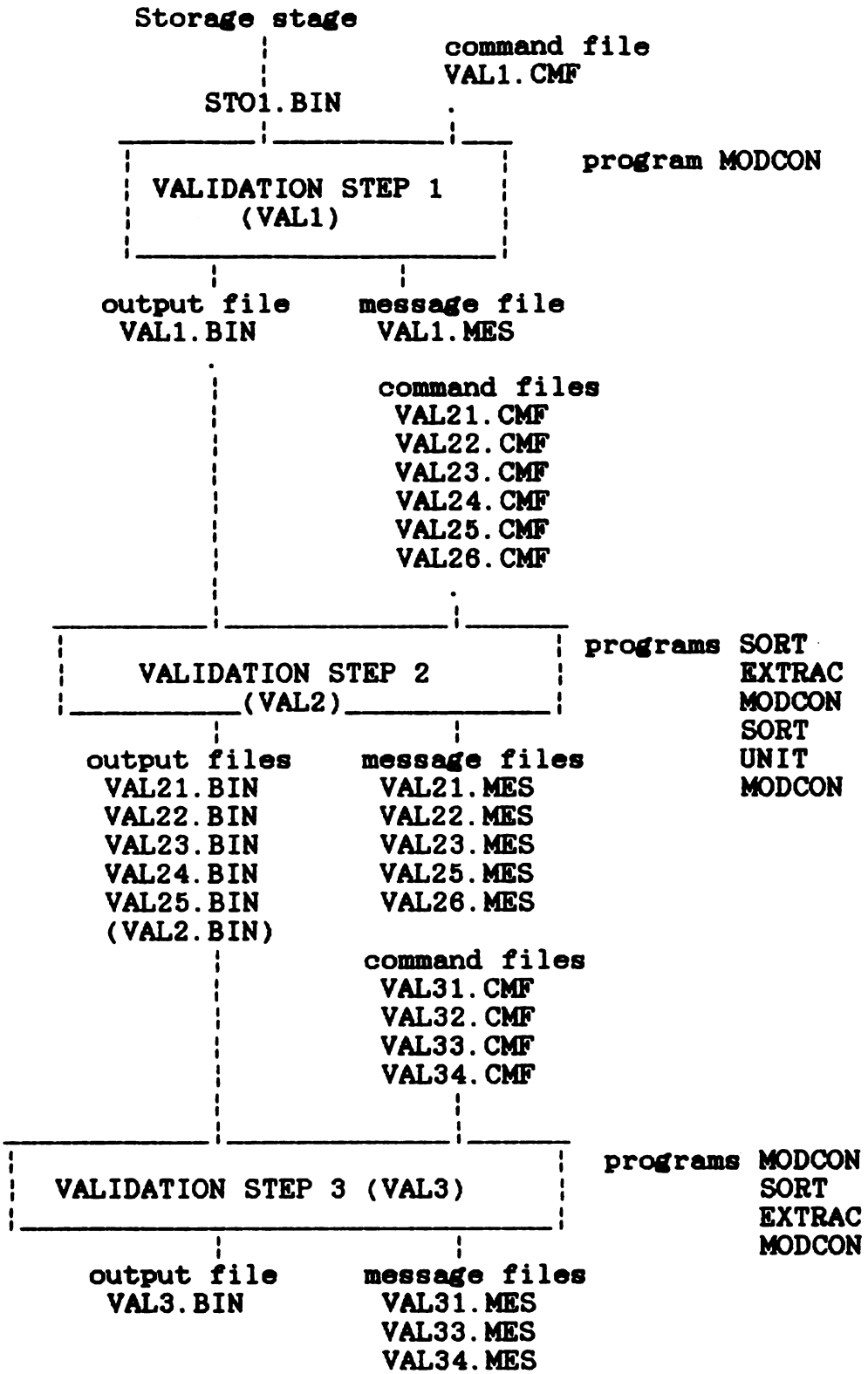

Figure 4.2 STEPS IN FARMAP DATA VALIDATION STAGE

Source: adapted from FARMAP User's Manual, volume 2, FAO, Rome, 1985.

4.1.4.3 Tabulation Stage

FARMAP tables can be produced in three different modes which correspond to levels in the hierarchy of data. These are:

* farm mode, one table for an entire farm
* activity mode, one table for each activity on a farm
* plot mode, one table for each plot of land.

Standard subtables cover the topics of household composition, land resources, cropping pattern, animal resources, net worth, economics, cash-kind flow, and power use and types (human, animal, and machine).

FARMAP tabulation process comprises the following four processing steps:

1- Tabulation Step 1 (TAB1): checking, modification.

2- Tabulation Step 2 (TAB2): aggregation of input and output into subtotals.

3- Tabulation Step 3 (TAB3): individual tabulation.

4- Tabulation Step 4 (TAB4): group means tabulation.

Figure 4.3 shows different input, command, message, and output files utilized during tabulation process. The command and message files appear with the extensions '.CMF' and '.MES' respectively. Extensions '.BIN' and '.DAT' represent the binary unformatted and the ASCII formatted files, respectively. The "M" appearing on output files indicates the three modes mentioned above (i.e., F for farm, A for activity, and P for plot). In addition to the the above four tabulation steps, step TAB5 is used to generate advanced user-designed tables.

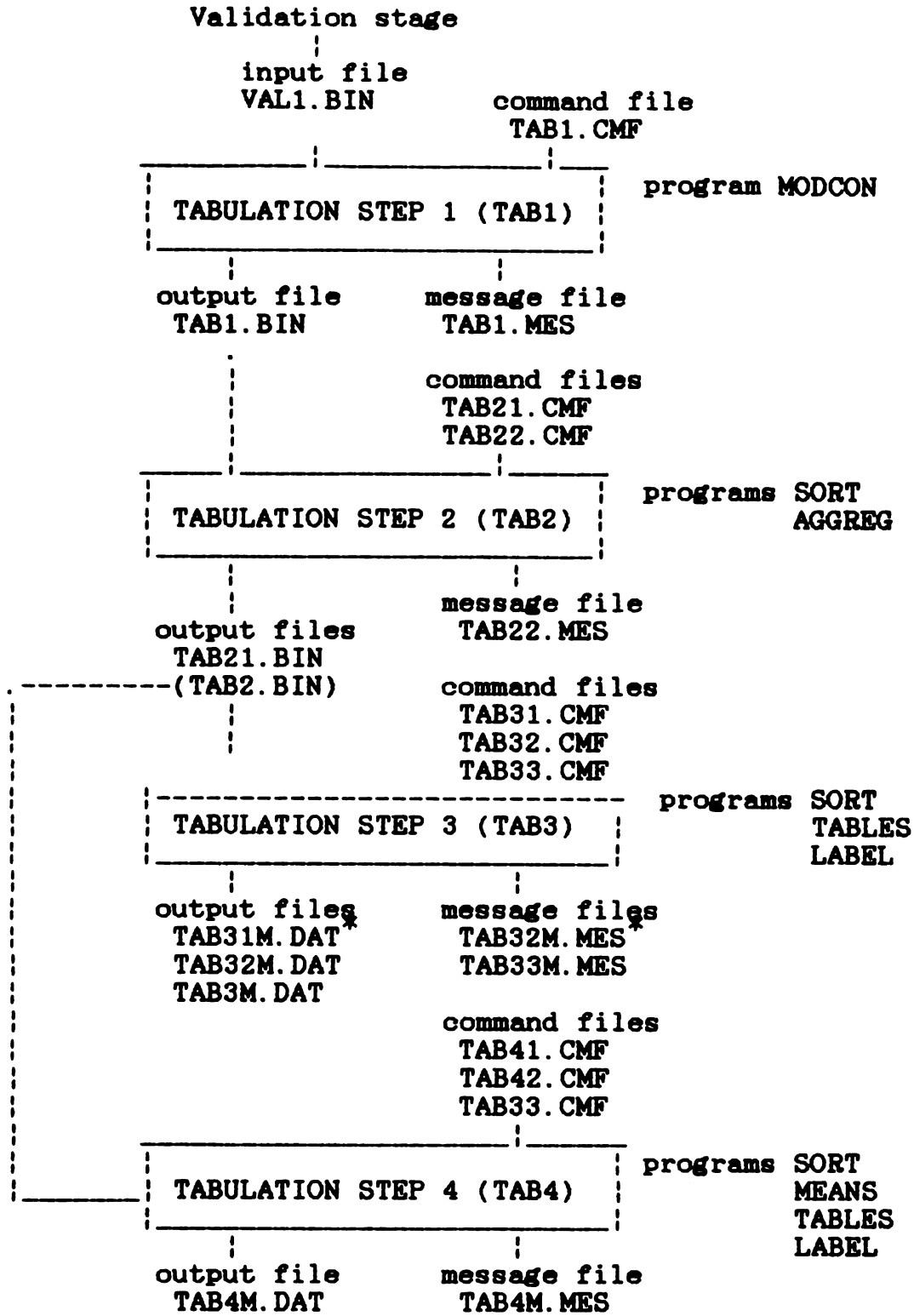

Figure 4.3 STEPS IN FARMAP TABULATION STAGE

* M stands for the three different modes, i. e. F for farm, A for activity, and P for plot modes.

Source: adapted from FARMAP User's Manual, FAO, Rome 1983.

4.1.4.4 Further Processing Stage

Further processing is usually desirable following tabulation stage. This stage allows the transfer of FARMAP data files to other packages for further processing. FARMAP contains program EXTRAC to transfer the required data fields and records into an ASCII file format. Since, FARMAP does not support further statistical and planning models, other packages must be used for these types of analysis.

4.1.5 Analytical Procedures

As mentioned earlier, two versions of FARMAP were used, i.e., the menu-and the non-menu driven. Any differences between the two versions, or any special procedures performed when running each of them will be discussed.

The different stages of processing and the detailed analytical procedures are discussed below.

1-Data Storage

General survey data was transferred from the coding sheets into the computer storage media (floppy disks) using commercial word processor, since, it was inconvenient to use the line editor (program EDIT of FARMAP, or program EDLIN of MS-DOS). Examples of the coding sheets used for recording data identification record type '010', and general survey information record type '020' are shown on Table 4.9. These

Table 4.9 EXAMPLES OF FARMAP CODING SHEETS

Data Identification Record Type 010

	Record type	Survey code	Survey title
Data field number	2	7	8
Columns number	6-8	12-17	18-77
	010	EGY263	FRAMEWORK FOR MICRO-LEVEL RESEARCH IN DEVELOPING COUNTRIES USING DATABASE MANAGEMENT SYSTEMS

General Survey Information Record Type 020

	Record type	Sequence number	Description
Data field number	2	5	8
Columns number	6-8	9-11	12-79
	020	1	COUNTRY: EGYPT
	020	2	MAIN OBJECTIVE: STUDY THE USEFULNESS OF USING DATA
	020	3	BASE MANAGEMENT SYSTEMS (DBMS) IN MICRO-LEVEL RESEARCH
	020	4	IN DEVELOPING COUNTRIES
	020	5	RESEARCH DESIGNER: ALI KAMEL M. KAMEL
	020	6	DATE: JUNE-SEP. 1986.

Source: adapted from FAO Farm Analysis Package, Users Manuals, FAO, Rome 1985.

forms can be used to design questionnaires for rural survey data. A separate secondary input file was obtained ST01.DAS, which is shown on Figure 4.4. This file contains all descriptive information in alphanumeric fields such as survey title; research objectives; location, regional, and national information and so forth. Also, numeric fields concerning local conversion factors and user-defined data fields are included in that file.

However, resource description information and resource flow/utilization data were entered into the computer using program ENTERD of FARMAP. Minor modifications were done to the command file to alter the data entry forms in order to eliminate redundancy. The command file ENTST.CMF is the way of telling the main program ENTERD of which record types and data fields will be selected for processing. Therefore, this command file was modified to remove undesired data fields and record types or to add user-defined data fields.

As shown in Figure 4.5, only record types '110', '200', '210', '230', '410', '510' and '700' were employed. They represent household, farm, land characteristics, crop characteristics, physical assets, credit, and resource utilization data records, respectively. The user can add or eliminate any records types or data fields required according to type and objectives of the survey. Also, it should be noticed that not all the 27 data fields of the standard FARMAP record must be filled in.

The primary output file ST01.BIN was generated.

```
************ GENERAL SURVEY INFORMATION DATA ***************
************** survey title & code ************************
010   EGY263FRAMEWORK FOR MICRO-LEVEL RESEARCH IN DEVELOPING
010   COUNTRIES USING DATABASE MANAGEMENT SYSTEMS
*************** survey information ************************
020 1 COUNTRY: EGYPT
020 2 MAIN OBJECTIVE: STUDYING THE USEFULNESS OF USING DATA
020 3 BASE MANAGEMENT SYSTEMS (DBMS) IN MICRO-LEVEL RESEARCH
020 4 IN DEVELOPING COUNTRIES.
020 5 RESEARCH DESIGNER: ALI KAMEL M. KAMEL
020 6 DATE: JUNE-SEP. 1986.
023 1 DATA SOURCES:  CONSEQUENCES  OF  SMALL  RICE  FARM
023 2 MECHANIZATION PROJECT, WEST JAVA, INDONESIA.
023 3 INTERNATIONAL RICE RESEARCH  INSTITUTE.
023 4 SAMPLE SIZE: 10 FARMS OF ABOUT 600 FARMAP RECORDS.
*************** local information *************************
040 1 CROP: RICE
040 2 VARIETIES: MODERN HIGH YIELDING
040 3 LOCATION: WEST JAVA, INDONESIA.
040 4 SEASON: WET SEASON 1979
040 5 FARMING SYSTEM:  LOW  AND  DECLINING  PRODUCTIVITY
040 6 CHARACTERIZED BY MOSTLY TRADITIONAL TECHNOLOGIES
040 7 SOIL TEXTURE: CLAY LOAM
040 8 SOIL COLOR: BLACK
***************** climate and production hazards ************
050 1 RAIN: NOVEMBER-FEBRUARY
050 2 ANNUAL RAINFALL: 1055 mm
050 3 AVERAGE SUMMER TEMPERATURE: 28 DEGREES (C).
***************** new code definitions ***********************
060   121013    1Ha  HECTARE HECTARES       * area conversion
060   2230 7   89HYVRHGHYLDVAHIGH YIELDING VARIETIES
060   3700 36019TRACTRACTORITRACTOR RENTAL INCOME
060   4410 78999TOOLTOOLS   ASSORTED TOOLS
********** conversion factors ********************************
060   570013    1Ha  HECTARE HECTARES
060   670013    2Hrs HOURS   HOURS
060   770013    3Ltr LITRES  LITERS
060   870013    4KG  KILOGRM KILOGRAMS
060   970013    5No. NUMBERS NO. OF ITEMS
********** user-defined codes ********************************
060 11700 74399HLABHLABOR  HIRED LABOR
060 12700 71639INSCINSCTCD INSECTCIDES
060 13700 76019TWT TWTRACT TWO WHEEL TRACTOR
060 14700 77149ROTRROTARY  ROTARY
060 15700 77339SPRYSPRAYER SPRAYER
060 16700 71029SDLGSDLINGS SEEDLINGS
060 17700 77039PLG PLOUGH  PLOUGH
060 18700 77049HRW HARROW  HARROW
060 19700 74499CHLACHLABOR CONTRACT HIRED LABOR
```

Figure 4.4 FARMAP SECONDARY INPUT FILE STO1.DAS CONTENT.

```
060 20700 71329TSP TSPHOST TRI-SUPER PHOSPHATE
060 21700 71209UREAUREA    UREA
060 22700 74159FHH FHHMEMR FEMALE HOUSEHOLD MEMBER<15YRS
060 23700 8  99SBD SDBDPREPSEEDBED PREPARATION
060 24700 8 139HRWGHARROWG HARROWING
060 25700 8 159BFRTBASFERT BASIC FERTILIZER APPLICATIONS
060 26700 8 699HTW H,T& W  HARVESTING, THRES. & WINNOWING
060 27700 8 709DRG DRYING  DRYING
060 28700 8 459TFRTTOPFRT  TOP DRESSING FERTILIZERS
060 29700 8 209SDLGPULSDLG PULLING OF SEEDLINGS
060 30700 8 229TRSGTRNSPLG TRANSPLANTING
060 31700 39399GFRMGENFRMA GENERAL FARM ACTIVITY
060 32700 79899TXS TAXES   TAXES
060 33700 38399RNT RENTOUT RENT OUT
060 34700 7 859RINCRENTINC RENT-OUT INCOME
060 35700 74699HLA HLABOR  HIRED LABOR
060 36700 55999TFM TOTFARM TOTAL FARM AREA
060 37700 38099OJB OFF/JOB OFF-FARM JOB
```

Figure 4.4 (Cont'd)

This file containing 621 records with an average of 62 data records per farm and is the primary input file for the next step, (i.e., data validation). This file was stored in a binary form which is not easily read by human beings. Binary files are used because they occupy less disk space and can be processed faster.

To check data entered and correct any errors, two FARMAP programs were used. The first one (program DISPLAYB) displays the binary records in a readable form. The second one, CORREC, corrects erroneous data fields and/or deletes undesired records. Both programs were employed to make necessary corrections.

2-Data Validation

After execution of storage stage, data were checked and modified in validation stage. Automatic correction and modification are not done by FARMAP. The user has to check or modify data fields or records. There was a difference between executing the validation stage using the menu- and the non-menu driven versions of FARMAP. The processing time using the menu driven version was faster and it was easier than using non-menu driven version.

Checking that data fields fall within acceptable limits was done in step VAL1 using program MODCON of FARMAP. The command file VAL1.CMF was executed and corrections were done using programs DISPLAYB and CORREC (mentioned above). This step, VAL1, performs within-record validation, i.e., checks

```
FILE ENTST.CMF
*****************************************************************
* THIS COMMAND FILE WAS ALTERED TO INCLUDE ONLY THE DESIRED*
* RECORD TYPES AND/OR DATA FIELDS. IT CONTAINS RECORD TYPE *
* CODE, DATA FIELD CONTENTS, DATA FIELD NUMBERS, AND THE *
* THE ACCEPTABLE LOWER AND UPPER LIMITS RESPECTIVELY. THE  *
* Z's ALLOW FOR ZERO ENTRIES WHENEVER MISSING OR UNDETERM- *
* INED OBSERVATIONS OCCUR.                                 *
*****************************************************************
700 ACTIVITY              03     10.00   9899.00
700 COMPONENT             04     10.00   9899.00 Z
700 PARCEL/PLOT/SEASON    05   1000.00  99999.00
700 INPUT-OUTPUT          07     10.00   9899.00
700 OPERATION             08     10.00   8999.00 Z
700 FREQUENCY             09      0.00      3.00
700 MONTH                 10      1.00     12.00 Z
700 WEEK                  11      1.00      4.00 Z
700 QUANTITY              12
700 QUANTITY CONV.CODE    13
700 SOURCE-DESTINATION    14      1.00     99.00 Z
700 PRICE OR VALUE        15
700 CASH/KIND             16      0.00      9.00
700 ENTER '1' IF PRICE    17      1.00      1.00 Z
230 ACTIVITY              03     10.00   4499.00
230 COMPONENT             04     10.00   3999.00 Z
230 PARCEL/PLOT/SEASON    05   1000.00  99999.00
230 VARIETY               07      1.00     99.00
230 AREA                  12      0.01 999999.00
230 AREA CONV.CODE        13
230 VALUE                 15      0.01 999999.00 Z
230 CASH-KIND OF CHANGE   24      1.00      9.00 Z
230 TYPE INVENT (CHANGE)  25      1.00     89.00
230 DATE INVENT.(CHANGE)  26      1.00    124.00 Z
110 RELAT. TO HEAD HHOLD  08      1.00     99.00
110 AGE-SEX CATEGORY      09     10.00    999.00
110 AGE, YRS-MONTHS       11      0.00   9900.00
110 NO.OF PERSONS         12      1.00     99.00
110 YRS IN DISTRICT       13
110 YRS FARMING           14
110 YRS EDUCATION         15
110 TIME IN RESIDENCE %   17      0.00    100.00
110 AVAIL.FOR WORK%       18      0.00    100.00
110 TYPE OFF-FARM WORK    19      0.00    999.00
110 TYPE INVENT (CHANGE)  25      1.00     89.00
110 DATE INVENT.(CHANGE)  26      1.00    124.00 Z
210 PARCEL (1=1000)       05   1000.00  99000.00
210 TENURE                07      1.00     99.00 Z
```

Figure 4.5 FARMAP COMMAND FILE ENTST.CMF.

Source: adapted from FAO Farm Analysis Package, vol. 3, FAO, Rome 1985.

210	LAND USE TYPE	08	1.00	99.00	
210	AREA	12	0.01	999999.00	
210	AREA CONV.CODE	13			
210	IMPROVED LAND VALUE	15	1.00	999999.00	Z
210	CASH-KIND OF CHANGE.	24	1.00	9.00	Z
210	TYPE INVENT (CHANGE)	25	1.00	89.00	
210	DATE INVENT.(CHANGE)	26	1.00	124.00	Z
410	(ACTIVITY)	03	10.00	9899.00	Z
410	(COMPONENT)	04	10.00	9899.00	Z
410	(PARCEL/PLOT/SEASON)	05	1000.00	99999.00	Z
410	ASSET ITEM	07	100.00	999.00	
410	LOCATION	08	1.00	99.00	Z
410	CAPACITY, SIZE	09			
410	AGE, YEARS-MONTHS	10			
410	REMAINING LIFE (YRS)	11			
410	NUMBER OF ITEMS	12			
410	TOTAL PRESENT VALUE	15	0.01	999999.00	
410	SALVAGE VALUE	16			
410	OWNERSHIP	19	1.00	99.00	
410	CASH/KIND OF CHANGE	24	1.00	9.00	Z
410	INVENT.TYPE (CHANGE)	25	1.00	89.00	
410	DATE INVENT.(CHANGE)	26	1.00	124.00	Z
510	(ACTIVITY)	03	10.00	9899.00	Z
510	(COMPONENT)	04	10.00	9899.00	Z
510	(PARCEL/PLOT/SEASON)	05	1000.00	99999.00	Z
510	ITEM BOUGHT W/LOAN	07	10.00	9899.00	Z
510	TYPE OF CREDIT	08	1.00	99.00	
510	SOURCE	09	1.00	99.00	Z
510	YRS-MTHS OBTAINED	10			
510	DURATION (YRS-MTHS)	11			
510	ANNUAL INTEREST %	12			
510	ORIGINAL PRINCIPAL	13			
510	OUTSTAND(AMT REPAID)	15	0.01	999999.00	
510	CASH/KIND OF CHANGE	24	1.00	9.00	Z
510	INVENT.TYPE (CHANGE)	25	1.00	89.00	
510	DATE INVENT.(CHANGE)	26	1.00	124.00	Z
200	FARM AREA	12	0.01	999999.00	
200	AREA CONVERSION	13			
200	FARM VALUE	15			
200	CROP AREA	16			
200	PASTURE AREA	17			
200	FOREST, WASTELAND	18			
200	INVENT.TYPE (CHANGE)	25	1.00	89.00	
200	DATE INVENT.(CHANGE)	26	1.00	124.00	Z
750	CONSUMP/EXPEND ITEM	03	10.00	9899.00	
750	OUTPUT CODE FOR FOOD	07	10.00	799.00	Z
750	FREQUENCY	09	0.00	3.00	
750	MONTH	10	1.00	12.00	Z
750	WEEK	11	1.00	4.00	Z

Figure 4.5 (Cont'd)

750	QUANTITY	12			
750	QUANTITY CONVERSION	13			
750	SOURCE	14	1.00	99.00	Z
750	VALUE (OR PRICE)	15			
750	CASH/KIND	16	1.00	9.00	
750	ENTER '1' IF PRICE	17	1.00	1.00	Z
430	(ACTIVITY)	03	10.00	9899.00	Z
430	(COMPONENT)	04	10.00	9899.00	Z
430	TYPE OF LOAN/ASSET	08	1.00	99.00	
430	DESTINATION/LOCATION	09	1.00	99.00	Z
430	YRS-MTHS GRANTED	10			
430	DURATION (YRS-MTHS)	11			
430	ANNUAL INTEREST %	12			
430	ORIGINAL PRINCIPAL	13			
430	OUTSTAND(AMT REPAID)	15	0.01	999999.00	
430	CASH/KIND OF CHANGE	24	1.00	9.00	Z
430	INVENT.TYPE (CHANGE)	25	1.00	89.00	
430	DATE INVENT.(CHANGE)	26	1.00	124.00	Z

Figure 4.5 (Cont'd)

on information on a single record. However, range checks on the magnitude of inputs (step VAL2) and multirecord consistency checks (step VAL3) can also be done. These later steps, VAL2 and VAL3, are advanced and optional validation steps and do not affect the course of processing.

In step VAL1 the following modifications were done

1. Missing component codes, in record types '230-700', were set equal to the corresponding activity codes.
2. Valuation of unpriced power inputs (e.g., family labor) in record type '700'. Because of lack of enough data these unpriced power inputs were set equal to zero matching with the standard FARMAP command file VAL1ST.CMF.
3. Conversion of unit prices into total values for record types '700' and '750'.
4. Conversion of quantities/areas according to the user-defined conversion factors. This step is appropriate for local units conversions
5. Calculation of total quantities and values according to the frequency codes.
6. Standard checks were included to check for illegal record types, activities, components, and so forth. Also to check for quantities, monetary values and missing codes.

3-Data Tabulation

There exists two levels of tabulation: standard tabulation and advanced or user-defined tabulation. On standard tabulation a set of standard FARMAP command files

was used with minor modifications. A number of standard subtables, and also some user-defined subtables were produced as will be discussed in detail in the next chapter.

Three different modes correspond to different levels in the hierarchy of data can be produced, i.e., farm, activity, and plot modes. Only farm and activity modes were processed, since, plot mode was not applicable.

The standard FARMAP subtables cover the following topics:

* household composition
* land resources
* cropping pattern
* animal resources
* net worth
* economics
* cash-kind flow
* power use and type (human, machine and animal)

Different FARMAP programs were used including:

1) program MODCON for checking and modification of data was used in tabulation step 1 (TAB1), discussed earlier,

2) programs FMSORT and AGGREG for reorganization and partial aggregation in tabulation step 2 (TAB2), discussed earlier,

3) programs FMSORT, TABLES, and LABEL for production of individual tables in tabulation step 3 (TAB3), discussed earlier, and

4) in tabulation step 4 (TAB4), programs FMSORT, MEANS,

TABLES, and LABEL were employed to produce mean tables of the 10 farms as discussed previously.

The standard FARMAP command files were used including TAB1, TAB22, TAB32M (where M stands for mode. F for farm, A for activity, P for plot, and Y for power types), TAB33, and TAB42 with 'CMF' extension.

During step TAB1 the following data modifications were processed:

1. Final checks for illegal codes.
2. Recoding of months of survey year so that the first month (November) is shown in the first columns of FARMAP subtables, or to any required order.
3. Creation of '702' records for power use subtables.
4. Creation of '671' records for net worth subtables.
5. Creation of '700' records for calculating cash-kind flow, and depreciation or appreciation.
6. Assigning general farm activity code when no activity is specified.
7. Duplication of '310' records for age-sex changes.
8. Creation of '232' records for crop list subtable.

The level of aggregation was set to the 'disaggregated level', and number of farm was set to 10 in step TAB2 which depends on the choice of the user.

Tabulation step TAB3 were processed according to the standard FARMAP command files. However, some modifications were done on the command files to alter the new labels for user-defined field codes.

As mentioned above, there exist three different modes: farm, activity and plot modes. In the activity mode the following subtables were requested for each activity (per unit area):

1. Crops grown.
2. Economics.
3. Cash-kind flow.
4. Human power type.
5. Human power use.
6. Animal power type (not applicable).
7. Animal power use (not applicable).
8. Machine power type.
9. Machine power use.

Two runs, using different sorting, were performed to produce the farm mode subtables. The first run processed the following subtables:

1. Household composition.
2. Land use.
3. Crops grown.
4. Seasonal animal resources (not applicable).
5. Animal resources. (not applicable).
6. Net worth statement.
7. Economics.
8. Cash kind flow.
9. Human power use.
10. Animal power use (not applicable).
11. Machine power use.

Human, animal, and machine power type subtables were produced in a separate run, using a different sorting.

In order to produce means subtables of the 10 farms under consideration, step TAB4 was employed. The command file 'TAB42.CMF' (see Figure 4.6) was modified to alter the number of selected farms to be included in the mean. This number was used as a divisor in order to get the means subtables.

It should be noted that, all the animals subtables were excluded from the analysis due to lack of enough information. The user must refer to FAO farm Analysis Package (FARMAP), User's Manuals, Volumes 1-3, for more details.

4- Advanced Processing

In order to interface FARMAP with other statistical and linear programming packages, program EXTRAC of FARMAP was used. The command file associated with that program should be designed by the user.

The command file 'EXTAC1.CMF' is shown on Figure 4.7. It produced ASCII file which was exported to statistical package, ABSTAT, for further processing. Any data fields and/or record type can be processed according to the user's choice and the objectives of the study. Data required for linear programming analysis, estimations of whole farm production functions, and obtaining information regarding multi-year variability for risk analysis can also be

```
FILE TAB42.CMF
*************************************************************
* The user must specify whether all or selected farms(which*
* ones) are to be included in the mean. If 'ALL' is *
* indicated, the total number of farms in the data file *
* must be supplied. This number is used by MEANS as a *
* divisor. In this example all the 10 farms are included. *
* The FUNCTIONS commands allow for transfer of operations *
* transfer and are followed by record types and codes for *
* transfer operations for data fields 2-27 in groups of 2 *
* or 3. The BREAK parameter enables the user to control the*
* grouping or aggregation of output records. The EACH para-*
* meter indicates that one output record will be produced *
* for every input record.(See FARMAP USER's MANUAL, vol. 2 *
* for more details). *
*************************************************************
SELECT ALL 10          *10 farms are included in the data file
FUNCTIONS 1101 333 112 222 222 222 222 222 222 22
FUNCTIONS 1102 333 112 222 222 222 222 222 222 22
FUNCTIONS 1103 333 112 222 222 222 222 222 222 22
FUNCTIONS 1104 333 112 222 222 222 222 222 222 22
FUNCTIONS 1105 333 112 222 222 222 222 222 222 22
FUNCTIONS 1106 333 112 222 222 222 222 222 222 22
FUNCTIONS 1107 333 112 222 222 222 222 222 222 22
FUNCTIONS 1109 333 112 212 222 222 222 222 222 22
FUNCTIONS 2100 333 333 332 121 223 323 333 333 33 EACH
FUNCTIONS 2300 555 115 252 221 222 252 111 155 55 BREAK 7
FUNCTIONS  2310  333 333 333 323 333 333 333 333 33  BREA  3
BREA 4 BREA 5 BREA 7
FUNCTIONS 3201 333 133 311 132 222 222 222 222 11 BREAK 8
FUNCTIONS 3202 333 133 311 132 222 222 222 222 11 BREAK 8
FUNCTIONS 3203 333 133 311 132 222 222 222 222 11 BREAK 8
FUNCTIONS 3204 333 133 311 132 222 222 222 222 11 BREAK 8
FUNCTIONS 3206 333 133 311 132 222 222 222 222 11 BREAK 8
FUNCTIONS 3207 333 113 111 112 222 222 221 111 11 BREAK 8
FUNCTIONS 3208 333 113 111 112 222 222 221 111 11 BREAK 8
FUNCTIONS 3209 333 113 111 112 222 222 221 111 11 BREAK 8
FUNCTIONS 3210 333 113 111 112 222 222 221 111 11 BREAK 8
FUNCTIONS 3211 333 113 111 112 222 222 221 111 11 BREAK 8
FUNCTIONS 3212 333 113 111 112 222 222 221 111 11 BREAK 8
FUNCTIONS 6710 333 352 222 222 222 222 222 225 32 EACH
FUNCTIONS  6800 333 322 222 222 222 222 222 223 22 BREAK  25
BREAK 5
FUNCTIONS 7091 333 322 222 222 222 222 222 222 32 BREAK 26
FUNCTIONS 7092 333 322 222 222 222 222 222 222 32 BREAK 26
FUNCTIONS 7093 333 322 222 222 222 222 222 222 32 BREAK 26
*************************************************************
```

Figure 4.6 FARMAP COMMAND FILE TAB42.CMF

Source: adapted from FAO, FAO Farm Analysis Package, Vol. 2, Rome, 1985.

```
FILE EXTRAC1.CMF COMMAND FILE
*************************************************************
* THIS  FILE  TRANSFER  SPECIFIC  DATA  FIELDS AND RECORDS *
* REQUIRED  FOR  OTHER  COMPLEMENTARY  SOFTWARE,  e.g.      *
* STATISTICAL AND/OR LINEAR PROGRAMMING PACKAGES.           *
* ADAPTED FROM FARMAP USER'S MANUAL, JULY 1986.             *
*************************************************************
FORMAT USERSPECIFIED 1 8  * request 8 variables
(2X, F4.0, 1X, '¦', 5(1X,F5.0, '¦'), F9.2, '¦',F9.2)
MODE FARM  * process the farm mode
TITLE  5 1 * title of five lines and output record of 1 line
                ¦   **** HOUSEHOLD **  ¦    *** FARM ****
 FARM ¦NO.     ¦ YRS.  ¦ YRS.  ¦ YRS.  ¦ NO.   ¦ VAR.      ¦   GROSS
 NO.  ¦ OF     ¦ OLD-  ¦ HEAD  ¦ FAR-  ¦ PAR_  ¦ COSTS     ¦ INCOME
      ¦ MEM-   ¦ EST   ¦       ¦ MING  ¦ CELS  ¦           ¦
      ¦ BERS   ¦       ¦       ¦       ¦       ¦           ¦
SELECT 110 * select record type 110 (household record)
TRANSFER MAXIMUM 11 3 MAXIMUM 1 1 ACCUMULATE 12 2
SELECT 110 8 1.0 1.0 * select record type,  data field,  and
                     * upper and lower limit of the data.
TRANSFER MAXIMUM 11 4 MAXIMUM 11 5
SELECT 210
TRANSFER FREQUENCY 2 6 MAXIMUM 1 1
SELECT 700 3 10.0 5999.0 7 1000.0 8999.0
TRANSFER  ACCUMULATE 15 7 MAXIMUM 1 1 * to add related  data
                                      * fields together.
SELECT 700 3 10.0 9999.0 7 10.0 999.0
TRANSFER ACCUMULATE 15 8 MAXIMUM 1 1
```

Figure 4.7 FARMAP COMMAND FILE EXTRAC1.CMF.

extracted by using program EXTRAC of FARMAP. This procedures will be discussed in the next chapter.

The advanced processing stage was employed only on the rice activity, which is the main activity of the 10 farms.

Results of FARMAP analysis, limitations and operational errors, and advanced processing, will be discussed in Chapter 5.

4.2 Structure of dBASE III PLUS

4.2.1 Introduction

dBASE III PLUS is a software package marketed by Ashton Tate, Inc., and is a powerful development tool for microcomputers. It is a relational database management system. The data is arranged in the form of a matrix, with the rows of the matrix forming each individual record in the database, and the columns of the matrix forming the individual fields of information across all records.

dBASE III PLUS can be used in the conceptualization and creation of databases for numerous types of applications. The basic features of it include:

* Creation of unique database structures to fit specific problems.
* Displaying, editing, modifying, and documenting the structure of the database files.
* Physical sorting and logical indexing of the databases.
* Creation of reports and labels with totals and averages.
* Writing menu-driven systems for inexperienced users.
* Generating screen formats for easier data entry.
* Multiple files manipulation (e.g. combining several files, editing files simultaneously, using and processing up to 15 files simultaneously).
* A programming language which has a variety of uses

including mathematical, relational, logical, and string operations to create relational database structures. It is a high level procedural langauge which contains an application encoder and editor. Also it has many commands and functions including mathematical, basic statistical, and string manipulation functions. In addition there exist many classes of commands which can be used for creation of files, addition, editing, modifying, manipulating, and displaying of data.

* A full screen assistant and help menu.

* An applications' generator for novice users which can be used to generate wide variety of applications without knowing dBASE III PLUS programming and features.

There are two ways to use dBASE III PLUS. The first is through the assistant; which is, a collection of menus. The second is using "dot commands" to perform directly any operation.

dBASE III PLUS can be used either as a stand-alone system for a single-user, or it can be networked in a multiuser local-area network (LAN) environment. This study only used single-user system, and the LAN environment will not be addressed.

4.2.2 Computer and Other Requirements

dBASE III PLUS can be executed on a variety of microcomputers, under any one of the popular operating

systems (e.g. MSDOS, PC-DOS, CP/M, UNIX, XENIX). However, mainframe and minicomputer versions are not available.

A microcomputer with a two floppy drives and a minimum of 256 K bytes of RAM (Random Access Memory) is recommended. However, for a full utilization of the package, 640 K bytes of RAM is essential.

In addition, hard disk operation is highly recommended for faster and smoother processing.

dBASE III PLUS provides an 'assistant' menu-driven feature to provide the novice with the ability to create data files and other supporting files (e.g. screen format information, index and sort files). Also, it provides an 'application generator' utility programs to assist the user in building and creating a wide variety of application.

4.2.3 dBASE Data Structure

4.2.3.1 Technical Specifications

dBASE III PLUS is a programming language developed to handle relational database files. Up to one billion records or 2 billion bytes can be processed depending on the computer memory available. The maximum record size is 4000 bytes in a database file and 512 K bytes in database memo files with, up to 128 data fields.

The field width varies according to the field types. For example, a maximum of 254 bytes for character, 8 bytes for date, 1 byte for logical, 5000 bytes for memo, and 19 bytes for numeric fields. Fifteen open files of all types

(of which 10 open database files, seven open index file, and one open format file per active data base file can be processed in the same time.

The largest and smallest positive numbers which can be handled by dBASE are 1 x 10^{+99} and 1 X 10^{-307}, respectively. The numeric accuracy is fifteen digits with a maximum of nine digits being to the right of the decimal point. However, the decimal point and the sign each use one digit place. Hence, the accuracy is 13 when comparing non-zero numbers with decimal points.

Finally, the command line may contain up to 254 characters as maximum length .

4.2.3.2 Database Files and Structure

There are 13 specialized formats to save information on files. Each serves a specific processing need. They are described in Table 4.10

The structure of a database file is established by defining each of the fields' name, type, and width in the database. Field names may be up to 10 characters in length but must begin with a letter. They may contain letters, numbers, and underscores, but, embedded blank spaces are not permitted.

There are five types of fields used which have variable field width. These are:

1. Character fields: they are used to store any printable ASCII characters including letters, numbers,

Table 4.10 dBASE III PLUS FILES' TYPES.

File name	Files extention	Description
Catalog	.cat	contains sets of related database files and their associated operational files (such as .fmt,.frm, and .lbl files).
Database	.dbf	stores data in records and fields, and rows and columns respectively. Each record contains a set of unique information.
Memo	.dbt	store the information of memo fields.
Index	.ndx	provides the means to access a database in logical (alphabetical, chronological, or numerical) order rather than the physical order (the order in which the records were entered).
Command & Procedures	.prg	contains instructions that have been stored as programs.
Format	.fmt	create screen forms for use in data entry and printed output.
Label form	.lbl	contains the information needed to print labels.
Memory	.mem	saves the contents of memory variables for later use.
Query	.qry	restricts the records (through filter conditions) that are displayed in commands that require a database file to be in use.
Screen	.scr	contains information that is used to generate and modify format files.
View	.vue	contains the names of database files, their associated indexes, format files, a list of selected field names, filter conditions and relationships between these files.
Report	.frm	contains the information needed to prepare reports.
Text	.txt	interfaces dBASE III with other software packages. These are ASCII files.

Source: exerted from Learning and Using dBASE III PLUS, User's Manual, Ashton Tate, 1985.

special symbols, and blank spaces. The maximum field size is 254 characters.

2. Date fields: they are used to store dates. The maximum field size is 8 bytes.

3. Numeric fields: these are of two types: integer and decimal. The field width is the number of digits the field can hold. The decimal point and sign each count as one digit. The maximum field width is 19 bytes. 4. Logical fields: they only accept single characters (width) representing True/False values. For example, T, t, Y, y for true and F, f, N, n for false.

5. Memo fields: these accommodate large blocks of textual information and are stored in auxiliary file to database file. The field size is variable from 0 up to a maximum of 5000 bytes depending on the size of the memo related to the record being entered.

Additionally, there exist a special type of variables that store data outside the database file structures. These are the memory variables which provide a convenient way of temporary storage of data. These variables can be used for further calculations in programming applications. For example, the contents of any data fields might be summed or averaged and the result stored as a memory variable. Memory variable names can have up to 10 characters long. There are four kinds of memory variables: character, date, numeric, and logical. The normal dBASE III allows for up to 256 memory variables. However, by modifying the dBASE

configuration file the number can be increased.

4.2.3.3 dBASE III PLUS Commands and Functions

There are also a set of dBASE commands and functions which are very useful. There are various classes of commands which perform the following major tasks:

1. Creation of files: the followings are selected dBASE III commands used to create files:

COPY: copies database in use to a new database.
CREATE: creates a new database file.
CREATE REPORT: creates a report form file.
CREATE SCREEN: creates a screen file, a format file, and optionally a database file.
SORT: creates a sorted version of the active database file.

2. Addition of data: the following commands add new records to databases:

APPEND: adds data at the end of a database file.
BROWSE: adds data at the end of a database file.
INSERT: inserts data into a database file.

3. Editing of data: the following dBASE commands edit the data within a database:

EDIT: alters data fields in a database.
DELETE: marks records for deletion.
PACK: removes records marked for deletion.
REPLACE: replaces data fields with specified values.

4. User assistance: the following commands give on-line information:

ASSIST: menu-driven; aids execution of dBASE commands.
DIR: displays files on designated disk drive or directory.
HELP: menu-driven; explains commands and other information.

5. Data display: the following commands display selected

data from a database:

@... SAY: displays user-formatted data on the screen or printer.
LIST: lists records and fields.
REPORT: displays a report of data.
SUM: computes and displays the sum of an expression for a database records specified.

In addition, there also exist classes of commands which perform other tasks including positioning record pointer, manipulating databases, using memory variables, programming, parameter control, and debugging commands.

dBASE III functions are also very useful. The following examples illustrate some of these functions:

ABS() returns the absolute value of a number.
BOF() locates the beginning of file
INT() provides the intger value of an expression.
ISLOWER() evaluates for lower case input.
ISUPPER() evaluates for upper case input.
LTRIM() removes leading blanks from a character expression.
MAX() determines the greater of two values.
MIN() determines the lesser of two values.
OS() returns the name and version of the operating system.
SUBSTR() checks for the occurrence of a required string of characters within a character field.
STR() views a numeric field as a character field.
TYPE() finds out the type definition of any field (character, numeric, logical, date, or memo).
VAL() derives numeric data from a character field.

These commands and functions with their related syntax are explained in details in dBASE III PLUS User's Manuals.

4.2.4 Analytical Procedures

1. Introduction

The same data used with FARMAP were also processed using dBASE III PLUS. The reason for using the same data

with both programs is to make the comparison more meaningful.

First, FARMAP binary files were transferred into an ASCII files by using program DISPLAYB of FARMAP along with MS-DOS utilities and a special editor called 'P- Edit'. Then, program ALI.prg was designed using dBASE programming techniques to transfer FARMAP data into dBASE file structure. The program is shown in Figure 4.8.

Two files are listed in this program: STRUCTUR.dbf and DATA.dbf. The first file contained FARMAP ASCII data on single-lines' records. Each standard FARMAP records (i. e. of 27 data fields on six lines) comprised six single-line records. The structure of this file was first created based on 80-columns single field's records. Then, database structure of the second file was created based on multiple lines/fields' records to transfer each six single-line records to one multi-line record. Using dBASE 'DO' command, to run program 'ALI.prg', data were transferred to 'DATA.dbf' file. 'SELECT' command was employed to use multiple databases simultaneously,

The 'APPEND BLANK' command of dBASE III was executed to add blank records to the structure of 'DATA' database file. Whereas, the 'REPLACE' command was used to replace and exchange data fields between the two files. The 'SELECT' commands was used to manipulate multiple files. Other commands and functions are explained earlier.

2. Creation of Database Structures

After transferring FARMAP data file into dBASE file structures, various database structures were created. To fully utilized dBASE III PLUS, the two ways of using dBASE (the menu-driven assistant and the dot commands) were both performed throughout the analysis.

New database files were created for each correspondent FARMAP record type. In addition, a master file was created to control the filter conditions upon which specific data fields and/or records can be processed. The followings are database files which were created:

* RT110.dbf, which corresponds to FARMAP Household record type '110'.
* RT200.dbf, which corresponds to FARMAP Farm record type '200'.
* RT210.dbf, which corresponds to record type '210'; land characteristics record.
* RT230.dbf, which corresponds to FARMAP record type '230'; Crop characteristics record.
* RT310.dbf, which corresponds to FARMAP Animal record type '310'.
* RT410.dbf, which corresponds to Physical assets record type '410'.
* RT700.dbf, which corresponds to FARMAP Resource flow record type '700'

In addition to the above mentioned database files, a

```
*************************************************************
* THIS IS A PROGRAM TO CONVERT FARMAP MULTI-LINES RECORDS   *
* INTO dBASE III PLUS SINGLE-LINE RECORDS(each 6 lines of   *
* program structur.dbf are combined into  one single line   *
* in program data.dbf)"ALI.PRG JULY, 1986)                  *
*************************************************************
select 1
use structur
select 2
use data
do while .not. eof()
    append blank
    select 1
    replace data->a1 with val(substr(text ,1 ,4))
    replace data->a2  with val(substr(text ,11 ,5))
    skip
    select 2
    replace a3 with val(substr(structur->text ,1 ,7))
    replace a4 with val(substr(structur->text ,12 ,8))
    replace a5 with val(substr(structur->text ,24 ,7))
    replace a6 with val(substr(structur->text ,40 ,5))
    replace a7 with val(substr(structur->text ,51 ,11))
    select 1
    skip
    select 2
    replace a8 with val(substr(structur->text ,1 ,7))
    replace a9 with val(substr(structur->text ,15 ,4))
    replace a10 with val(substr(structur->text ,25 ,7))
    replace a11 with val(substr(structur->text ,39 ,4))
    replace a12 with val(substr(structur->text ,47 ,12))
    select 1
    skip
    select 2
    replace a13 with val(substr(structur->text ,1 ,4))
    replace a14 with val(substr(structur->text ,12 ,8))
    replace a15 with val(substr(structur->text ,22,12))
    replace a16 with val(substr(structur->text ,40 ,6))
    replace a17 with val(substr(structur->text ,53 ,4))
    select 1
    skip
    select 2
    replace a18 with val(substr(structur->text ,1 ,4))
    replace a19 with val(substr(structur->text ,13 ,4))
    replace a20 with val(substr(structur->text ,27 ,4))
    replace a21 with val(substr(structur->text ,39 ,4))
    replace a22 with val(substr(structur->text ,52 ,4))
```

Figure 4.8 PROGRAM ALI.PRG TO TRANSFER FARMAP DATA FILES INTO dBASE III PLUS DATA FILES.

```
    select 1
    skip
    select 2
    replace a23 with val(substr(structur->text ,1 ,4))
    replace a24 with val(substr(structur->text ,13 ,4))
    replace a25 with val(substr(structur->text ,27 ,4))
    replace a26 with val(substr(structur->text ,39 ,4))
    replace a27 with val(substr(structur->text ,52 ,4))
    select 1
    skip
    select 2
close all   *to close all files
enddo
```

Figure 4.8 (Cont'd)

master file; FARMAP.dbf; was created to control data hierarchy and levels of aggregation.

To achieve the objectives of the study, screen forms were designed for each database file to make data entry process much more easier. This was mainly done to overcome the difficulty of FARMAP data entry process. Also, these screen forms contain codes definitions for easier references and to facilitate data entry process and to eliminate errors.

The structures of database files and their associated screen forms are listed in Figure 4.9-17. The two ways of using dBASE were employed (the menu-driven assistant and advanced programming). The X's appearing on the figures represent data fields' width. For instance 2 X's represent 2 characters data field width, and so on. Each figure has two main parts: 1) feild definition for screen, and 2) the screen format. The first part contains data fields' names, types, width, database file' name, and decimal locations for numeric data fields. The second part which is the screen format show data fields arranged for easier data entry, and explain codes definition to eliminate errors.

It should be mentioned that checking for data entry errors was not done because the same FARMAP data were transfer d after performing the checking and validation proced s mentioned earlier. However, dBASE III PLUS features allow for error traping and performing checking and validation of data. This can be done by using the 'RANGE'

option of the MODIFY command of dBASE to specify the accepted lower and upper ranges of each data field. For example, any data lie outside these specified limits will be rejected by the program. Also, dBASE provides a built-in editor to check for data fields types according to the specified database structure. In addition, dBASE III PLUS provides many commands for editing and checking the data within a database. For example, the command EDIT alters data fields in a database, and the command CHANGE edits specified fields and records in a database.

Database files were checked and validated using the DISPLAY command of dBASE III PLUS. Through the use of this command the following operations were displayed on the screen or on paper:

1) display all the data from a database

2) display a single or a group of records from the database

3) display a specified field from selected records

4) display record(s) that fulfill a simple or a complex condition

5) display records or fields from multiple databases

6) display any combinations of the above

Field definitions for screen : C:FARMAPF.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	9	40	FARMAP	VILLAGE_NO	Numeric	2	0
1	11	25	FARMAP	FARM_NUMBR	Numeric	2	0
1	11	57	FARMAP	SEASON	Character	3	
1	13	38	FARMAP	DATE	Date	8	

Content of page : 1

```
================================================
=     FARM MANAGEMENT ANALYSIS PACKAGE (FARMAP)  =
================================================
            ************************
+----------------------------------------------+
|  RECORD DESCRIPTION: MASTER FILE "FARMAP.DBF"|
|  RECORD NUMBER: FARMAP.DBF                   |
+----------------------------------------------+
|                VILLAGE_NO  XX                |
|                                              |
|  FARM NUMBER  XX                SEASON  XXX  |
|                                              |
|                DATE        XXXXXXXX          |
|                                              |
+----------------------------------------------+
```

Figure 4.9 dBASE III PLUS MASTER FILE FARMAP.DBF SCREEN FORM.

Field definitions for Screen : C:RT110F.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	5	48	RT110	RECORDTYPE	Character	3	
1	8	56	RT110	SERIALNUM	Numeric	2	0
1	9	32	RT110	RELATOHHOU	Character	2	
1	14	36	RT110	AGE	Numeric	2	0
1	14	62	RT110	SEX	Logical	1	
1	15	20	RT110	YRSFRMING	Numeric	2	0
1	15	50	RT110	YRSEDUCATE	Numeric	2	0
1	16	27	RT110	TIMERESID	Numeric	3	0
1	16	59	RT110	TIMEWORK	Numeric	3	0
1	17	26	RT110	OFFRMWORK	Character	6	
1	8	22	RT110	NAME	Character	15	
1	12	22	RT110	AGESEXCATG	Character	3	
1	14	21	RT110	NUOFPERSON	Numeric	2	0
1	14	62	RT110	SEX	Logical	1	
1	9	56	RT110	CIVILSTATS	Character	2	
1	17	60	RT110	TYPINVTORY	Character	2	
1	5	25	RT110	FARM_NUMBR	Numeric	2	0
1	4	35	RT110	VILAGE_NO	Numeric	2	0

Content of page : 1

```
**********************************************
*  RECORD DESCRIPTION: HOUSEHOLD RECORD      *
*  RECORD NUMBER : RT110.DBF                 *
*--------------------------------------------*
*               VILLAGE No. XX               *
*  FARM NUMBER   XX       RECORD TYPE   XXX  *
**********************************************
```

```
+------------------------------------------------------------+
| NAME (last,first) XXXXXXXXXXXXXXX     SERIAL NUMBER XX     |
| RELATION TO HEAD-HOUSEHOLD  XX        CIVIL STATUS  XX     |
|  (1 head, 2 spouse, 3 child,          (19 single, 49       |
|   7 parent, 99 per. labor)             married,59 widowed  |
|                                       , 99 undet.)         |
| AGE-SEX CATEGORY  XXX  (69 head, 129 spouse/daughter,      |
|                   149 child son, 269 per. labor, 159 son,  |
|                   109 child daughter)                      |
| NO. PERSONS  XX  AGE (Years) XX  SEX(MALE(M)/FEMALE(F) X   |
| YEARS FARMING   XX          YEARS OF EDUCATION XX          |
| TIME IN RESIDENCE (%) XXX  TIME AVAIL. FOR WORK (%) XXX    |
| TYPE OF OFF-FARM WORK XXXXXX  TYPE INVENTORY CHANGE  XX    |
|                               (9 closing,11 born,51 died,  |
|                               88 left,85 sale,40  purch.)  |
+------------------------------------------------------------+
```

Figure 4.10 dBASE III PLUS FILE RT110.DBF SCREEN FORM.

Field definitions for Screen : C:RT200F.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	38	RT200	VILLAGE_NO	Character	2	
1	5	22	RT200	FARM_NUMBR	Character	2	
1	5	55	RT200	RECORDTYPE	Character	3	
1	9	19	RT200	NUOFPACELS	Numeric	2	0
1	9	67	RT200	DISTANCETO	Numeric	2	0
1	10	22	RT200	REFR_POINT	Character	10	
1	11	18	RT200	DIRCTNTORP	Character	3	
1	12	13	RT200	FARMAREA	Numeric	8	2
1	12	55	RT200	AREACONVER	Character	1	
1	13	21	RT200	ELEVATION	Numeric	4	0
1	13	59	RT200	FARM_VALUE	Numeric	10	0
1	15	15	RT200	AREACROPED	Numeric	6	2
1	15	39	RT200	AREAPASTUR	Numeric	6	2
1	15	63	RT200	AREAFOREST	Numeric	6	2
1	17	17	RT200	NOCATTLE	Numeric	4	0
1	17	40	RT200	NOSHEEP	Numeric	4	0
1	17	65	RT200	NOGOATS	Numeric	4	0
1	19	17	RT200	NODONKEYS	Numeric	4	0
1	19	34	RT200	OTHERS	Numeric	4	0
1	19	66	RT200	TYPINVTORY	Character	2	

Content of page : 1

```
  **********************************************************
  *  RECORD DESCRIPTION: FARM RECORD                       *
  *  RECORD NUMBER: RT200.DBF                              *
  *-------------------------------------------------------*
  *                    VILLAGE_NO  XX                     *
  *   FARM NUMBER  XX                  RECORD TYPE  XXX   *
  **********************************************************

============================================================
NUMBER OF PARCELS XX     DISTANCE TO REFERENCE POINT (km)  XX
REFERENCE POINT (RP) XXXXXXXXXX  (e.g. market, home,...etc.)
DIRECTION TO RP XXX (N:north, S:south, NW:north west,..etc.)
FARM AREA   XXXXXXXX     AREA CONVERSION CODE  X (1 hectare )
ELEVATION (meters)  XXXX              FARM VALUE    XXXXXXXXXX

AREA CROPPED XXXXXX   AREA PASTURE XXXXXX  AREA FOREST XXXXXX

No. OF CATTLE XXXX    No. OF SHEEP XXXX    No. OF GOATS  XXXX

No. OF DONKEYS XXXX  OTHERS XXXX  TYPE OF INVENTORY CHANGE XX
============================================================
```

Figure 4.11 dBASE III PLUS FILE RT200.DBF SCREEN FORM.

Field definitions for Screen : C:RT210F.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	42	RT210	VILLAGE_NO	Numeric	2	0
1	5	24	RT210	FARM_NUMBR	Numeric	2	0
1	5	62	RT210	RECORDTYPE	Numeric	3	0
1	8	21	RT210	PRCPLTSESN	Character	5	
1	10	9	RT210	TENURE	Character	2	
1	12	15	RT210	LANDUSETYP	Character	2	
1	13	12	RT210	FARMAREA	Numeric	8	2
1	13	45	RT210	AREACONVER	Character	1	
1	15	13	RT210	IRRIGATION	Character	3	
1	16	11	RT210	DRAINAGE	Character	2	
1	18	18	RT210	WATERDEPTH	Numeric	3	0
1	18	36	RT210	TOPOGRAPHY	Numeric	2	0
1	19	15	RT210	SOILTEXTUR	Numeric	2	0
1	20	13	RT210	SOILCOLOR	Numeric	2	0
1	21	33	RT210	SOILDEPTH	Numeric	4	2
1	21	69	RT210	TYPINVTORY	Character	2	
1	14	40	RT210	LANDVALUE	Numeric	8	0

Content of page : 1

```
  **********************************************************
  *  RECORD DESCRIPTION: LAND CHARACTERISTICS              *
  *                                                        *
  *  RECORD NUMBER: RT210.DBF                              *
  *--------------------------------------------------------*
  *                      VILLAGE_NO  XX                    *
  *  FARM NUMBER  XX                        RECORD TYPE  XXX *
  **********************************************************
==============================================================
PARCEL-PLOT-SEASON  XXXXX (1000 owned,31000 rented in, 50000
                           rented out, 80000 communal)
TENURE  XX (29 owned and managed, 49 rented in and managed,
            59 rented out and managed, 89 communal)
LAND USE TYPE XX (19 rainfed, 29 irrigated, 89 mixture)
FARM AREA  XXXXXXXX   AREA CONVERSION CODE  X  (1 hectare)
                   FARM LAND VALUE  XXXXXXXX
IRRIGATION  XXX (199 flood,299 river,319 well,499 bore,
                 599 tank,799 other)
DRAINAGE XX (19 very poor,29 poor,39 occasional waterlogging,
             49 good, 59 excellent)
WATER DEPTH (m.) XXX   TOPOGRAPHY XX (9 level, 19  hilly)
SOIL TEXTURE XX  (13 sandy clay, 21 clay loam, 22 sandy
                  clay loam)
SOIL COLOR  XX (29 red, 59 black)
SOIL DEPTH (m.) XXXX          TYPE OF INVENTORY CHANGE   XX
==============================================================
```

Figure 4.12 dBASE III PLUS FILE RT210.DBF SCREEN FORM.

Field definitions for Screen : C:RT230F.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	42	RT230	VILLAGE_NO	Numeric	2	0
1	5	25	RT230	FARM_NUMBR	Numeric	2	0
1	5	60	RT230	RECORDTYPE	Character	3	
1	9	11	RT230	ACTIVITY	Character	4	
1	9	69	RT230	COMPONENT	Character	4	
1	10	21	RT230	PRCPLTSESN	Character	5	
1	11	9	RT230	VARIETY	Character	2	
1	12	20	RT230	PLANTARRNG	Character	2	
1	14	20	RT230	PUPOSGRWNG	Character	2	
1	15	8	RT230	AREA	Numeric	8	2
1	15	46	RT230	AREACONVER	Character	1	
1	16	18	RT230	PLTCONDTON	Character	1	
1	17	26	RT230	PLTPOPULTN	Numeric	3	0
1	18	13	RT230	CASH_KIND	Character	1	
1	19	26	RT230	TYPINVTORY	Character	2	

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```
*************************************************************
* RECORD DESCRIPTION: CROP CHARACTERISTICS RECORD            *
* RECORD NUMBER: RT230.DBF                                  *
*-----------------------------------------------------------*
*                      VILLAGE_NO  XX                       *
* FARM NUMBER  XX                          RECORD TYPE  XXX *
*************************************************************

=============================================================
ACTIVITY  XXXX (29 rice, 19 wheat, 919 cotton)  COMPONENT XXXX
 PARCEL-PLOT-SEASON  XXXXX (cc,tt,s)
 VARIETY XX (89 modern high yielding, 49 local, .....etc.)
 PLANT  ARRANGEMENT   XX  (19 broadcast,  29  scattered,  59
                           regular, 69 ridges)

 PURPOSE OF GROWING  XX  (29 consumption, 39 mixed food/cash,
                          49 cash)
AREA   XXXXXXXX          AREA CONVERSION CODE  X  (1 hectare)
PLANT CONDITION  X (1 excellent,  2 good, 3 average, 4 poor,
5 very poor)
 PLANT POPULATION ('000)  XXX  (e.g. # of plants/ha)
 CASH_KIND   X ( 1 all kind, 2 25%cash, 3 50%cash,4 75%cash,
5 all cash)
 TYPE OF INVENTORY CHANGE XX  ( 9 closing inventory)
=============================================================
```

Figure 4.13 dBASE III PLUS FILE RT230.DBF SCREEN FORM.

Field definitions for Screen : C:RT310.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	38	RT310	VILLAGE_NO	Numeric	2	0
1	5	24	RT310	FARM_NUMBR	Numeric	2	0
1	5	54	RT310	RECORDTYPE	Numeric	3	0
1	8	10	RT310	ACTIVITY	Numeric	4	0
1	10	12	RT310	COMPONENT	Numeric	4	0
1	10	51	RT310	PRCPLTSESN	Character	5	
1	11	18	RT310	AGESEXCATG	Character	3	
1	12	20	RT310	MGMTPRCTIC	Character	2	
1	13	8	RT310	BREED	Character	3	
1	14	19	RT310	AGE	Numeric	4	2
1	14	50	RT310	REMANGLIFE	Numeric	2	0
1	15	19	RT310	NO_ANIMALS	Numeric	3	0
1	15	44	RT310	SERIAL_NO	Numeric	3	0
1	16	23	RT310	PURCH_COST	Numeric	8	0
1	16	60	RT310	PREST_VALU	Numeric	8	0
1	17	23	RT310	SLVAG_VALU	Numeric	8	0
1	18	23	RT310	PURPOSE	Character	2	
1	19	12	RT310	CONDITION	Character	1	
1	20	18	RT310	OWNER_STAT	Character	2	
1	21	16	RT310	AVE_WEIGHT	Numeric	4	0
1	21	52	RT310	CASH_KIND	Numeric	1	0
1	22	26	RT310	TYPINVTORY	Character	2	

```
   ********************************************************
   *  RECORD DESCRIPTION: ANIMAL RECORD                   *
   *  RECORD NUMBER: RT310.DBF                            *
   *-----------------------------------------------------*
   *                  VILLAGE_NO  XX                     *
   *  FARM NUMBER  XX                RECORD TYPE  XXX    *
   ********************************************************
============================================================
ACTIVITY  XXXX  (5099 cattle,5199 buffaloes,5299 sheep, 5399
      goats,5499 horses,5599 pigs,5699 camels,5799 poultry)
COMPONENT   XXXX                PARCEL-PLOT-SEASON   XXXXX
AGE-SEX CATEGORY  XXX (199 female,299 male, 999 undet.)
MANAGEMENT  PRACTICE  XX (19 extensive  grazing,49  herded,99
                          undetermined)
BREED XXX (199 local,299 crossbred,499 exotic,999 undet.)
AGE (yrs.,months)  XXXX   REMAINING LIFE (years)  XX
NUMBER OF ANIMALS  XXX    SERIAL NUMBER     XXX
PURCHASE COST(total) XXXXXXXX PRESENT VALUE (total) XXXXXXXX
SALVAGE VALUE (total)  XXXXXXXX
PURPOSE FOR KEEPING XX (29 consumption,49 cash,89 mixed)
CONDITION X (1 excellent,2 good,4 poor,5 very  poor,9 undet)
OWNERSHIP STATUS  XX  (29 owned,49 taken in,59 given  out)
AVERAGE WEIGHT  XXXX            CASH/KIND OF CHANGE  X
TYPE OF INVENTORY CHANGE   XX
============================================================
```

Figure 4.14 dBASE III PLUS FILE RT310.DBF SCREEN FORM.

Field definitions for Screen : C:RT410F.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	38	RT410	VILLAGE_NO	Numeric	2	0
1	5	24	RT410	FARM_NUMBR	Numeric	2	0
1	5	53	RT410	RECORDTYPE	Character	3	
1	9	14	RT410	ACTIVITY	Character	4	
1	10	14	RT410	COMPONENT	Character	4	
1	10	41	RT410	PRCPLTSESN	Character	5	
1	11	14	RT410	ITEM_CODE	Character	4	
1	12	14	RT410	LOCATION	Character	2	
1	13	17	RT410	CPACTYSIZE	Numeric	6	0
1	14	14	RT410	AGE	Numeric	4	2
1	14	47	RT410	REMANGLIFE	Numeric	4	2
1	15	16	RT410	NO_ITEMS	Numeric	2	0
1	15	39	RT410	ORIG_COST	Numeric	9	0
1	16	17	RT410	PRESTVALUE	Numeric	9	0
1	16	45	RT410	SALVGVALUE	Numeric	9	0
1	17	13	RT410	CONDITION	Character	1	
1	18	20	RT410	OWNERSTAT	Character	2	
1	19	13	RT410	CASH_KIND	Character	1	
1	19	44	RT410	TYPINVTOR	Character	2	

```
**********************************************************
*  RECORD DESCRIPTION: PHYSICAL ASSETS RECORD            *
*  RECORD NUMBER: RT410.DBF                              *
*------------------------------------------------------*
*                  VILLAGE_NO  XX                       *
*  FARM NUMBER  XX                RECORD TYPE  XXX      *
**********************************************************

============================================================
| ACTIVITY XXXX (29 rice, 9399 general farm activity)      |
| COMPONENT XXXX  PARCEL-PLOT-SEASON XXXXX (99999 not appl.|
| ITEM_CODE   XXXX (6019 small tractor, 8999 tools)        |
| LOCATION  XX (11 farm, 12 home, 13 market, 19 warehouse) |
| CAPACITY/SIZE XXXXXX (e.g. horsepower, cubic meters,etc.)|
| AGE (years) XXXX     REMAINING LIFE (years)  XXXX        |
| NO. OF ITEMS  XX      ORIGINAL COST  XXXXXXXXX           |
| PRESENT VALUE  XXXXXXXXX    SALVAGE VALUE  XXXXXXXXX     |
| CONDITION  X (1 excellent, 3 good, 4 poor, 5 very poor)  |
| OWNERSHIP STATUS XX (29 owned,49 rented in,59 rented out)|
| CASH_KIND X     TYPE OF INVENTORY CHANGE XX (9 closing)  |
============================================================
```

Figure 4.15 dBASE III PLUS FILE RT410.DBF SCREEN FORM.

Field definitions for Screen : C:RT510.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	41	RT510	VILLAGE_NO	Numeric	2	0
1	5	27	RT510	FARM_NUMBR	Numeric	2	0
1	5	56	RT510	RECORDTYPE	Character	3	
1	8	14	RT510	ACTIVITY	Character	4	
1	9	14	RT510	COMPONENT	Character	4	
1	9	40	RT510	PRCPLTSESN	Character	5	
1	10	17	RT510	ITEM_PURCH	Character	4	
1	11	15	RT510	CREDITTYPE	Character	2	
1	12	19	RT510	SOURCLOCTN	Character	2	
1	13	17	RT510	WHNOBTAIND	Date	8	
1	13	52	RT510	DURATION	Character	4	
1	14	12	RT510	APR	Numeric	4	2
1	14	47	RT510	OTHRCHARGS	Numeric	2	0
1	15	23	RT510	PRINCIPAL	Numeric	8	0
1	15	58	RT510	OUTSTANDNG	Numeric	8	0
1	16	26	RT510	PROP_CASH	Numeric	2	0
1	17	22	RT510	REPMT_SCHD	Numeric	2	0
1	18	12	RT510	PURPOSE	Character	2	
1	19	12	RT510	SECURITY	Character	2	
1	20	24	RT510	DIFFICULTY	Character	1	
1	21	14	RT510	TYPINVTORY	Character	2	

```
**********************************************************
*   RECORD DESCRIPTION: CREDIT RECORD                    *
*   RECORD NUMBER: RT510.DBF                             *
*------------------------------------------------------*
*                  VILLAGE_NO  XX                      *
*   FARM NUMBER  XX                RECORD TYPE  XXX    *
**********************************************************
```

```
============================================================
| ACTIVITY    XXXX (29 rice, 9399 general farm activity)   |
|  COMPONENT  XXXX   PARCEL-PLOT-SEASON XXXXX (99999  not  |
|                                              applicable) |
|   ITEM PURCHASED  XXXX  (6529 pump, 6019 tractor,1000    |
|                          material,1999 undet.)           |
| CREDIT TYPE  XX (39 given, 59 received)                  |
| SOURCE,LOCATION  XX (19 bank, 39 cooperative, 79 trader) |
| WHEN OBTAINED  XXXXXXXX   DURATION(years,months)  XXXX   |
| APR (%)   XXXX            OTHER CHARGES (%)  XX          |
| ORIGINAL PRINCIPAL  XXXXXXXX    OUTSTANDING XXXXXXXX     |
| PROPORTION OF CASH (%)  XX                               |
| REPAYMENT SCHEDULE  XX  (13 annual, 39 lump sum)         |
| PURPOSE   XX  (39 farm inputs, 49 farm capital items)    |
| SECURITY XX (19 land, 49 livestock, 89 mixed, 99 undet.) |
| DIFFICULTY OBTAIN. X (1 easy,3 moderate,5 very difficult)|
| TYPE INVENTORY  XX  ( 9 closing inventory)               |
============================================================
```

Figure 4.16 dBASE III PLUS FILE RT510.DBF SCREEN FORM.

Field definitions for Screen : C:RT700F.scr

Page	Row	Col	Data Base	Field	Type	Width	Dec
1	4	29	RT700	FARM_NUMBR	Numeric	2	0
1	4	48	RT700	RECORDTYPE	Numeric	3	0
1	7	12	RT700	ACTIVITY	Numeric	4	0
1	9	12	RT700	COMPONENT	Numeric	4	0
1	9	42	RT700	PCLPLTSESN	Numeric	5	0
1	10	14	RT700	INPT_OUTPT	Numeric	4	0
1	13	12	RT700	OPERATION	Numeric	4	0
1	17	12	RT700	FREQUENCY	Numeric	1	0
1	17	57	RT700	MONTH	Numeric	2	0
1	18	12	RT700	QUANTITY	Numeric	8	2
1	18	43	RT700	QTYCONVERS	Numeric	1	0
1	19	20	RT700	SOURCEDSTN	Numeric	2	0
1	21	12	RT700	PRICE_VALU	Numeric	8	2
1	21	32	RT700	CASH_KIND	Numeric	1	0
1	22	13	RT700	PRICEVALUE	Numeric	1	0
1	22	66	RT700	TYPINVTORY	Numeric	1	0

```
        ***********************************************
        *  RECORD DESCRIPTION: RESOURCE UTILIZATION   *
        *  RECORD NUMBER: RT700.DBF                   *
        *---------------------------------------------*
        *   FARM NUMBER  XX    RECORD TYPE  XXX       *
        ***********************************************
============================================================
ACTIVITY XXXX (29 rice,6019 tractor rental,8099 off-farm job
               ,9399 tax paid, 8399 income from land rent)
COMPONENT XXXX    PARCEL-PLOT-SEASON  XXXXX (pcpc,ptpt,sn)
INPUT/OUTPUT  XXXX (10-999 produce,1000-1999 plant material
     inputs,  3000-3999  special activ.material inputs,4000-
     6999  power  inputs,   7000-8999  equipment,  9000-9199
     rent,9899 taxes)
OPERATION   XXXX (99 seedbed prep.,109 ploughing,139  harro-
     wing,159   appl.   basic   fert.,199   land   prep.,209
     seedling,229    transplanting,369   insecticide   applic.,429
     weeding,459  top dress.  fert.,619  harvest.,699  harv.;
     thres.&winnowing,709 drying)
FREQUENCY X (1 daily,2 weekly,3 monthly)     MONTH XX
QUANTITY     XXXXXXXX      QTY CONVER.  CODE  X (1 ha,2 hrs,3
                                              ltrs,4 kg,5 items)
SOURCE DESTINATION XX (39 on-farm transfer,49 friends/labor,
59 shop, 69 market, 9 off-farm transfer,4 tax payment transfer)
PRICE/VALUE  XXXXXXXX   CASH/KIND  X  (1  kind,2   75%kind,3
                                    50%kind,4 75%cash,5 cash)
PRICE/VALUE X (0 value,1 unit price)   TYPE OF  INVENTORY
                                       CHANGE  X (9 closing)
============================================================
```

Figure 4.17 dBASE III PLUS FILE RT700.DBF SCREEN FORM.

3. Editing Process

The DISPLAY, BROWSE, EDIT and LIST commands of dBASE III PLUS were used to edit data fields and records. These commands display, alter, edit, and list specified data fields or records within a database (see section 4.2.3.3 for more details). Since, the same FARMAP data were used, only minor modifications were employed. For instance, alphanumeric data fields were added since it was not possible to process them with FARMAP. Also, the whole digits of numeric fields were entered manually. This was done on land characteristics record type, since only seven digits of the numeric fields were entered using FARMAP. However, the monetary value exceeded that limits. Therefore, no scaling factor was used with dBASE.

In addition to the above mentioned commands, other dBASE III commands were used including the APPEND, INSERT, DELETE, PACK, USE, and ZAP commands. The two ways of using dBASE III were performed: the menu-driven assistant, and the dot commands (programming).

Using the REPLACE command data fields were modified to replace numeric codes with labels (This is similar to program LABEL of FARMAP).

To prepare the data for generating reports, all database files were sorted and/or indexed. Sorting involved the physical resequensing of the records in a database. Another databases, identical in structure and size to the original files, but with records physically rearranged in

the required sequence were created. Sorting were done on multiple fields (namely, village number, farm number, activity, and input/output) in ascending/ descending sequence.

However, logical indexing were also done without changing the original files. The index files were created based on multiple data fields only in ascending order. Those index files played a role in subsequent commands, in that the records were processed by the commands in the logical order of the index.

4. The Reporting Process

To produce reports, some modifications were made to the structure of databases. The programs designed to modify database structures are listed in Figures 4.18-21. Each program was designed for one or multiple purpose. For example programs FIN1, FIN2, FIN3, and FIN4.prg were designed to create labels by replacing numeric fields with appropriate alphanumeric character fields. Also, they were designed to get the sum for each input/output quantities, prices or values of each farm.

However, the four different programs mentioned were merged together into one command file, i.e., FINTOT.PRG to facilitate processing.

After preparing the database files to produce reports' new database files were created with additional character fields (labels). The report format files were created using

```
*************************************************************
* THIS COMMAND FILE WAS DESIGNED TO SUM THE QUANTITIES AND *
* VALUES FOR EACH FARM TRACTOR RENTAL ACTIVITY.             *
*************************************************************
select 1
use xrt700
select 2
use rt700all
m_farm_num = 1
do while m_farm_num <= 10
    append blank
    select 1
    goto top
    sum quantity to q1 for inpt_outpt < 4000 .and. inpt_outpt
    > 1000 .and. farm_numbr = m_farm_num .and. activity = 6019
    sum price_valu to p1 for inpt_outpt < 4000 .and. inpt_outpt
    > 1000 .and. farm_numbr = m_farm_num .and. activity = 6019
    sum quantity to q0 for inpt_outpt <= 1000 .and. farm_numbr
    = m_farm_num .and. activity = 6019
    sum price_valu to p0 for inpt_outpt <= 1000 .and.
    farm_numbr = m_farm_num .and. activity = 6019
    sum quantity to q2 for inpt_outpt > 2000 .and.
    inpt_outpt < 5000 .and. farm_numbr = m_farm_num .and.
    activity = 6019
    sum price_valu to p2 for inpt_outpt > 2000 .and.
    inpt_outpt < 5000 .and. farm_numbr = m_farm_num .and.
    activity = 6019
    select 2
    replace qty1 with q1
    replace farm_numbr with m_farm_num
    replace price1 with p1
    replace qty0 with q0
    replace price0 with p0
    replace qty2 with q2
    replace price2 with p2
    replace activity with 6019
    m_farm_num = m_farm_num + 1
enddo
close all
use rt700all
```

Figure 4.18 dBASE III PROGRAM FIN1.PRG.

```
*************************************************************
* THIS FILE WAS CREATED TO SUM THE QUANTITIES AND VALUES    *
* OF EACH FARM FOR RENTED-OUT LAND ACTIVITY.                *
*************************************************************
select 1
use xrt700
select 2
use rt700all
m_farm_num = 1
do while m_farm_num <= 10
    append blank
    select 1
    goto top
    sum quantity to q0 for inpt_outpt <= 1000   .and.
    farm_numbr =     m_farm_num .and. activity = 8399
    sum price_valu to p0 for inpt_outpt <= 1000  .and.
    farm_numbr =     m_farm_num .and. activity = 8399
    select 2
    replace farm_numbr with m_farm_num
    replace qty0 with q0
    replace price0 with p0
    replace activity with 8399
    m_farm_num = m_farm_num + 1
enddo
close all
use rt700all
```

Figure 4.19 dBASE III PROGRAM FIN2.PRG.

```
*************************************************************
* THIS PROGRAM WAS CREATED TO SUM QUANTITIES AND VALUES OF  *
* EACH FARM FOR INCOME FROM OFF-FARM JOB ACTIVITY.          *
*************************************************************
select 1
use xrt700
select 2
use rt700all
m_farm_num = 1
do while m_farm_num <= 10
    append blank
    select 1
    goto top
    sum quantity to q0 for inpt_outpt <= 1000 .and.
    farm_numbr = m_farm_num .and. activity = 8099
    sum price_valu to p0 for inpt_outpt <= 1000 .and.
    farm_numbr = m_farm_num .and. activity = 8099
    select 2
    replace farm_numbr with m_farm_num
    replace qty0 with q0
    replace price0 with p0
    replace activity with 8099
    m_farm_num = m_farm_num + 1
enddo
close all
use rt700all
```

Figure 4.20 dBASE III PROGRAM FIN3.PRG.

```
*************************************************************
* THIS PROGRAM WAS DESIGNED TO SUM QUANTITIES AND VALUES OF*
* EACH FARM FOR THE RICE ACTIVITY.                          *
*************************************************************
select 1
use xrt700
select 2
use rt700all
m_farm_num = 1
do while m_farm_num <= 10
    append blank
    select 1
    goto top
    sum   quantity  to  q1  for  inpt_outpt  <  2000   .and.
    inpt_outpt > 1000  .and.  farm_numbr = m_farm_num  .and.
    activity = 29
    sum  price_valu  to  p1  for  inpt_outpt  <  2000  .and.
    inpt_outpt > 1000  .and.  farm_numbr = m_farm_num  .and.
    activity = 29
    sum  quantity  to  q0  for  inpt_outpt  <=  1000   .and.
    farm_numbr =     m_farm_num .and. activity = 29
    sum  price_valu  to  p0  for inpt_outpt  <=  1000  .and.
    farm_numbr =     m_farm_num .and. activity = 29
    sum   quantity  to  q2  for  inpt_outpt  >  2000   .and.
    inpt_outpt <  5000 .and.  farm_numbr = m_farm_num  .and.
    activity = 29
    sum  price_valu  to  p2  for  inpt_outpt  >  2000  .and.
    inpt_outpt <  5000 .and.  farm_numbr = m_farm_num  .and.
    activity = 29
    sum   quantity  to  q3  for  inpt_outpt  >  5000   .and.
    inpt_outpt   < 8000 .and.  farm_numbr = m_farm_num .and.
    activity = 29
    sum  price_valu  to  p3  for  inpt_outpt  >  5000  .and.
    inpt_outpt < 8000 .and. activity = 29 .and. farm_numbr =
    m_farm_num
    sum   quantity  to  q4  for  inpt_outpt  =  9000   .and.
    farm_numbr = m_farm_num
    sum  price_valu  to  p4  for  inpt_outpt =  9000  .and.
    farm_numbr = m_farm_num
    sum   quantity  to  q5  for  inpt_outpt  =  9899   .and.
    farm_numbr =     m_farm_num .and. activity = 9399
    sum  price_valu  to  p5  for  inpt_outpt  =  9899  .and.
    farm_numbr =      m_farm_num .and. activity = 9399
    select 2
    replace qty1  with q1
    replace farm_numbr with m_farm_num
    replace price1 with p1
    replace qty0 with q0
    replace price0 with p0
    replace qty2 with q2
```

Figure 4.21 dBASE III PLUS PROGRAM FIN4.PRG.

```
    replace price2 with p2
    replace qty3 with q3
    replace price3  with p3
    replace qty4 with q4
    replace price4 with p4
    replace qty5 with q5
    replace price5 with p5
    replace activity with 29
    m_farm_num = m_farm_num + 1
enddo
close all
use rt700all
```

Figure 4.21 (Cont'd)

the built-in reporting facility of dBASE.

The steps involved to create format files include:

* Creating the general layout of each report: the general layout of the report determines page title, page width and margins, number of lines per page, page spacing, and printing forms.

* Creating groups and sub-groups: in this step, totals, subtotals and sub-subtotals were obtained for the desired data fields of each database files.

* Filling out the content of the report: the content of each column of each report was determined from data fields or memory variables. Arithmetic operations (i.e., multiplication, addition, subtraction and so forth), were performed to get the required results. In addition, new data fields were defined, e.g., by adding two or more fields together.

Multiple databases were also used simultaneously to create farm reports. This was done by selecting two or more database files (including the Master file), based on key fields.

While the built-in reporting feature of dBASE provides great flexibility in creating report formats, there also exists a set of restrictions (e. g. the user has to be content with the format as presented by dBASE). Therefore, the same reports were created by designing special dBASE programs (without the built-in reporting facility of dBASE). The same results were obtained with more user control on the required output and the report formats.

The results obtained will be discussed in Chapter 5. The limitations of dBASE III PLUS are also discussed in the next chapter.

CHAPTER 5

THE RESULTS

5.1 The Results of FARMAP

5.1.1 Introduction

FARMAP output tables were produced in two modes: farm and activity mode. A summary table for the entire farm was produced in the farm mode for each of the 10 farms. A second run was required to produce the power types' subtables in the farm mode. In the activity mode, one table was obtained for each activity on each farm. Means of the ten farms were produced in three separate runs for the farm and activity modes.

Using the standard tabulation procedures the following tables were obtained:

1. Table 5.1, Farm Mode: it includes different subtables covering the topics of household composition, land resources, crops list, net worth, economics, cash-kind flow, and human and machine power use.
2. Table 5.2, Farm Mode (Power Types): it contains human and machine power types.
3. Tables 5.3-7 , Activity Mode: these tables cover the same topics as the farm mode except that the household composition subtable and net worth statement subtable are not applicable. Also, one table was produced for each activity of each of the ten farms.

4. **Means Tables**: means for the ten farms are shown in **Appendix A** for the two different tables of the farm mode, and the activity mode' tables.

Because of the similarity of the output for the ten farms, only one farm' tables (i.e., farm number 9) are presented here. The output of farm number 9 was selected because all different activities are covered under that farm. Also, the output tables for all the ten farms would be very long and would add little in terms of understanding.

It should be noted that the monetary unit of the Indonesian currency (Rupiah) is small when compared to the United States dollar (1 US $ = 625 rupiahs in the survey year, 1970-80). Therefore, all values and unit prices are stated in 100 units. The unit of area is hectare.

Due to the lack of statistical capabilities of FARMAP, the advanced tabulation procedure was used. The output of this procedure and the results of the statistical analysis will be discussed in detail in a subsequent section.

The following discussion illustrates different tables and their associated subtables.

5.1.2 Results of Standard Tabulation

5.1.2.1 Farm Mode Tables

As mentioned earlier, two separate runs with separate sorting requirements were required to produce the standard farm mode tables. The power types' tables of the farm mode required different sorting procedures than that needed for

the other farm mode subtables. The following subtables were produced after the first run (Table 5.1).

1. Household Composition Subtable

The HOUSEHOLD COMPOSITION subtable was calculated from information contained in the household records type '110'. It contains information about household members living in the same place including permanent laborers. This summary (Table 5.1a) provides basic demographic information, consumer units indicating the demand for food, and labor supply.

For farm 9, the first row of the HOUSEHOLD COMPOSITION subtable shows the total number of persons, 6, in the household, the number of family members by age category (aged, adult, youth, and children), the number of permanent laborers (PERMLAB), and the number of other person (OTHER) in the household. The same information are shown on the second and third row divided into sex categories (males and females).

The consumer units were calculated from the age-sex group, percent of time in residence, and consumer unit equivalent. Information on age-sex group and percent of time in residence were taken directly from household records type '110'. The default value of the consumer unit equivalent derived from FAO experience were employed. For example, 1.00 was used for adult male, 0.80 for adult female and youth male, 0.75 for youth female, and 0.50 for children. As shown

on Table 5.1a, the consumer units of the adults are 1.8 which are one male and one female. Whereas, they are 1.0 for two children.

Similarly, the labor supply information is based on the age-sex grouping, percent of time available for work, and adult-equivalent. The default values for the adult-equivalent were 0.5 for aged and youth, 1.0 for adult and laborer, and zero for children. For instance, the labor supply is totaled to 2.5 units which is composed of 2 adults and 1 youth. The second youth was not calculated based on the information about his non-availability for work.

Finally, information on the head of household are shown on the last line of the household composition subtable. For example, he is 38 year old, male, has attended 5 years of schooling, and resided 12 months on the farm during the year under observation.

2. Land Resources Subtable

The LAND RESOURCES subtable provides information about the land area under various types of tenure and irrigation practices. The data were derived from the land characteristics records type '210'. The information provided helps evaluate the economic productivity of the farm and are very useful for making interfarm comparative analyses.

The subtable (Table 5.1b) shows that 7.1 hectares is the total farm area, of which 6.4 is owned and managed and 0.7 is rented out. All of the owned and managed land area is

Table 5.1a FARMAP STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - HOUSEHOLD COMPOSITION.

	TOTAL	FAMILY			PERMLAB	OTHERS
		AGED	ADULT	YOUTH	CHILDREN		
PERSONS	6.0	.0	2.0	2.0	2.0	.0	.0
FEMALE	1.0	.0	1.0	.0	.0	.0	.0
MALE	5.0	.0	1.0	2.0	2.0	.0	.0
CONSUMER UNITS	4.4	.0	1.8	1.6	1.0	.0	.0
LABOUR SUPPLY	2.5	.0	2.0	.5	.0	.0	.0

HEAD: SEX M AGE 38 YRS SCHOOLING 5.0 MTHS RESIDENCE 12.0

Table 5.1b FARMAP STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - LAND USE.

	TOTAL	ANN.RF.	ANN.IRR	PERM.RF	PERM.IR	PAS.	OTHER
OWNED AND MANAGED	6.4	.0	6.4	.0	.0	.0	.0
RENTED IN AND MANAGED	.0	.0	.0	.0	.0	.0	.0
RENTED OUT AND MANAGED	.7	.0	.0	.0	.0	.0	.7
TOTAL	7.1	.0	6.4	.0	.0	.0	.7

irrigated (ANN. IRR), while the rented out land is undetermined (OTHER). No land fell under the other categories, i.e., annual rainfed (ANN.RF.), permanent rainfed (PERM.RF), permanent irrigated (PERM.IRR), or pasture.

3. Crops List Subtable

The CROPS LIST subtable (see Table 5.1c) contains information on crops grown, variety, and plot area for every crop. This information was derived from the crop characteristics records type '230'.

As shown, modern rice variety is grown on parcel 1 in the wet season (code 1001). The area allocated for growing rice is 6.43 hectares which is owned and managed. The rented out land area is not included.

4. Net Worth Subtable

The NET WORTH STATEMENT subtable provides information on value of farm assets, debts, the farm net worth, and any changes in each of these categories during the survey period. This subtable was calculated from record types '210' (land characteristics), '230' (crop characteristics), '410' (physical assets), and '510' (debts).

As shown in Table 5.1d, the first row of the NET WORTH STATEMENT subtable shows the closing inventory value of the farm assets in 1000's rupiahs (e.g., land = 26000, and physical assets = 830), its debts, and the total net worth

Table 5.1c FARMAP STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - CROPS GROWN.

****

** CROPS GROWN **

CROP	COMPONENT	PARCEL-PLOT	VARIETY	AREA
RICE	RICE	1001.	MODERN	6.43

****

Table 5.1d FARMAP STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - NET WORTH STATEMENT

****

	LAND	PH.ASSET	PRCROP	ANMALS	OTHRS	DEBTS	TOTAL
CLOSING INVENTORY	26000.0	830.0	.0	.0	.0	-80.0	26750.0
INCOMING AND APPRECIATION	.0	.0	.0	.0	.0	.0	.0
OUTGOING AND DEPRECIATION	.0	.0	.0	.0	.0	.0	.0

****

(=26750) which is assets minus debts. The assets are broken down into five categories: land, physical assets (including buildings, tools, machinery, and consumer durables), permanent crops, animals, and others. Appreciation and depreciation are also shown on the second and third lines of the net worth subtable, respectively.

5. Economics Subtables

The ECONOMICS subtable of Table 5.1e provides the major part of information on economic performance of the farm. The data were obtained from the resource flow record type '700'.

The ECONOMICS subtable gives the resource economics of the entire farm. It is structured vertically and horizontally. The vertical structure is divided into two main sections, resource economics and farmer economics, to differentiate between resource productivity and tenant farmer economics. To illustrate, the resource economics columns show all resource flows, regardless of the origin of inputs or the destination of outputs. While, the farmer economics columns show all resource flow originating from or ending with the farmer. Therefore, the difference between them is the treatment of transfer payments and inputs acquired from sources other than the farmer. For example, rent, share payments, taxes, and off-farm income are excluded from the resource economics section of the ECONOMICS subtable.

The columns titles show the returns, costs and

quantities under the resource economics section, and quantity, price, value, and percent cash (%CASH) under the farmer's economics section. Percent cash indicates the percent of value that was actually in cash.

In the farm mode, quantities and prices are suppressed, except for labor inputs. This is because these non-labor inputs are often stated in different units (i. e. kilograms, tons, or liters) and thus the totals would be meaningless.

The horizontal divisions group together the same inputs and outputs in rows. These rows include income, variable costs (material, human power, and machine power inputs), and fixed costs (rent, insurance, interest, depreciation, and taxes). These pre-defined groupings are denoted by the row titles GROSS INCOME, GROSS MARGIN, USER-SUPPLIED TITLE, NET RETURN BEFORE TAXES, and NET RETURN AFTER TAXES. The difference between gross income and variable costs gives the gross margin. The net return before taxes is calculated by subtracting selected fixed costs (depreciation, interest, and insurance) from the gross margin. And by subtracting taxes from net return before taxes, the net return after taxes is obtained. The user-supplied title can be used for user definition title when the land and family labor are valued (which is not the case here), or to indicate rent and share costs.

The gross income of four activities is shown in Table 5.1e. These activities are rice (RICE), two-wheel tractor rental (TWTRCR), off-farm job (OFFFRMJB), and rented-out

Table 5.1e FARMAP STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - ECONOMICS SUBTABLE.

****

** ECONOMICS **
(IN UNITS OF)

AREA 7.14 QUANTITY 1.000 PRICE 1.000 VALUE 10.000

ACT	COMP	RESOURCE QUANTITY	ECONOMICS VALUE	FARMER QUANTITY	ECONOMICS PRICE	ECONOMICS VALUE	%CASH
RICE	RICE		2516			2516	82
TWTRCTR	TWTRCTR					147	100
OFFFRMJB	OFFFRMJB					110	75
RNTINCOM	RNTINCOM					80	
GROSS INCOME			2516.			2853.	80
MATERIALS							
RICE	RICE		86			86	93
TWTRCTR	TWTRCTR					26	100
LABOUR							
RICE	RICE	3806	736	3806	1.94	736	17
TWTRCTR	TWTRCTR			336	.73	25	100
DRAFT							
POWER							
RICE	RICE						
VARIABLE COSTS			822.			872.	29
GROSS MARGIN			1694.			1981.	
USER-SUPPLIED TITLE			1694.			1981.	
NET RETURN BEFORE TAXES			1694.			1981.	
GENFARM	GENFARM					80	100
NET RETURN AFTER TAXES			1694.			1901.	

****

land (RNTINCOM). Their gross incomes in 1000's rupiah are 2516, 147, 110, and 80 respectively. The components (COMP) have the same names as the activities, since there were not any mixed activities (e.g. maize-beans, dairy cattle-corn, and so on) in the analysis.

Material inputs are shown for the rice and two-wheel tractor rental activities. They are 86 and 26 (1000's rupiah), respectively. The net return after taxes for the whole farm amounts to Rp. 1,901,000 for the farmer economics, and Rp. 1,694,000 for the resource economics sections. This difference is due to the exclusion of transfer payments (taxes, rental,.etc.) and off-farm income from the resource economics section.

6. Cash-Kind Flow Subtable

The CASH-KIND FLOW subtable displays the flows of cash and kind for the whole farm based on the information provided from record types '700' (resource flow records) and '230' (crop characteristics records). It contains important information needed to make judgments concerning debt servicing or repayment capacity.

The CASH-KIND FLOW subtable of farm number 9 is shown in Table 5.1f. Area 7.14 indicates the total area of the farm in hectares. In units of 10.000 indicates the scaling factor for the units displayed (it should be recalled that data were manually scaled and entered in 100 units before any scaling by the program, therefore, the scaling factor is

in 1000 units, 10 by FARMAP and 100 manually).

The header of the CASH-KIND FLOW subtable contains the total flows and abbreviations for the 12 months. The sum of the cash flow (the first line) and the kind flow (the second line) appears on the totals (the third line) for the whole year and for each month. For example, the cash flow for the whole year is Rp. 1,950,000, and the kind flow is Rp. -49,000. The latter is negative due to home consumption and/or payments paid in kind for labor or material inputs. The total flow is the sum of the cash and kind flow, which is Rp. 1,901,000.

7. Power Use Subtables

The monthly distributions by activity and component are shown on the POWER USE (human, and machine) subtables. The total area of the farm and scaling factor (which is done automatically by the program) are listed in Table 5.1g, at the top of the POWER USE subtables. Two activities, rice and tractor rental, are displayed on the HUMAN POWER USE subtable which sum to 4142 hours. And, only the rice activity appears on the MACHINE POWER USE subtable with a total of 120 hours of machine power use. The monthly distributions are shown and the rest of POWER USE subtables are self-explanatory. The user can define different time intervals such as daily, weekly, or bi-monthly power tables. This can be done by changing the output tables' format in the command files.

Table 5.1f FARMAP STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - CASH AND KIND FLOW SUBTABLE.

** CASH KIND FLOW **

AREA 7.14 IN UNITS OF 10.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
CASHFLOW	1950.	-115	74	97	1903	0	0	0	0	0	0	0	-9
KINDFLOW	-49.	-9	-50	0	18	0	0	0	0	0	0	0	-8
TOTALS	1901.	-123	24	97	1920	0	0	0	0	0	0	0	-17

Table 5.1g STANDARD TABLE - FARM MODE - COMPLETELY DISAGGREGATED - POWER USE SUBTABLE

** HUMAN POWER USE **

MONTHLY DISTRIBUTION BY ACTIVITY AND COMPONENT

AREA 7.14 IN UNITS OF 1.00000

ACT	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
RICE	RICE	3806.	654	1298		1770								84
TRAC	TRAC	336.			336									
TOTALS		4142.	654	1298	336	1770	0	0	0	0	0	0	0	84

** MACHINE POWER USE **

MONTHLY DISTRIBUTION BY ACTIVITY AND COMPONENT

AREA 7.14 IN UNITS OF 1.00000

ACT	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
RICE	RICE	120.	32	48										40
TOTALS		120.	32	48	0	0	0	0	0	0	0	0	0	40

As mentioned earlier, two runs with different sorting requirements were required to produce the farm mode subtables. The first run produced the above mentioned subtables in the farm mode. The second run produced the POWER TYPE subtables (shown in Table 5.2) which are discussed below.

The POWER TYPE subtables show the origins of power (human, and machine). There was not enough data in the sample to generate a animal power subtable. The area of the farm which is 7.14 hectares and the scaling factor in units of 1.00 are shown at the top on the POWER TYPE subtables (Table 5.2).

There are three categories on the HUMAN POWER subtable: the farmer (FARMER), temporary labor (TEMPLAB), and the hired labor (HRLABOR). Their total is 4142 hours for the entire farm activities. The farmer exerted only 16 hours, since he has off-farm job (services and tractor rental) in addition to the farm work. The temporary labor (seasonal labor) represents the largest part of the power origin (e. g., 3040 hours). The hired labor constitutes almost 25%, or 1086 hours, of the total human power.

The MACHINE POWER TYPE subtable contains three categories: tractor, plough, and sprayer. They sum up to 120 hours use.

Table 5.2 FARMAP STANDARD TABLE - FARM MODE - FULLY AGGREGATED- POWER TYPES.

****

FARM NUMBER 9.0

****

** HUMAN POWER TYPE **

MONTHLY DISTRIBUTION BY HUMAN POWER CATEGORY

AREA 7.14 IN UNITS OF 1.00000

I/O COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
FARMER	16.				16								
TEMPLAB	3040.	204	698	336	1754								48
HRLABOR	1086.	450	600										36
TOTALS	4142.	654	1298	336	1770	0	0	0	0	0	0	0	84

****

** MACHINE POWER TYPE **

MONTHLY DISTRIBUTION BY MACHINE POWER CATEGORY

AREA 7.14 IN UNITS OF 1.00000

I/O COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
TRACTOR	32.	16											16
PLOUGH	32.	16											16
SPRAYER	56.		48										8
TOTALS	120.	32	48	0	0	0	0	0	0	0	0	0	40

****

5.1.2.2 Activity Mode Tables

In the activity mode, one table was produced for each activity of each farm. The HOUSEHOLD COMPOSITION and the NET WORTH subtables are not applicable in the activity mode.

As shown in Tables 5.3-7, the same subtables as those produced in the farm mode are listed. However, some differences between the two modes are presented. Unlike the farm mode, one table is produced for each activity of each farm in the activity mode. For example, different tables with their associated subtables are listed for each of the five activities of farm number 9. They are: rice, 2-wheel tractor rental, off-farm job income, and rented-out land income activities. In addition, taxes are assumed to be as a general farm activity which appears on a separate table (Table 5.7). This is handled in this manner because taxes are paid for the whole farmland area, not for a specific activity.

Only the rice growing activity is discussed here, because of the similarity of the outputs for the other activities little would be gained from outputting similar tables. Also, the crops list, land resources, cash-kind flow, power use and type subtables have exactly the same interpretation as in the farm mode except that they are calculated separately for each activity on a unit of area basis. Therefore, they are excluded from the following discussion.

The economics subtables have the same vertical and horizontal structure as in the farm mode. However, the quantities are not suppressed for the same units of inputs and outputs. For example, material inputs in kilograms or liters are grouped separately based on the quantity conversion factors provided for each activity. Also, in the activity mode, outputs and variable costs are given in a per unit of area or per head/animal basis, not as a total for the entire farm. For instance, the average productivity of rice for farm number 9 is 4852 kilograms/hectare.

The scaling factors appear at the top of the economics subtable (i. e., price and value in units of 100 which were done manually). The area is one hectare units, based on a total of 6.43 hectares, which is only the area allocated to rice (not the total area of the farm which is 7.14 hectares). Other than those mentioned differences, the rest of the economics subtable is exactly the same as in the farm mode (discussed earlier on section 5.1.2.1).

Table 5.3 FARMAP STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED- RICE ACTIVITY.

****

FARM NUMBER 9.0

****

** CROPS GROWN **

CROP	COMPONENT	PARCEL-PLOT	VARIETY	AREA
RICE	RICE	1001.	MODERN	6.43

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

*** ACT RICE

****

** ECONOMICS **
(IN UNITS OF)

AREA 1.000 QUANTITY 1.000 PRICE 1.000 VALUE 1.000
(FROM TOTAL AREA 6.43)

I/O	COMP	RESOURCE QUANTITY	ECONOMICS VALUE	FARMER QUANTITY	ECONOMICS PRICE	ECONOMICS VALUE	%CASH
GRAIN	RICE	4852	3913	4852	.81	3913	82
GROSS INCOME			3913.			3913.	82
MATERIALS							
PLANTMAT	RICE		9			9	
FERT-N	RICE		78			78	100
MATERIAL	RICE		34			34	100
CHEMICAL	RICE		6			6	100
OTHER	RICE		7			7	100
LABOUR							
FARMER	RICE	2		2			
TEMPLAB	RICE	421	967	421	2.30	967	16
HRLABOR	RICE	169	177	169	1.05	177	26
DRAFT POWER							
TRACTOR	RICE						
PLOUGH	RICE						
SPRAYER	RICE						
VARIABLE COSTS			1278.			1278.	25
GROSS MARGIN			2635.			2635.	
USER-SUPPLIED TITLE			2635.			2635.	
NET RET. BEFORE TAXES			2635.			2635.	
NET RETURN AFTER TAXES			2635.			2635.	

Table 5.3 (Cont'd)

****

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** CASH KIND FLOW **

AREA 1.00 (FROM TOTAL AREA 6.43) IN UNITS OF 1.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
CASHFLOW	2878.	-178	-13	0	3083	0	0	0	0	0	0	0	-13
KINDFLOW	-243.	-14	-244	0	27	0	0	0	0	0	0	0	-13
TOTALS	2635.	-192	-258	0	3110	0	0	0	0	0	0	0	-26

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** HUMAN POWER TYPE **

MONTHLY DISTRIBUTION BY HUMAN POWER CATEGORY AND COMPONENT

AREA 1.00(FROM TOTAL AREA 6.43) IN UNITS OF 1.00000

I/O	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
FRMR	RICE	2.				2								
TLAB	RICE	421.	32	109		273								7
HLBR	RICE	169.	70	93										6
TOTALS		592.	102	202	0	275	0	0	0	0	0	0	0	13

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** HUMAN POWER USE **

MONTHLY DISTRIBUTION BY OPERATION AND COMPONENT

AREA 1.00(FROM TOTAL AREA 6.43) IN UNITS OF 1.00000

OP	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
SBED	RICE	6.												6
SOIL	RICE	25.	17											7
PLNT	RICE	42.	42											
PROT	RICE	7.		7										
CARE	RICE	51.	43	8										
HARV	RICE	449.		187		263								
DRYG	RICE	12.				12								
TOTALS		592.	102	202	0	275	0	0	0	0	0	0	0	13

****

Table 5.3 (Cont'd)

****

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** MACHINE POWER TYPE **

MONTHLY DISTRIBUTION BY MACHINE POWER CATEGORY AND COMPONENT

AREA 1.00 (FROM TOTAL AREA 6.43) IN UNITS OF 1.00000

I/O	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
TRTR	RICE	5.	2											2
PLGH	RICE	5.	2											2
SPRY	RICE	9.		7										1
TOTALS		19.	5	7	0	0	0	0	0	0	0	0	0	6

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** MACHINE POWER USE **

MONTHLY DISTRIBUTION BY OPERATION AND COMPONENT

AREA 1.00(FROM TOTAL AREA 6.43) IN UNITS OF 1.00000

OP	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
SBED	RICE	1.												1
SOIL	RICE	10.	5											5
PROT	RICE	7.		7										
TOTALS		19.	5	7	0	0	0	0	0	0	0	0	0	6

****

Table 5.4 FARMAP STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED- TWO-WHEEL TRACTOR RENTAL ACTIVITY.

*** ACT TWTRCTR

** ECONOMICS **
(IN UNITS OF)
AREA NOT APPL QUANTITY 1.000 PRICE 1.000 VALUE 1.000

I/O	COMP	RESOURCE	ECONOMICS QUANTITY	ECONOMICS VALUE	FARMER QUANTITY	FARMER PRICE	FARMER ECONOMICS VALUE	%CASH
POWER	TWTRCTR				7	210.00	1470	100
GROSS INCOME							1470.	100
MATERIALS								
FUEL-LUB	TWTRCTR						164	100
SERVICES	TWTRCTR						93	100
LABOUR								
TEMPLAB	TWTRCTR				336	.73	245	100
DRAFT								
POWER								
VARIABLE COSTS							502.	100
GROSS MARGIN							968.	
USER-SUPPLIED TITLE							968.	
NET RETURN BEFORE TAXES							968.	
NET RETURN AFTER TAXES							968.	

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

** CASH KIND FLOW **
AREA NOT APPL IN UNITS OF 1.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
CASHFLOW	968.	0	0	968	0	0	0	0	0	0	0	0	0
TOTALS	968.	0	0	968	0	0	0	0	0	0	0	0	0

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

** HUMAN POWER TYPE **

MONTHLY DISTRIBUTION BY HUMAN POWER CATEGORY AND COMPONENT

AREA NOT APPL IN UNITS OF 1.00000

I/O	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
TLAB	TRAC	336.			336									
TOTALS		336.	0	0	336	0	0	0	0	0	0	0	0	0

Table 5.4 (Cont'd)

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** HUMAN POWER USE **

MONTHLY DISTRIBUTION BY OPERATION AND COMPONENT

AREA NOT APPL IN UNITS OF 1.00000

OP	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
SBED	TRAC	336.			336									
TOTALS		336.	0	0	336	0	0	0	0	0	0	0	0	0

****

Table 5.5 FARMAP STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

*** ACT OFFFRMJB (OFF-FARM JOB)

****

** ECONOMICS **
(IN UNITS OF)

AREA NOT APPL QUANTITY 1.000 PRICE 1.000 VALUE 1.000

I/O COMP RESOURCE	ECONOMICS QUANTITY	ECONOMICS VALUE	F A R M E R QUANTITY	E C O N O M I C S PRICE	VALUE	%CASH
SERVES OFFFRMJB			100	11.00	1100	75
GROSS INCOME					1100	75
MATERIALS						
VARIABLE COSTS						
GROSS MARGIN					1100	
USER-SUPPLIED TITLE					1100	
NET RETURN BEFORE TAXES					1100	
NET RETURN AFTER TAXES					1100	

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** CASH KIND FLOW **

AREA NOT APPL IN UNITS OF 1.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
CASHFLOW	825.	0	825	0	0	0	0	0	0	0	0	0	0
KINDFLOW	275.	0	275	0	0	0	0	0	0	0	0	0	0
TOTALS	1100.	0	1100	0	0	0	0	0	0	0	0	0	0

****

Table 5.6 FARMAP STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

*** ACT RNTINCOM (RENTED-OUT LAND)

****

** ECONOMICS **
(IN UNITS OF)
AREA NOT APPL QUANTITY 1.000 PRICE 1.000 VALUE 1.000

I/O	COMP	RESOURCE ECONOMICS QUANTITY	VALUE	FARMER ECONOMICS QUANTITY	PRICE	VALUE	%CASH
RNTINCOM	RNTINCOM			.71	1126.76	800	
GROSS INCOME						800	
MATERIALS							
VARIABLE COSTS							
GROSS MARGIN						800	
USER-SUPPLIED TITLE						800	
NET RETURN BEFORE TAXES						800	
NET RETURN AFTER TAXES						800	

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** CASH KIND FLOW **
AREA NOT APPL IN UNITS OF 1.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
KINDFLOW	800.	0	800	0	0	0	0	0	0	0	0	0	0
TOTALS	800.	0	800	0	0	0	0	0	0	0	0	0	0

****

Table 5.7 FARMAP STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

*** ACT GENFARM (GENERAL FARM, TAXES)

****

** ECONOMICS **
(IN UNITS OF)
AREA NOT APPL QUANTITY 1.000 PRICE 1.000 VALUE 1.000

I/O	COMP	RESOURCE ECONOMICS QUANTITY	VALUE	F A R M E R E C O N O M I C S QUANTITY	PRICE	VALUE	%CASH
GROSS INCOME							
MATERIALS							
LABOUR							
DRAFT							
POWER							
VARIABLE COSTS							
GROSS MARGIN							
USER-SUPPLIED TITLE							
NET RETURN BEFORE TAXES							
TAXES	GENFARM					800	100
NET RETURN AFTER TAXES						-800	

STANDARD TABLE - ACTIVITY MODE - PARTLY AGGREGATED

****

** CASH KIND FLOW **
AREA NOT APPL IN UNITS OF 1.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
CASHFLOW	-800.	0	0	0	-800	0	0	0	0	0	0	0	0
TOTALS	-800.	0	0	0	-800	0	0	0	0	0	0	0	0

****

5.2 The Results of dBASE III PLUS

The same data used with FARMAP, were also processed using dBASE III PLUS for comparison purposes. The results are shown in Tables 5.8-12 for the 10 farms. The household composition, land characteristics, and farm economics tables were processed based on the procedures described in Chapter 4. The household composition (Table 5.8) shows more information than those of FARMAP on all members of the household. This information includes number of persons, age, sex, percent of time available for work, age/sex category, labor and consumer units. The same FARMAP codes and consumer and labor unit equivalents were used to calculate the consumer and labor units (see discussion in section 5.1.2.1). The age/sex categories are denoted by HEAD, SPOUSE, SON, YNGSON, DAUGTR, YDAGTR, PLABOR for the head of the household, spouse, son (10-20 years), young son (less than 10 years), daughter (10-20 years), young daughter (less than 10 years), and permanent laborer, respectively. The sex is M for male and F for female. The subtotal for each farm and the total for the 10 farms are provided. For example, for farm number 1 the head of household is male, 39 year old, and is 100 percent available for work. He is equivalent to one consumer and one adult labor unit.

The land characteristics output, Table 5.9, includes additional information needed for farm management systems analysis which is not contained in FARMAP outputs. These

information include farm area, tenure, land value, topography, soil texture, and soil color. The capability of dBASE III to process character data fields (in addition to numeric, date, logical, and memo fields), was utilized to produce this information. Farm area and land value subtotals for each farm and the totals for the 10 farms, are displayed. The soil texture and color are clay loam and black, respectively. They are denoted by CLYLOAM and BLCK. The remaining part of the table is self-explanatory.

Farm economics results (shown on Table 5.10), are similar to those processed by FARMAP. However, more aggregations were done to obtain more usable data and to improve understanding by producing less lengthy results. For example, the farm and activity modes were merged together when different activities were sub-grouped under each farm data.

For each of the 10 farms, gross income, variable costs (material, human power, machine power), fixed costs (rent and taxes), the subtotal for each activity, and the total for each farm are provided. The scaling factors for values and unit prices are in units of 100 rupiah. For example, the gross income of the rice activity for farm number 1 is Rp. 1,807,000, and materials input is Rp. -32,900 (which appears in negative sign for calculating the net income of the farm).

Table 5.8 dBASE III RESULTS- HOUSEHOLD COMPOSITION OUTPUT TABLE.

No. OF PERSONS	AGE	SEX	TIME WORK	AGE/SEX CATEGORY	LABOR UNITS	CONSUMER UNITS
** FARM NUMBER 1						
1	39	M	100	HEAD	1.00	1.00
1	30	F	100	SPOUSE	1.00	0.80
1	15	M	100	SON	0.50	0.80
1	14	M	100	SON	0.50	0.80
1	12	M	100	SON	0.50	0.80
1	8	M	0	YNGSON	0.00	0.50
** Subtotal **						
6	118				3.50	4.70
** FARM NUMBER 2						
1	40	M	100	HEAD	1.00	1.00
1	36	F	100	SPOUSE	1.00	0.80
1	16	M	100	SON	0.50	0.80
1	14	F	100	DAUGTR	0.50	0.80
** Subtotal **						
4	106				3.00	3.40
** FARM NUMBER 3						
.	..	.	...	....	....	....
.	..	.	...	....	....	....
.	..	.	...	....	....	....
** FARM NUMBER 9						
1	38	M	100	HEAD	1.00	1.00
1	31	F	100	SPOUSE	1.00	0.80
1	14	M	100	SON	0.50	0.80
1	12	M	100	SON	0.00	0.80
1	7	M	0	YNGSON	0.00	0.50
1	4	M	0	YNGSON	0.00	0.50
** Subtotal **						
6	106				2.50	4.40
** FARM NUMBER 10						
1	38	M	100	HEAD	1.00	1.00
1	7	M	0	YNGSON	0.00	0.50
** Subtotal **						
3	70				1.80	2.30
*** Total ***						
56	962				28.30	41.20

Table 5.9 dBASE III RESULTS- LAND CHARACTERISTICS OUTPUT TABLE.

FARM AREA	TENURE	LAND VALUE(000)	TOPOGRAPHY	SOIL TEXT.	SOIL COLOR
** FARM # 1					
4.50	OWNED	13600.00	LEVEL	CLYLOAM	BLCK
** Subtotal **					
4.50		13600.00			
** FARM # 2					
2.13	OWNED	6500.00	LEVEL	CLYLOAM	BLCK
** Subtotal **					
2.13		6500.00			
** FARM # 3					
3.75	OWNED	9500.00	LEVEL	CLYLOAM	BLCK
2.17	RNTDOUT	4500.00	LEVEL	CLYLOAM	BLCK
** Subtotal **					
5.92		14000.00			
** FARM # 4					
....	.....	.....	.....	.....	....
....	.....	.....	.....	.....	....
....	.....	.....	.....	.....	....
** FARM # 8					
3.64	OWNED	10200.00	LEVEL	CLYLOAM	BLCK
0.36	RNTDOUT	800.00	LEVEL	CLYLOAM	BLCK
** Subtotal **					
4.00		11000.00			
** FARM # 9					
6.43	OWNED	60000.00	LEVEL	CLYLOAM	BLCK
** Subtotal **					
7.14		60500.00			
** FARM # 10					
1.43	OWNED	3600.00	LEVEL	CLYLOAM	BLCK
0.21	RNTD_IN	375.00	LEVEL	CLYLOAM	BLCK
** Subtotal **					
1.64		3975.00			
*** Total ***					
36.30		141419.90			

Table 5.10 dBASE III RESULTS- FARM ECONOMICS OUTPUT TABLE.

INPT OUTPT	QUANTITY	UNITS	UNIT PRICE	TOTAL VALUE
** FARM # 1			(100 rupiah)	
* ACTIVITY RICE				
GRSS_INCOM	19800.00	kg.	0.91	18070.00
MATRL_INPT	414.00	kg/ltr	-0.79	-329.00
LABOR_INPT	2232.00	hrs.	-2.47	-5512.50
MACHN_INPT	160.00	hrs.	-0.56	-90.00
RENTL_COST	0.00	ha.	0.00	0.00
TAXES	4.50	ha.	-98.22	-442.00
* Subsubtotal *				
				11696.50
* ACTIVITY 2WTRENTL				
GRSS_INCOM	5.00	ha.	193.20	966.00
MATRL_INPT	117.00	kg/ltr	-1.40	-164.00
LABOR_INPT	230.00	hrs.	-0.59	-135.00
MACHN_INPT	0.00	hrs.	0.00	0.00
TAXES	0.00	ha.	0.00	0.00
* Subsubtotal *				
				667.00
* ACTIVITY OFFFRMJB				
* Subsubtotal *				
				0.00
* ACTIVITY LANDRENT				
* Subsubtotal *				
				0.00
** Subtotal **				
				12363.50
** FARM # 2				
* ACTIVITY RICE				
GRSS_INCOM	9700.00	kg.	0.90	8730.00
MATRL_INPT	334.50	kg/ltr	-0.79	-264.05
LABOR_INPT	896.00	hrs.	-2.55	-2281.80
MACHN_INPT	95.00	hrs.	-0.63	-60.00
RENTL_COST	0.00	ha.	0.00	0.00
TAXES	2.13	ha.	-103.29	-220.00
* Subsubtotal *				
				5904.15
* ACTIVITY 2WTRENTL				
GRSS_INCOM	4.30	ha.	209.53	901.00
MATRL_INPT	253.00	kg/ltr	-1.15	-291.00
LABOR_INPT	240.00	hrs.	-0.50	-120.00
MACHN_INPT	0.00	hrs.	0.00	0.00
TAXES	0.00	ha.	0.00	0.00
* Subsubtotal *				
				490.00

Table 5.10 (Cont'd)

INPT OUTPT	QUANTITY	UNITS	UNIT PRICE	TOTAL VALUE
* ACTIVITY LANDRENT			(100 rupiah)	
* Subsubtotal *				0.00
** Subtotal **				6394.15
** FARM # 3				
.....	.....	....	....	.....
.....	.....	....	....	.....
** FARM # 9				
* ACTIVITY RICE				
GRSS_INCOM	31200.00	kg.	0.81	25160.00
MATRL_INPT	1153.98	kg/ltr	-0.75	-860.60
LABOR_INPT	2753.00	hrs.	-2.67	-7356.00
MACHN_INPT	120.00	hrs.	0.00	0.00
RENTL_COST	0.00	ha.	0.00	0.00
TAXES	7.14	ha.	-112.04	-800.00
* Subsubtotal *				16143.40
* ACTIVITY 2WTRENTL				
GRSS_INCOM	7.00	ha.	210.00	1470.00
MATRL_INPT	234.00	kg/ltr	-1.10	-257.00
LABOR_INPT	336.00	hrs.	-0.73	-245.00
MACHN_INPT	0.00	hrs.	0.00	0.00
TAXES	0.00	ha.	0.00	0.00
* Subsubtotal *				968.00
* ACTIVITY OFFFRMJB				
GRSS_INCOM	100.00	hrs.	11.00	1100.00
MATRL_INPT	0.00	kg/ltr	0.00	0.00
LABOR_INPT	0.00	hrs.	0.00	0.00
MACHN_INPT	0.00	hrs.	0.00	0.00
* Subsubtotal *				1100.00
* ACTIVITY LANDRENT				
GRSS_INCOM	0.71	ha.	1126.76	800.00
MATRL_INPT	0.00	kg/ltr	0.00	0.00
TAXES	0.00	ha.	0.00	0.00
* Subsubtotal *				800.00
** Subtotal **				19011.40
** FARM # 10				
.....	.....	....	....	.....
*** Total ***				106860.06

5.3 Results of Advanced Processing

The output tables and reports generated with FARMAP and dBASE III PLUS provide data to needed establish a basis for an information system. However, these data should be processed and evaluated into a form which is meaningful to decision makers. To illustrate, FARMAP and dBASE III PLUS do not provide a built-in features to perform statistical and some advanced economic analysis, which are required for farming system analysis and decision-making process. However, they provide means to export data files to complementary packages for further processing. It is essential to link micro level data with the macro policy analysis through processing these data into usable information. Therefore, the following discussion will illustrate means of interfacing FARMAP and dBASE III PLUS with some complementary tools such as statistical and economic packages. The economic analysis tools include forward planning models (e.g., long-range financial budgeting and total business linear programming), whole-farm production function estimate, and multi-year variability estimates for risk and uncertainty analysis. These tools are often used to transfer micro level data into usable information for the macro policy formulation.

The following discussion applies to both FARMAP and dBASE III PLUS. However, some restrictions and differences will be illustrated (see section 5.4).

5.3.1 Statistical Analysis

As mentioned earlier in Chapter 4 (see section 4.1.5), program EXTRAC was used and command file EXTRAC1.cmf was designed to extract means data of the rice activity for the ten farms under study. The output obtained with some modifications are shown in Table 5.11. These modifications were done for statistical analysis purposes and because of the operational error found in the command TITLE of program EXTRAC (see section 5.4 for details). Eight variables were obtained: farm number, number of persons per farm, age of the head of household, maximum age of family members (the oldest), number of parcels, area allocated for rice, variable costs and gross income for the rice activity.

The output was exported to a commercial statistical software, ABSTAT, for further analysis not supported by FARMAP.

Table 5.12 describes the results obtained using ABSTAT. The five variables processed were number of persons (NO. PRS.), age of the head of household (AGE HH.), gross income/hectare (G. IN. HA.), variable costs/hectare (V. CST. HA.), and area allocated for rice for each farm (AREA).

Three sets of results were obtained for each of the five variables. The first set provides mean values, standard deviation, variance, standard error of the mean, and coefficient of variation. For example, the mean rice area of the 10 farms is 3.127 hectare and for number of persons is

5.6 person.

The second set provides the minimum, maximum, range, and the total values for each variable. The third set of results gives the median and mode of each variable. It also provides the skewness and kurtosis of the error distribution (either more or less peaked than a normal distribution). These descriptive statistics can be used to analyze the performance of each farm and describe factors affecting the productivity of each farm. They also help to establish a comparative analysis criteria among the performances of different farms.

Table 5.11 RESULTS OF PROGRAM EXTRAC

Farm No.	No.of Pers.	Max. Age	Age H. H.	No. pcls.	Rice Area	Var. Costs	Gross Income
1.	6.	39.	39.	1.	4.50	5931.50	19036.00
2.	4.	40.	40.	1.	2.13	2605.85	9631.00
3.	10.	36.	36.	2.	3.75	7939.68	21311.00
4.	6.	35.	35.	2.	2.42	3544.80	13202.00
5.	4.	45.	45.	2.	3.46	4260.10	22836.00
6.	4.	24.	24.	1.	1.85	2756.30	14921.00
7.	4.	26.	26.	1.	2.35	3692.60	13144.00
8.	9.	41.	41.	2.	3.64	6878.05	20356.00
9.	6.	38.	38.	2.	6.43	8216.60	26630.00
10.	3.	38.	38.	2.	1.64	3588.46	6764.00

Table 5.12 RESULTS OF STATISTICAL ANALYSIS

ABSTAT 4.12

FILE: ALI1

THERE ARE 8 VARIABLES AND 10 CASES IN THE DATA SET

10 CASES (100.0%) ARE VALID

VARIABLE	MEAN	STD.DEV.	VARIANCE	STD ERROR OF MEAN	COEFF OF VARIATION
2 NO. PRS.	5.60000	2.31900	5.37778	0.733333	41.4108
3 AGE HH.	36.2000	6.52857	42.6222	2.06452	18.0347
6 G.IN.HA.	4439.40	396.162	156944	125.277	8.92378
7 V.CST.HA.	1577.20	362.789	131616	114.724	23.0021
8 AREA	3.21700	1.46877	2.15729	0.464466	45.6566

VARIABLE	MINIMUM	MAXIMUM	RANGE	TOTAL
2 NO. PRS.	3.00000	10.0000	7.00000	56.0000
3 AGE HH.	24.0000	45.0000	21.0000	362.000
6 G.IN.HA.	3913.00	4968.00	1055.00	44394.0
7 V.CST.HA	1223.00	2188.00	965.000	15772.0
8 AREA	1.64000	6.43000	4.79000	32.1700

VARIABLE	MEDIAN	MODE	SKEWNESS	KURTOSIS
2 NO. PRS.	5.00000	4.00000	0.851991	2.47777
3 AGE HH.	38.0000	38.0000	-0.841065	2.70464
6 G.IN.HA.	4442.00	NONE	0.0566567	1.44036
7 V.CST.HA	1477.50	NONE	0.695571	1.97076
8 AREA	2.94000	NONE	0.983365	3.22149

5.3.2 Forward Planning (Predictive Analysis)

Because of the continuous stream of changing circumstances including price fluctuations, new technology, change in input availability, and new marketing strategies, forward planning in needed. Forward planning tools allow to predict the expected outcomes of various adjustment under different assumptions regarding the future.

There are seven interrelated steps in forward planning (Harsh, et al., 1981): 1) appraisal of the goals and objectives, 2) inventory of resource availability, 3) selection of alternative to be analyzed. 4) selection of input/output information to be used in the analysis process, 5) selection of prices to be used in the analysis process, 6) organization of input/output and price information into an appropriate analysis structure, and 7) analysis of various alternatives.

Identification of family-business goals and the integration between them lie under management by objectives approach. The availability of land, labor, capital, and other resources have a major impact on the farming business. Table 5.13 shows a worksheet designed to asses the availability of these resources. As shown on the table FARMAP and dBASE PLUS can provide the information needed to identify resources currently available and to establish an

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* this part draws heavily on Harsh et al., Managing the Farm Business, 1981.

inventory of farm resources. Tabulating the future availability of these resources can be done based on their current availability. The boxes marked X show that these information can be provided by either FARMAP or dBASE. Whereas, the boxes left blank show that these information should be provided by other sources. Most of these data are provided by FARMAP standard record type groups.

Tables 5.13 INVENTORY OF FARM RESOURCES WORKSHEET

Resource	Current Availability FARMAP	dBASE+
Dollars Capital		
Owner equity	X	X
Short-term debt	X	X
Intermediate debt	X	X
Long term debt	X	X
Land		
Cropland (owned, rented-in, rented-out, leased, communal)	X	X
Grazing land (owned, rented-in, rented-out)	X	X
Labor(operator, family, permanent, seasonal, contract labor)	X	X
Management Operator	X	X
Management services (extension, consulting firms, input suppliers)	X	X
Depreciable assets capacity		
Equipment or machinery systems (owned, rental, custom hire, lease-purchase option, share purchase)	X	X
Improvements (owned, rental, lease-purchase option)	X	X
Livestock (owned, leased)	X	X
Product markets (cash, contract sales, vertical integration)++	X	X
Purchased inputs markets(commercial, cooperatives, feedstuffs, farm produced, purchased)	X	X

Source: adapted from Harsh, et al., Managing Farming Business, 1981.

+ The user has to create database structures to incorporate these data.

++ The user has to define new records and/or data fields to cover these topics which are not included in the standard FARMAP record types groups.

FARMAP and dBASE III PLUS can be used to perform the selection of input/output information, and prices to be used in the analysis process. For example, data sources needed for the development of input/output relation include the farm's own accounting system, experimental data, and farm surveys can be included in FARMAP questionnaires (coding sheets), and record type groups. Also, database structures can be designed to cover the data needed for the selection of input/output relationships and prices to be used in the analysis process.

Forward planning techniques include: total business budgeting and partial budgeting are used to organize input-output and price information. Enterprise budgets are used to simplify the process of doing partial and total business budgets. An example of using FARMAP and dBASE III PLUS to provide data needed to prepare enterprise budgets appear on Table 5.14. The income, expenses, and resource needs of the rice activity on a per unit basis. Most of these data needs are included on the standard FARMAP record type groups. However, database structures should be generated by the user when using dBASE III PLUS to generate enterprise budgets. Partial and total business budgets can then generated and an analysis of various alternatives can be performed. These are essential factors for eliminating risk and uncertainty involved in decision making.

Table 5.14 AN EXAMPLE OF RICE ACTIVITY BUDGET *

Rice for Sale Enterprise (per acre figures)	FARMAP+	dBASE III+
Income		
Cash rice sales (-Kg @ -/Kg)	X	X
Total gross income	X	X
Cash expenses		
seed	X	X
Fertilizer	X	X
Chemicals	X	X
Fuel and Repairs	X	X
Hauling Cost	X	X
Other Misc. cash Costs	X	X
Interest on current debt	X	X
Total cash expenses	X	X
Selected resource needs		
Cropland	X	X
Labor	X	X

* The body of the enterprise budget in adapted from Harsh, et al., Managing the Farm Business, 1981.

\+ The X's denotes the availability of data needed for different aspects.

5.3.3 Whole-Farm Planning

Evaluating the impacts of possible adjustments in the farming operation, whole-farm planning, is very important to enhance the decision-makers ability to select the better decisions. There are two techniques commonly used for doing whole-farm planning: 1) long-range financial budgeting, and 2) total business linear programming. In this section, total business linear programming will be discussed. However, long-range financial planning will also be briefly discussed.

The objective here is to study the usefulness of using FARMAP and dBASE III PLUS to perform micro-level research in developing countries. This will be done through illustrating an example to explain the data needed to carry out linear programming analysis and how these data can be provided by FARMAP and dBASE structures.

Data needed to carry out long-range financial planning can be extracted from the output tables and reports of FARMAP and dBASE III. For FARMAP, the standard output tables can provide most of the data needed, while for dBASE III, the user has to design the output formats to get these data. For example, to compare the base situation with the proposed expansion of different enterprises, data are needed to cover the following aspects:

1) projected enterprise mix,

2) projected beginning balance sheet which includes

assets, liabilities and net worth, and analysis factors,

3) projected income statement which includes: income, expenses, and net farm income,

4) projected annual flow of funds which includes: source of funds, use of funds, and total cash outflow,

5) projected growth in net worth, and

6) projected profit and return analysis.

The data needed to calculate the above mentioned financial statements can be provided from the standard FARMAP and dBASE III output tables. For example, FARMAP activity mode subtables provide the whole data for each enterprise (activity). Of course, some calculation will be required to get the best option. For instance, the analysis factors (current, intermediate, and net capital ratio), must be calculated.

Linear programming is a mathematical method to find the optimal combination of activities to meet a specific objective. It has three components: 1) a desire to maximize or minimize some objective, 2) a set of activities or processes available to accomplish this objective, and 3) a set of constraints that limit the ability to achieve this objective.

Table 5.15 is adapted from Ibnouf (1985), to show the data needed to carry out linear programming analysis in developing countries. One activity is selected (which is sufficient enough) to illustrate data requirements and their

availability to be transferred from FARMAP or dBASE III into linear programming package. The X's appear on the table denote the availability of these data on the standard FARMAP output tables. For example, the resources (Bi's) including land, hired labor (by month), operating capital (by month), and quantity of early sorghum are all covered under standard FARMAP output tables. The six activities which are land preparation, planting, two weeding activities, (first and second weeding), and two crop harvesting activities are also provided by the standard FARMAP output tables. Program EXTRAC of FARMAP can be used to extract and export these data into linear programming package. This can be done by designing command file similar to that shown on Figure 4.6 with the commands required to obtain these data. For dBASE III PLUS, the same discussion can be applied, however, the user has to specify the data report formats for the output required.

Table 5.15 EXAMPLE OF INTERFACING FARMAP AND dBASE III PLUS WITH LINEAR PROGRAMMING DATA REQUIREMENTS

Objective function (Cj's)		Early sorghum						Sign	RHS
		LNDP	PLNT	WED1	WED2	HVST1	HVST2		
		X	X	X	X	X	X		
Resource (Bi's)	Units								
LAND	ha	1						<	X
	ha	-1	1					<	0
	.		.	.	.			.	.
	.			.	.			.	.
	ha					1		<	0
	ha					-1	1	<	0
HIRED LABOR									
June	MD	X						<	0
July	MD		X					<	0
Aug.	MD			X				<	0
.	.				.			.	.
.	.					.		.	.
Feb.	MD						X	<	0
March	MD							<	0
OPERATING CAPITAL									
June	$	X						<	0
July	$		X					<	0
Aug.	$			X				<	0
.	.				.			.	.
.	.					.		.	.
Feb.	$						X	<	0
March	$							<	0
QU. E. SO.	kg						X	<	0

Source: the body of the table is adapted from, Ibnouf, M. A. O. An Economic Analysis of Mechanized Food Production Schemes in the Central Plains of the Sudan. Ph. D. Dissertation, Michigan State University 1985.

Abbreviations:
LNDP= land preparation, PLNT= planting, WED1= 1st weeding, WED2= 2nd weeding, HVST1= 1st harvest, HVST2= 2nd harvest, RHS= right hand side, ha= hectare, MD= man-day, $= monetary currency, QU. E. SO.= quantity of early sorghum, X's= data found on standard FARMAP output tables.

5.3.4 Whole-farm Production Function Analysis

In developing a farm plan there exist three basic questions addressed by production economics: 1) what to produce?, 2) how to produce?, and 3) how much to produce?. One approach to the problem of optimum allocation is to estimate a whole-farm production function from which the elasticity coefficients of production and the marginal value products of factors can be estimated. Different levels of inputs combined in optimum proportions can be increased until the ratio between marginal factor cost and marginal value product for each variable input becomes equal to one. Under this condition, the high profit point is reached and the optimum level of resource use is determined.

There are several algebraic forms which can be used to fit the production function including Cobb-Douglas, spillman, quadratic, power and square root functions. To illustrate, the Cobb-Douglas type functions (Heady and Dillon, 1961) is shown because of its goodness of fit to the data, efficient use of degrees of freedom and computational feasibility. The equation is of the form

$$Y = A\, X_1^{b1}\, X_2^{b2} \ldots X_n^{bn} \quad 5.1)$$

where Y represents the dependent variable G(output), XPV1PV,...,X_n represents the independent variables (inputs) that determine the output, and the exponents bi (i = 1,...,n) are the elasticities of the independent inputs X_i's with respect to the dependent variables (Y) (i.e., these exponents indicate percentage change in output associated

with a one percent change in the respective input factors while keeping all other inputs constant).

The above equation (5.1) can be expressed in logarithmic form as follows:

$$\text{Log } Y = \log A + b_1 \log X_1 + b_2 \log X_2 + \ldots + b_n \log X^n \quad (5.2).$$

After fitting the equation to empirical data by the least squares regression technique the marginal value productivities (MVP's) for each factor input can be estimated by using the following equation

$$MVP^{xi} = b^i \; Y \; / \; X^i \qquad (5.3)$$

All the variables required to fit the production function estimate can be extracted from FARMAP and dBASE III output tables. For example, the following Cobb-Douglas model can be fitted to empirical data by the ordinary least square regression technique:

$$Y = a \; X^{1b1} \; X^{2b2} \; X^{3b3} \; X^{4b4} \; X^{5b5} \ldots (5.4).$$

where Y is the gross income (or the dependent variable), and the independent variables are:

X^1, land (acres),

X^2, labor (months),

X^3 operating expenses (monetary units),

X^4 machinery investment (monetary units), and

X^5, buildings (monetary units).

Data needed can be transferred using program EXTRAC of FARMAP into complementary package to carry out that sort of analysis. When using dBASE III PLUS the user can design the required output report formats according to data

requirements.

5.3.5 Multi-Year Production Variability Estimate

There are various economic and statistical tools to estimate multi-year production variability for risk and uncertainty analysis. These tools include time-series statistical analysis, quadratic programming, semivariance programming, and so forth.

In this section, the MOTAD (Minimum of Total Absolute Deviations) formulation (Hazell, 1971) is briefly discussed as an example of the various tools used for farm planning under uncertainty. This model uses the expected return and the mean absolute income deviation for farm planning under gross margin uncertainty (i.e., uncertainties in activity costs, yields, and prices). The steps involved are: 1) calculating the mean for each of the production activities (X1, ..., Xg) across all years (t1,.....,tn), 2) calculating the absolute deviations from the means for each year (t1, ..., tn) for each of the activities (X1, ..., Xg), 3) setting up n rows in the standard linear programming matrix to keep track of the absolute variations across all activities for each year, and 4) minimizing absolute deviations across all years subject to a desired level of income and other normal constraints.

Tables 5.16-17 describe numeric illustration of the MOTAD model. Table 5.16 shows a time series of gross margins for four vegetables (X1, ..., X4), and Table 5.17 shows a

tableau of constraints and activities for the MOTAD model. All of the data needed to perform this type of analysis can be extracted from the FARMAP output tables for each farm by using program EXTRAC of FARMAP. However, multi-year questionnaire must be designed to get the required data across all years (t1, ..., tn). The X's appear in Tables 5.16-17 denote the availability of these data on FARMAP and dBASE III PLUS output tables. However, the user has to design the output tables format when using dBASE III PLUS.

Table 5.16 ACTIVITY GROSS MARGINS PER ACRE FOR EXAMPLE PROBLEM.

Year	X1	X2	X3	X4
t^1	X	X	X	X
t^2	X	X	X	X
t^3	X	X	X	X
t^4	X	X	X	X
t^5	X	X	X	X
t^6	X	X	X	X
Average	X	X	X	X

Source: adapted from Hazell, P. B. R. "A Linear Alternative to Quadratic and Semivariance Programming for Farm Planning Under Uncertainty" Am. J. of Ag. Econ., 1971.

*The X's appear in the table denote the availability of data on FARMAP and dBASE III PLUS output tables.

Table 5.17 EXAMPLE OF INTERFACING FARMAP AND dBASE III PLUS WITH MOTAD DATA REQUIREMENTS.

Row and Unit	X1	X2	X3	X4	Y1	Y2...Y6	Constraints
A (dollars)	X	X	X	X	1	1 .. 1	Minimize
b1 (acres)	X	X	X	X			< X
b2 (hours)	X	X	X	X			< X
b3 (dollars)	X	X	X	X			< X
t1 (dollars)	Y	Y	Y	Y	1		> 0
t2 (dollars)	Y	Y	Y	Y		1	> 0
t3 (dollars)	Y	Y	Y	Y		..	> 0
t4 (dollars)	Y	Y	Y	Y		..	> 0
t5 (dollars)	Y	Y	Y	Y		...	> 0
t6 (dollars)	Y	Y	Y	Y		1	> 0
E (dollars)	X	X	X	X			= ⅄

Source: adapted from Hazell, P. B. R. "A Linear Alternative to Quadratic and Semivariance Programming for Farm Planning Under Uncertainty" Am. J. of Ag. Econ.,1971.

*The X's appear in the table denote the availability of data on FARMAP and dBASE III PLUS output tables.

+The Y's denote the availability of data on FARMAP and dBASE III PLUS output tables which are needed to get these activity gross margin deviations from their sample means in the respective year.

5.4 Features and Limitations

5.4.1 FARMAP Features and Limitations

FARMAP is a very powerful tool for rural surveys data storage, processing and retrieval. It was developed to overcome slow manual processing of farm management survey data. The package is designed for world wide application, since numeric codes are used throughout the execution and processing of data. Therefore, it is language independent which is very convenient for farming system research analysis in developing countries. The coding system is also very logical.

FARMAP provide a unique tool to carry out micro level research of rural data. The record type groups and the coding system can be used to design a unified system for rural data collection and analysis. For example, they can be used to design questionnaires for a wide variety of rural surveys. The record types groups and coding system comprise an agricultural information coding system. This facilitate the processing and analysis of rural survey data with the pre-defined structures of these record types groups. The FAO experience in farm management analysis is also reflected in the package. For example, the package provides very useful economic information regarding the consumer and labor units' adult equivalent. The standard output tables also provide very useful information needed to establish a basis for a farm management information system. The output tables are

pre-defined and automatically generated by the package. They cover many topics such as: household composition and demographic information, land characteristics, crops and animals productivity, cash and kind flow, net worth statements, enterprise budgets, farm economics, and so forth. FARMAP also provides a very convenient way to generate user-defined output tables. This feature allows for generating unique reports and tables which better meet the objectives of the survey under consideration.

However, there exist some limitations and operational difficulties which must be solved to fully utilize the whole feature of the package. The following discussion demonstrates the most important limitation which hampered processing with FARMAP:

1. Accuracy: the size of the largest number that can be handled by FARMAP micro version is up to 10 figures. This is usually not convenient for small units of area and currency. Also, rounding of the results on the output subtables is somewhat misleading.

2. Trailing and leading zeros should be consistently recorded (or omitted) for any particular variable. This might cause errors or frustration during data entry process. For example, the month-week code 032 which represents the second week of March cannot be entered as 32 otherwise an error will occur.

3. All keyboard entries should be in upper case. The package does not recognize lower case characters.

4. Some commands of some programs are not operational or do not operate correctly. For example, the command TITLE of program EXTRAC is not operational, and program TRANSB does not operate correctly (this program is used to combine binary data files together), especially when merging multiple files containing multiple farms' data.

5. Data entry process, using program EDIT, of general farm survey data is not convenient, because the user has to keep track of columns and rows position. Also, it is not possible to append or insert new data records when using program ENTERD.

6. FARMAP was originally designed for use on mainframe computers, and the micro version is still not developed completely. For example, many modifications and new micro versions are being developed to correct some programs and commands which are not currently operational.

7. The User's Manuals are not an easy task to be totally understood which contain more than 800 pages. In addition, the command files are not simply described.

8. Some difficulties arise when using program CORREC, since a new file should be created in addition to the old file being edited. Also, correcting data records should be in ascending order (i. e., the first record cannot be edited unless you were at the beginning of the file).

9. The user has a limited control over the standard pre-defined output subtables produced during standard tabulation stage (This can only be handled by performing advanced

tabulation, which is not easy for the novice users).

10. The total disk space required to run the package for only 10 farms (of about 620 records) amounted to 5.6 mega bytes which is not affordable by most microcomputers. Therefore, a hard disk is highly recommended. To illustrate, about 332.4 k bytes were required for each of TAB2.BIN, TAB31A.BIN, TAB31F.BIN, TAB31Y.BIN, and TAB41.BIN files. In addition, the message files, which have as their main functions the listing of errors, also contained redundant and unnecessary information about their associated command files.

11. The package does not provide any statistical or linear programming capabilities. Therefore, complementary packages are required to carry out those features.

Finally, it is a challenge to utilize the full features of FARMAP and a programming experience and data processing background are required. However, it should be mentioned that, many of the limitations and operational difficulties were reduced or totally eliminated by using FARMAP menu-driven version on a microcomputer with a hard disk.

5.4.2 Features and Limitations of dBASE III PLUS

dBASE III PLUS is powerful development tool designed for microcomputer business applications. It can be used as a stand-alone system for a single-user, or it can be networked in a multiuser local-area network (LAN). dBASE III PLUS can be used to conceptualize and create databases for numerous

types of applications. Editing and modifying of data fields and records can be done with great level of flexibility. Also, importing and exporting data files are provided by the package. The database structures allow for a flexible processing and updating of data. The file structures better utilize the disk space available (e.g. only less than one mega byte was needed to process the ten farm data which is about one-fifth as the disk space with FARMAP). Although the package is well-developed, some operational difficulties arise especially when utilizing the command mode rather than the menu-driven assistant feature. The followings are some limitations encountered:

1. Unlike FARMAP, the package is mainly designed for business applications as a relational database manager, not for farm management analysis. So, the user has to design his sort of analysis, the report forms, and the required output.
2. The technical manuals have proven frustrating. They contain almost 1000 pages which is a difficult challenge to accomplish.
3. The menu-driven Assistant feature of dBASE is supposed to provide the novice with the ability to create data files and other supporting files (e.g. format, index, sort, etc.). However, the terminology shown at the various menu screens, the 'assistant' features, and the 'application generators' features are some how confusing for the complete novice.

In addition, some features and capabilities of the package require programming and using the dot prompt

commands. For example, COPY TO and APPEND FROM commands can only be performed using the dot commands.

Therefore, programming knowledge is essential for the full utilization of the package. Also, for complex or sophisticated economic models, the 'assistant' feature or the 'application generator' of dBASE III PLUS will not be sufficient enough for developing such models. Programming with dBASE III PLUS can provide that knowledge, but prior knowledge of microcomputer operations and programming techniques is required.

4. The width and content of any particular data field cannot be changed at the same time, otherwise the content of that data field will be lost. Therefore, two runs are required for that purpose.

5. The cost of buying dBASE as a commercial package is about US $400 which is somehow expensive for the researchers in developing countries with the low salaries and standard of living.

6. Regardless the speed of execution, the biggest disadvantages of dBASE' SORT program is that any changes or alterations to the master file are not automatically reflected in the sorted versions of the master file. Since, a new sorted database file is generated which causes problems of data inconsistency and redundancy.

7. While the built-in reporting feature of dBASE provides great flexibility in creating report formats, there also exists a set of restrictions, the user has to be content

with the format as presented by dBASE. Therefore, the same reports were created by designing dBASE programs (without the built-in reporting facility of dBASE). The same results were obtained but with more user control on the required output. The same commands were used, however, more freedom in designing the report format was obtained by this programming feature. Thus, knowing dBASE programming techniques is essential.

8. The package does not provide statistical and linear programming features. The sum, count and average of data fields' contents can be performed.

Additionally, programming experience and data processing background are highly recommended to use the package for micro level research and farming system analysis.

Table 5.18 illustrates a comparison between FARMAP and dBASE III PLUS features. As discussed earlier, it is highly recommended to use microcomputers with 10 mega hard disk when executing FARMAP menu-driven version.

The maximum records per file for both programs are unlimited. However, the computer capacity or the memory space available will determine that number. The standard FARMAP number of fields per record is 27, while it is up to 123 fields per any particular record in dBASE.

In FARMAP, the maximum number of characters per data field is 10, however, that number is variable in dBASE. For example, the data field width is 19 for numeric fields, 8 for date, 254 for character fields, 1 for logical, and up to

5000 characters for memo fields.

dBASE III PLUS is superior in terms of users' friendliness, importing and exporting data files, On-line help, editing and modifying data fields/records, and level of user's control over data entry and processing.

Data entry process using the screen forms designed using dBASE III were tested for comparison purposes and it was found more easy and simple to be utilized. Also, errors were eliminated to great extent. For example, after filling the first data field the cursor moves automatically to the next data field, and so on. Therefore, editing can be done while entering data to correct any possible errors. Unlike FARMAP, editing of any records at different positions can be done (it is not possible to edit or correct data fields in smaller record sequence numbers in the same run unless you were in the beginning of the file).

Table 5.18 FARMAP AND dBASE III PLUS COMPARISON

Feature	dBASE	FARMAP
Cost	$400	free
Hardware Requirements		
RAM (bytes)	256 k	128 k
Disk (min. recommended)	360 k	10 mega bytes
Operating Systems	MSDOS, CP/M	MSDOS, CP/M
Maximums		
Records/File	unlimited	unlimited
Characters/Record	4000	80
Fields/Record	128	27
Characters/Field	up to 5000	10
Sorting and Indexing		
Sorting on single field	yes	yes
Sorting on multiple fields	yes	yes
Indexing	yes	no
Table Conversion		
DIF target	yes	no
ASCII target	yes	yes
LOTUS 1 2 3	yes	no
User Friendliness	high	low
On-line Help	yes	no
Edit Features		
Browse and Edit	yes	no
Display	yes	yes
Record Deletion	yes	yes
Record Marking	yes	no
Insert Records at specific location	yes	yes
Transfer Output		
To Screen	yes	yes
To Printer	yes	yes
To Disk	yes	yes
Statistical and Linear Programming features	no	no
Accuracy	high	low

5.5 Conclusion

As mentioned earlier, it is essential to have reliable and adequate data set to establish a basis for farm management information system to support the operation, management, and decision making functions in developing countries. Harsh, et al., 1983, state that an information system closely relating to the major functions of problem definition, observation, analysis, planning, and decision making contains the following four components: descriptive, diagnostic, predictive, and prescriptive information.

There exist some limitations when using FARMAP and dBASE III PLUS including hardware and software requirements. For example, some programming experience and background in microcomputers operations are required to generate advanced user-defined tables and reports. However, the results obtained are meaningful and promising. Learning and using database management systems such as FARMAP and dBASE III PLUS is a challenge and an essential task. This is especially true when considering the failure of the current system to generate reliable data to perform micro level research analysis which is needed to link micro farming system research data with macro policy analysis. This linkage is very crucial to achieve agricultural development in developing countries.

FARMAP is a very powerful tool for rural survey data storage, processing, and retrieval. It can be used to replace the tedious and slow manual processing of farm

management survey data. Many of the limitations (discussed in section 5.4.1) can be eliminated or reduced to a great extent by acquiring some programming experiences and background about microcomputers operations.

The coding system and data record groups provide a basis for establishing a unified system for rural data collection and analysis. They can also be used to set a basis for farm management information system by using pre-coded questionnaires with the required data sets for various farming system contexts.

The subtables of the farm and activity modes generated by FARMAP cover a wide variety of information which include:

(1) Household Composition Subtables.

(2) Land Resources Subtables.

(3) Crops List Subtables.

(4) Net Worth Subtables.

(5) Economics Subtables.

(6) Cash-kind Flow Subtables.

(7) Power Subtables.

The same sort of discussion can be applied on dBASE III application except for the differences and comparisons mentioned in Chapter 5, section 5.4. The same data were used and almost similar analytical procedures were employed as those done with FARMAP. However, more flexibility and simplicity in data entry, and data editing processes were obtained. In addition, a relatively higher level of user's control on the processing of data and generation of reports

were achieved when using dBASE III PLUS.

According to production economics theory, the three basic decisions that must be made by all producers are: what to produce, how much to produce, and how to produce various products. Thus, production function analysis can be performed to show the relationship between output of an enterprise and the variable and fixed inputs needed to achieve that output. Data about factors of production were considered in the FARMAP and dBASE III data structures. For example, FARMAP data records and output tables provide information about levels of nitrogen fertilizer and their associated levels of rice yield. Also, additional data requirements which were not available from the data set used in the research, could be included in a future questionnaires.

FARMAP and dBASE III PLUS do not provide statistical and forward planning tools often needed for a thorough farming system research and a sound decision making. However, they provide means for exporting and interfacing data files to other packages for further processing. Descriptive statistics were obtained which can be used to planning purposes.

Linear programming analysis can be used for whole farm planning to evaluate the impacts of possible adjustments in the farming systems employed in developing countries. Data reflecting changing conditions such as price trends, new technology employed, level of inputs availability and usage,

cost of production, and so forth, are provided or considered within the data structures designed. Due to lack of variability of data contained in the limited sample size of the ten farms, and the farms only having single primary enterprise, a linear programming analysis was not performed on these farms. However, it would be able to use FARMAP and dBASE III PLUS to generate the data needed to do linear programming analysis.

Microcomputers can replace the tedious and slow manual checking and manipulation of farming systems research data. This research approach is commonly used by researchers in developing countries. Microcomputers can play a vital role in eliminating or reducing chances of computational errors and the time required for data processing. In addition, the difficulty and amount of effort required are greatly reduced when microcomputers are used as a research tool.

To conclude, FARMAP and dBASE III PLUS represent two examples of database management systems. They are very powerful and useful tools to carry out micro level research in developing countries. There exist some limitations related to their full utilizations which can be solved by acquainting some programming experiences and background on microcomputers' operation. However, the results obtained are promising and these programs can be used to establish a unified system for data collection and analysis, and to structure a basis for farm management information systems highly needed in developing countries.

CHAPTER 6

Summary, Policy Implications, and Suggestions for Further Research

6.1 Summary

Agriculture plays a vital role in the economy of Egypt. About 20 percent of the total GDP of Egypt is produced by the agriculture sector, and almost 50 percent of the total labor force is engaged in agriculture.

Egypt's total area is about one million square kilometers of which only 3 percent is under cultivation. The population of Egypt was 45.2 million in 1983 with an average population growth rate of 2.5 percent which adds over one million newborns each year.

Thus, the country faces two fundamental problems; a rapid increase in population growth and a severe shortage cultivable land.

Egypt has become increasingly dependent upon imports to meet its food needs. In addition, the agricultural sector has shown a slow growth rate, about 2.5 percent. Services, including housing, public utilities, tourism, and other services grew by an average of more than 8 percent per year and petroleum by 30 percent per year. Several factors have contributed to the decline in the performance of the agricultural sector and the widening gap between the production and consumption of major agricultural commodities.

These factors include: a relatively low level of investment in agricultural research and extension programs. Also, there is a void of reliable micro and macro economic data. This absence is compounded by a lack of quantitative analysis of existing data. Other factors include: 1) the absence of the use of microcomputers and database management system on micro level research studies, and modern analytical techniques, 2) the absence of records of production, income and expenditures, and 3) the lack of a unified system for data collection and analysis, and the lack of information needed for the macro policy formulation.

The data collection and analysis problem has three inter-related aspects: (1) insufficient economic data is being collected, analyzed and fed into the decision-making process; (2) the capacity to utilize whatever data and analyses are available is insufficiently developed; and (3) links which integrate the research and analysis process into the decision-making process are weak or missing.

Thus, these factors led to the failure of the current system to generate the economic data and analyses needed to develop sound plans and rational policies for agriculture. Data currently available do not provide the basis for economic and financial analysis, and sound decision-making. Thus, decision-makers are tempted to institute policies which are politically popular because they do not comprehend the economic consequences.

The purpose of the study is to design a framework for

quantitative micro-level data collection and analysis using database management systems such as FARMAP and dBASE III PLUS and establish a basis for farm management information system with its four components: descriptive, diagnostic, prescriptive, and predictive information.

This study addresses the data collection and analysis problem of subsistence and semi-subsistence smallholder agriculture in developing countries which commonly have strong linkages between farm production and household consumption, and to create a unified system of rural data collection and analysis. Improvements in these areas should strengthen planning and policy formulation.

The objectives of the study are: (1) to describe the Egyptian agricultural sector and relate it to other developing countries emphasizing the constraints facing the agricultural development, (2) to develop an analytical model to help economic analysts better utilize database management systems in micro level research, (3) to evaluate the usefulness of using DBMS such as FARMAP and dBASE III PLUS in the quantitative analysis, and 4) to develop a database for farm management and production research in farming systems context, and, to evaluate the impact of using microcomputers in data processing and analysis, and (5) to design data structures that can be used for data collection and analysis in rural areas.

Due to lack of reliable economic data, along with limited funds and time constraints, secondary data were used

to carry out the research. In addition, sufficient economic data from the Egyptian agricultural sector were not available to satisfy data requirements to accomplish the research. Therefore, secondary data were chosen from another farm survey project of a developing country, Consequences of Small Rice Farm Mechanization Project (IRRI/USAID contract No. tac 1466). This project was conducted in three Asian countries, the Philippines, Thailand, and Indonesia.

A modest sample size of 10 was considered adequate to accomplish the objective of the study. Data, originally stored on magnetic tapes on 80 column records, were retrieved, manually interpreted, checked, validated, and transferred to recording sheets. Data were then interpreted and recorded using the FARMAP coding system. A microcomputer was used for data entry checking, validation, and processing using two database managers, FARMAP and dBASE III PLUS.

To determine the advantages and disadvantages of using FARMAP and dBASE III PLUS to carry out micro level research in developing countries, a set of comparison criteria was developed. There exist common set of tasks which most database management systems are able to perform. These tasks include access specific information at random, sort and index information, generate reports, create forms for ease of data entry and validation, update and modify selected records and/or fields, create new databases from existing files; append data from other sources, and export data to other statistical and planning models for further analysis.

Therefore, the comparison criteria between FARMAP and dBASE III are based on the above mentioned common tasks particularly as they can be used to generate economic data for planning purposes. In addition, other factors are used including cost, hardware and software requirements, user-friendliness, level of support by other packages, online support, and level of user's control.

The structure of FARMAP and dBASE III PLUS are described in Chapter 4. FARMAP data processing comprises four different stages. These stages are: data storage, data validation, data tabulation, and advanced processing. The four stages were employed and executed to accomplish the research. In data storage stage, data were transferred from the coding sheets into the computer. General survey qualitative data were entered using a word processor package (i.e., WORDSTAR). Resource description information and resource flow data records were entered interactively using program ENTERD of FARMAP.

Checking and modification of data was done during validation stage. The steps involved were checking single records, performing range checks on the magnitude of inputs and outputs, and doing multi-record consistency checks.

During the tabulation stage, FARMAP tables were produced in two different modes; farm mode and activity mode. The farm mode is used to produce a summary for an entire farm. In a second run with different sorting requirements, the power use tables for an entire farm were

produced. The activity mode produces one table for each activity on a farm.

Standard subtables cover the topics of household composition, land resources, cropping patterns, animal resources, net worth statement, economics, cash and kind flow, and power use and types (i. e. human, animal, and machine).

The advanced processing stage is used to design user-defined tables other than those mentioned above. Also, it is used to export FARMAP data files to other complementary programs such as statistical and economic planning tools. Data were exported to a statistical program called ABSTAT and descriptive statistics analysis were performed. Other economic tools (e.g., linear programming) are also examined to show how FARMAP and dBASE III PLUS data can be extracted and processed into these tools. The results of FARMAP are presented in Chapter 5.

The same analytical procedures were performed using dBASE III PLUS with the same data. dBASE III PLUS is a relational database management system for designed for microcomputer applications. Data files were transferred from FARMAP to dBASE III using the programming features of dBASE. However, the same data could have been entered directly into dBASE III PLUS. The structure of dBASE III and the analytical procedures employed are discussed in Chapter 4. The results obtained are presented in Chapter 5, which are similar to those of FARMAP. Some modifications were done on

data structures and the generated output reports which are also shown.

To conclude, data requirements to carry out micro level research in developing countries established the path and analytical procedures of this study. With the limitations of FARMAP and dBASE III PLUS discussed earlier, both programs can be used to establish a basis for farm management information system with its four components: descriptive, diagnostic, predictive, and prescriptive information.

Descriptive analysis including accounting information systems and farm records, and diagnostic analysis can be performed using FARMAP and dBASE III PLUS. Also, FARMAP and dBASE III PLUS provide means to export data needed to perform predictive and prescriptive analyses. However, other complementary packages such as linear programming and statistical programs are needed to strengthen and complement required processing tasks to accomplish micro level research in developing countries.

The use of microcomputers can eliminate to a great extent the involved and tedious process of data entry, retrieval, validation, and tabulation. A framework of data requirements was established for the farm management information system to be utilized in developing countries.

Both FARMAP and dBASE III PLUS are very powerful and excellent tools for carrying out micro level research in developing countries. They provide a unified system for data collection and analysis and a basis to establish a farm

management information system which is highly needed in developing countries to correctly evaluate policy alternatives. One should select dBASE III PLUS because it is more flexible and more powerful than FARMAP. However, FARMAP can be chosen if there is a budget constraint.

6.2 Policy Implications

On the assumption that the data sources and the analytical procedures have a reasonable degree of validity, the results obtained can provide some insights and guidelines to help policy makers and economic analysts carry out micro level research in developing countries.

The data requirements to establish a basis for farm management information system and to develop a unified system of rural data collection and analysis can be extracted from FARMAP data record groups, and data structures created using dBASE III PLUS.

Database structures can be used to create production, expenditures, and income records on the national and local levels in developing countries where the absence of these records is common. Organized and easily accessible database structures can contain accurate, and updated, economic information for better agricultural policy planning and decision making. These data may describe price series for inputs and products, financial balance sheets, farm income, and so forth. On the farm level, the use of microcomputers may be adequate. However, it may require larger computers

such as mini, maxi, or mainframe computer systems to process, store, and retrieve the data on the local, regional, and national level.

The study calls for strengthen investment on agricultural research and extension services based on more accurate, more reliable, and more timely agricultural data. More effective research and extension programs are needed to improve sector policies and programs.

The use of microcomputers is highly recommended to replace slow and tedious manual data processing. Using microcomputers substantially reduces chances of errors. It eases the time and effort required for data manipulation. The potential of using computerized database managers is great and very promising in developing countries.

Interfacing databases with other economic and statistical models is very essential to accomplish research needs in developing countries. Modern quantitative analysis tools including statistical, mathematical programming, and other related economic analysis are needed. Good coordination between data collection process and economic analysis is also needed to ensure that data collected meets the needs of policy analysis.

To conclude, using computerized database management systems to perform micro level research in developing countries are highly recommended to replace manual data storage, retrieval, and validation which caused the failure of the current system to generate reliable, accurate

economic data and perform quantitative analysis required for better planning and a sound decision making process.

6.3 Limitations of the Study and Suggestions for Further Research

The study is based on secondary data of West Java site (Indonesia) with a modest sample size of 10 farms. This was done mainly because of the limited funds, time constraints, and lack of reliable economic data from Egypt.

The research was also performed for illustrative purposes on a small scale to determine the usefulness of using database management systems to carry out micro level research in developing countries.

Therefore, the scope of the study should be expanded to cover larger studies based on primary data sources to test the validity of the models and database structures created. Also, more attention should be given to solving the operational errors found in the FARMAP system.

While means of interfacing both FARMAP and dBASE III PLUS with complementary packages were introduced, however, more analysis should be made for a thorough and a complete farming research system needed in developing countries. For example, illustrated manuals and comprehensive analytical summaries should be developed. Also, other planning tools should be tested regarding the proposed interfacing of these tools with FARMAP and dBASE III PLUS. These complementary packages include statistical, linear programming analysis,

and other planning tools. Other database management systems (e.g., Statistical Package for Social Science 'SPSS') should also be examined to study their usefulness to carry out micro-level research. Developing a national archive system for rural data is another task which must be considered in the future research.

Finally, more coordinated work is required to build a basis for the proposed farm management information system and the unified system of rural data collection and analysis.

APPENDIX

APPENDIX A

FARMAP GROUP MEANS TABLES

APPENDIX A - FARMAP GROUP MEANS TABLES

TABLE A.1 FARMAP STANDARD TABLE- FARM MODE- COMPLETELY DISAGGREGATED- GROUP MEANS TABLE

****

FARM NUMBER 999.0 (MEANS FOR THE 10 FARMS)

TABLE A.1.1 ** HOUSEHOLD COMPOSITION **

****

	TOTAL	FAMILY			PERMLAB	OTHERS
		AGED	ADULT	YOUTH	CHILDREN		
PERSONS	5.6	.0	2.1	1.3	2.0	.2	.0
FEMALE	1.9	.0	1.1	.2	.6	.0	.0
MALE	3.7	.0	1.0	1.1	1.4	.2	.0
CONSUMER UNITS	4.1	.0	1.9	1.0	1.0	.2	.0
LABOUR SUPPLY	2.8	.0	2.1	.6	.0	.2	.0

HEAD SEX F AGE 36 YRS SCHOOLING 5.4 MTHS RESIDENCE 12.0

****

TABLE A.1.2 ** LAND USE**

****

	TOTAL	ANN.RF.	ANN.IRR	PERM.RF	PERM.IR	PASTURE	OTHER
OWNED AND MANAGED	3.2	.0	1.9	.0	.0	.0	1.3
RENTED IN AND MANAGED	.0	.0	.0	.0	.0	.0	.0
RENTED OUT AND MANAGED	.4	.0	.3	.0	.0	.0	.1
TOTAL	3.6	.0	2.2	.0	.0	.0	1.5

****

Table A.1 (Cont'd)

TABLE A.1.3 ** CROPS GROWN **

CROP	COMPONENT	PARCEL-PLOT	VARIETY	AREA
RICE	29.	1001.	MODERN	2.96
RICE	29.	31001.	MODERN	.02

TABLE A.1.4 ** NET WORTH STATEMENT **

	LAND	PH.ASSET	PERCROP	ANIMALS	OTHERS	-DEBTS	TOTAL
CLOSING INVENTORY	10913.8	732.0	.0	.0	.0	-34.0	11611.8
INCOMING AND APPRECIATION	.0	.0	.0	.0	.0	.0	.0
OUTGOING AND DEPRECIATION	.0	.0	.0	.0	.0	.0	.0

Table A.1 (Cont'd)

TABLE A.1.5 ** ECONOMICS **

****

(IN UNITS OF)
AREA 3.63 QUANTITY 1.000 PRICE 1.000 VALUE 10.000

ACT	COMP	RESOURCE QUANTITY	ECONOMICS VALUE	FARMER QUANTITY	E C O N O M I C S PRICE	VALUE	%CASH
RICE	RICE		1403			1403	80
TWTRCTR	TWTRCTR					245	94
OFFFRMJB	OFFFRMJB					11	75
RNTINCOM	RNTINCOM					38	
GROSS INCOME			1403.			1697.	81
MATERIALS							
RICE	RICE		45			46	95
TWTRCTR	TWTRCTR					45	100
LABOUR							
RICE	RICE	2258	446	2258	2.02	446	24
TWTRCTR	TWTRCTR			411	.97	40	94
DRAFT							
POWER							
RICE	RICE		2			2	80
VARIABLE COSTS			494.			579.	41
GROSS MARGIN			910.			1118.	
RICE	RICE						
USER-SUPPLIED TITLE			910.			1112.	
NET RETURN BEFORE TAXES			910.			1112.	
GENFARM	GENFARM					43	100
NET RETURN AFTER TAXES			910.			1069.	

****

TABLE A.1.6 ** CASH KIND FLOW **

****

AREA 3.63 IN UNITS OF 10.00000

	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
CASHFLOW	941.	-31	-41	-12	189	837	0	0	0	0	0	0	-1
KINDFLOW	-19.	-6	6	0	-3	-16	0	0	0	0	0	0	-1
TOTALS	909.	-37	-47	-12	186	821	0	0	0	0	0	0	-2

****

Table A.1 (Cont'd)

TABLE A.1.7 ** HUMAN POWER USE **

****

MONTHLY DISTRIBUTION BY ACTIVITY AND COMPONENT

AREA 3.63 IN UNITS OF 1.00000

ACT	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
RICE	RICE	1029.	255	469	117	16	166							9
TRAC	TRAC	411.	23	324	65									
TOTALS		1440.	274	795	179	16	166	0	0	0	0	0	0	8

****

TABLE A.1.8 ** MACHINE POWER USE **

****

MONTHLY DISTRIBUTION BY ACTIVITY AND COMPONENT

AREA 3.63 IN UNITS OF 1.00000

ACT	COMP	TOTAL	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
RICE	RICE	112.	81	17	9	4								4
TOTALS		112.	80	17	8	4	0	0	0	0	0	0	0	4

****

N.B.: Only FARMAP FARM MODE TABLES are presented here. For more details see Chapter 5 (Section 5.1).

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