THE IRRIGATION-BASED TRANSMIGRATION PROGRAM IN INDONESIA:
AN INTERDISCIPLINARY STUDY OF POPULATION RESETTLEMENT AND RELATED STRATEGIES

By

A. Hafied A. Gany

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ABSTRACT

THE IRRIGATION-BASED TRANSMIGRATION PROGRAM IN INDONESIA, AN INTERDISCIPLINARY STUDY OF POPULATION RESETTLEMENT AND RELATED STRATEGIES

Despite a number of successful resettlement schemes, the implementation of irrigation-based transmigration resettlement has been characterized by both technical and non-technical problems.

Many resettlers have, therefore, been unable to realize the incomes and quality of life which had been promised them. The overall objective of the study is to formulate specific strategies or recommendations for technical and socio-economic interventions to improve the development of new agricultural land in irrigation-based transmigration programs.

Some major conditions have been drawn from the study. The technical problems of irrigation development are primarily caused by high initial water requirements of the newly reclaimed land. The design impacts of this unusual water requirement indicate that the new schemes will require much more time to become physically stable in comparison to the time required for the overall process of socio-economic adaptation of the transmigrants to the resettlement scheme. As a result, it is almost unrealistic to rely mainly on the land for producing a desirable level of revenue within the time frame originally envisaged.

The resettlement problems arose mostly from the fact that the pre-resettlement preparations not only lacked physical resources, but planners were paying less attention to socio-cultural and psychological aspects of human resettlement. The study also found that the current land allocation for the transmigrant household, with some degree of variation, was not adequate for a reasonable livelihood to the extent that they were able to provide for the operation and maintenance of the scheme for maintaining a sustainable irrigated agricultural practice.

The study further indicated that the settlers' adaptation to the scheme is highly dependent upon land ownership status. The more uncertain the land status the more reluctant the farmer will be to adapt and to participate in the resettlement activities. Finally, it was also concluded from the analysis that there is an obvious relationship between the land development progress and the availability and adequacy of water at the field.

In future, it is almost certain that the transmigration resettlement program will continue to be an important issue in the Indonesian development process. Furthermore, the irrigation-based resettlement schemes will play an important role in the current and future transmigration resettlement program. The findings of my study provide the basis for improving the success of the future schemes.

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INTRODUCTION

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In today's world the decision makers in the developing countries are increasingly setting their own development directions and priorities, rather than relying on the advice and example provided by the donor countries. Much of the historical development emphasis has been on the agricultural and industrial sectors and was geared towards economic growth, export, job creation and increased productivity. There are, however, other developmental objectives that a country must achieve in order to be able to move towards a stable and prosperous society. One of the most important aspects of a developmental policy is the human resource development in the broad sense of harmonizing the aspirations and the potential of people with its social and its economic needs and opportunities.

In a country like Indonesia with its extreme variations in population density, a harmonious development may require that people move away from overpopulated areas to regions where the opportunity for improvement of the standard of living is greater. It may also require the encouragement of increased settlement in areas where development lags behind because of the lack of people. In addition, local circumstances may also necessitate resettlement. For example, engineering projects in an existing may reduce the available arable land, and economic or environmental changes may erode a previously existing resource base.

Human resettlement projects are often associated with the notion of coercion. This negative image is understandable since in many cases the people that were relocated appear to have had little choice in the matter and would seem to have preferred to remain where they were born and raised. In many cases, however, the relocation policy was in response to a real need caused by an inadequate and deteriorating resource base. However, regardless of the nature of the compulsion, the feelings and the attitudes of the relocated persons are important factors in the success of any resettlement project. Moreover, even when the resettlement is strictly on a voluntary basis, problems and disappointments are common. For that reason any human resettlement program requires a broad coalition of effort involving all government and non-government agencies as well as the settlers themselves in an integrated attempt to make the relocation a success.

The Indonesian resettlement program is known as the transmigration program. It has a dual purpose. It aims at voluntary relocation of people from the most densely populated areas in the islands of Java, Madura, Bali, and

Lombok. It is also aims at settling the sparsely populated areas of the other islands of the archipelago so as to accelerate their agricultural development by providing a more adequate human resource.

The transmigration to be discussed in this study is irrigation-based transmigration. It is not the only type of transmigration. There are also schemes associated with swamp reclamation, cash crop development and rainfed agriculture that involve relocation of people. Irrigation, however, is considered to be one of the most important factors in attracting transmigrant farmers in Indonesia and ensuring their success in securing a stable and permanent agricultural income.▷[1]

New irrigation projects usually entail the opening of agricultural areas that were previously completely undeveloped and that therefore do not have the total infrastructure that is subsequently needed. It is not uncommon that the implementing agency cannot meet the development schedule that was originally drawn up because of the complexity of the problems that are encountered.

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1 ▷ *Before the introduction of the vast irrigation-based agricultural practices, the* "slash and burn" *or* "shifting cultivation" *method was widely practiced by traditional farmers in Indonesia. In this agricultural practice, land preparation is simply done by cutting the forest, burning the trees and spreading the seeds over the bare ground when the rainy season comes. As a result, soil conditions deteriorate very quickly, and cannot provide a sustainable agricultural way of life.*

Sometimes the problems are budget related, sometimes they are technical, often they are socio-economical.

It follows that the successful design and implementation of a transmigration scheme requires a realistic budgetary policy, good engineering and appropriate socio-economic support. None of these factors taken in isolation can guarantee success. The study, described in this thesis adopts an integrated approach involving economics, social science and engineering in the analysis of common problems encountered in irrigation based transmigration schemes and the identification of possible solutions.

There is no doubt that the trasnmigration program has at times been rather disappointing. Although it has met with some success in terms of the total numbers of people that were relocated and in terms of increased agricultural production, as a rural development initiative it is questionable in terms of its cost-effectiveness. Heavy, up front, capital investment is needed to make the new settlement operational. The returns are realized many years later. Technical provisions have not always been adequate. In addition, the settlers are transplanted into a new environment with different agricultural tenure and cropping systems. There is considerable evidence that they do not always adapt to the new environment as readily as the planners anticipate or the politicians promise. Thus many irrigated development projects created for transmigration have failed to meet the expectations set for them. Many settlers have failed to realize the income and the quality of life that was promised.

The purpose of this study is a multi-disciplinary analysis of the main problems encountered and the formulation of specific strategies and recommendations for technical and socio-economical interventions that may improve the success of irrigation based transmigration in the future.

1.2 THE CONTEMPORARY DEVELOPMENT CONDITION OF INDONESIA

1.2.1 ECONOMIC OVERVIEW

In 1966, a major shift in political orientation occurred in Indonesia which brought about a new policy in the country's development effort. Previously the country's economy had suffered from uncontrollable inflation which reached a rate of 595% in 1965 and another peak of 650% in 1966. As a result, the living standard of the people as well as the GNP rapidly declined.

In an attempt to overcome the economic difficulties, the New Order Government launched a new development policy in 1969 in the form of a national development plan. The new policy was successful in controlling the rate of inflation. While it was still as high as 120% in 1967, it went down continuously thereafter.

In 1969, the first year of the Five-Year Development Plan, the inflation rate was reduced to 10.7%. In the last decades, the inflation rate has been controlled at a constant level below 10%.

During the decade of the 1970s, the economy of Indonesia experienced an average economic growth of 7.7% annually. This remarkable achievement placed Indonesia among the the ranks of "middle-income" countries according to the World Bank classification of 1983, with a per capita income of US $530.

During the succession of Five Year Development Plans (PELITA)[▷2] Indonesia successfully survived a number of hardships and challenges and is now implementing the Sixth Five-Year Development Plan. This plan emphasizes (a) the agricultural sector and the industries that are geared towards producing export oriented goods, (b) industries that can absorb manpower, (c) industries producing machinery for processing agricultural products and (d) industrial machinery *(The Fifth Indonesian Fife-Year Development Plan, 1987-1992)*.

Despite the global economic recessions that have occurred in the last decades, Indonesia has achieved steady

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[2] ▷ *PELITA stands for "Pembangunan Lima Tahun" or Five Year Development Implementation of the Government of Indonesia. While REPELITA stands for "Rencana Pembangunan Lima tahun" or Five Year Development Plan.*

economic growth, and has had some success in industrialization, in maintaining sustainable agriculture, in achieving self sufficiency in food production, and in poverty reduction. While 54 million people were living below the poverty line in 1976 the number dropped to 30 million in 1987 *(Indonesian Department of Information, 1989:58-60)*. In that period, the percentage of poor rural inhabitants dropped from 40.4% to 14.4%, while the percentage of urban inhabitant living below the poverty line dropped from 38.8% to 20.1% *(Indonesian Department of Information, 1989:60-78)*.

In 1987, the gross domestic product of Indonesia was approximately Rp675,000 per capita. This represents an increase in GDP about 19.5% over 1986 or or an increase of 3.59% in terms of constant 1983 Rupiahs.

In the five year period from 1982 to 1987, Indonesia's GDP increased at an average annual rate of 10.36%, while at the same time the population increased by about 2.3% annually.

Indonesia is still considered to be an agriculture-based country. The contribution of the agricultural sector to the GDP, however, fell from 46.9% in 1969 to 25.5% in 1987. On the other hand, the share of the mining sectors, including oil and gas, increased from 12.3% in 1973 to about 19% by 1983. It subsequently declined again to 13.14% in 1987. The contribution of manufacturing industries to the GDP increased from 11.14% in 1983 to

13.97% in 1987. Figures for increases in other sectors are: trade 15.96%, public administration 8.53%, transport and communication 5.62%, construction 5.62%, banking and other financial institutions 5.56%, while services, electricity and water supply have contributed 3.1%, 4.0% and 0.83% respectively to the country's GDP.

The total gross domestic fixed investment at current market prices increased at an average of about 7.0% between 1984 and 1987 *(Indonesian Department of Information, 1989:78-80)*.

The economic policy of Indonesia is also directed towards a stable and consistent debt settlement. Repayment of foreign loans increased steadily from an average of 14.4% per annum within the Third Five-Year Development Plan to an average 25.8% per annum during the first four years of the Fourth Five-Year Development Plan.

1.2.2 THE TRANSMIGRATION POLICY

Indonesia is currently the fourth most populous country in the world.[▷3] The problem with this situation is that about 65% of people crowded together on only three of the more than 13,000 islands.

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3 ▷ *With the recent change of political structure in East Europe (i.e. the reformation of the USSR), the current population of Indonesia at 184.5 million [PRB, 1992], has brought the country to the fourth most populous in the world after China, India, and the USA.*

The explosive birth rate during the fifties and sixties caused a doubling of the population over the two decades. The latest census, which was held in 1980, recorded a population of 147,490,298, which is up from 119,208,229 in 1971 and from 97,085,348 in 1961. According to the inter-census population survey conducted in 1985, the population of Indonesia totaled 164,046,988. Over 60% of the population is concentrated on the island of Java which is only one fifteenth (6.89%) of the total land area of Indonesia. The local over-population gives rise to serious problems.

The rate of growth during the period of 1980-1985, was 2.15% or a little less than the rate of growth in the period of 1971-1980, which amounted to 2.32% per annum. It is estimated that during the Fourth PELITA the average rate of population growth was 2.1% per year. Most recently (1992), the estimated population growth of Indonesia is about 1.7% per year *(PRB, 1992)*.

The uneven distribution of population is reflected in an uneven population density -- despite that there is a long held body of opinion *(e.g. Fisher)* that the population distribution reflects the actual distribution of productive resources. In 1986, the population density of the island of Java and Madura was 774 people per sq. km., compared to Indonesia's average density of only 88 per sq. km. This makes Java one of the world's most densely populated areas.

Among the other islands, only Bali/NTB (Nusa Tenggara Barat) and Lampung with population density of 226 and 193 people per sq. km. respectively *(The World Bank, 1988:2)* ever approach that of Java. These figures may be compared to population densities of 72 in Sumatra, 51 in Sulawesi, 22 in Maluku, 15 in Kalimantan and 3 in Irian Jaya. The basic demographic data of Indonesia that illustrate the problem are presented in *Table 1-1* and *Figure 1-1* (Indonesia: general map of population distribution, 1985).

The Government policy with respect to population growth is aimed at lowering the birth rate and reducing the mortality rate, especially among infants and children. This policy is being implemented through family planning programs which also aim at improving mother and child welfare by creating what are called small "happy-and-prosperous" family units.

Another government policy with respect to population is the transmigration program. Incorporated in the national development plan, the transmigration plan attempts to overcome the unbalanced distribution of the population by resettlement. The program encourages families, especially, young couples in Java, Madura and Bali to resettle on less populated islands such as Sumatra, Kalimantan, Sulawesi, Maluku and Irian Jaya. This idea, however, has been criticized due to the fact in Java where population is growing by around 1 million people per year,

Table 1-1. Basic Demographic Data of Indonesia (as per 1984)

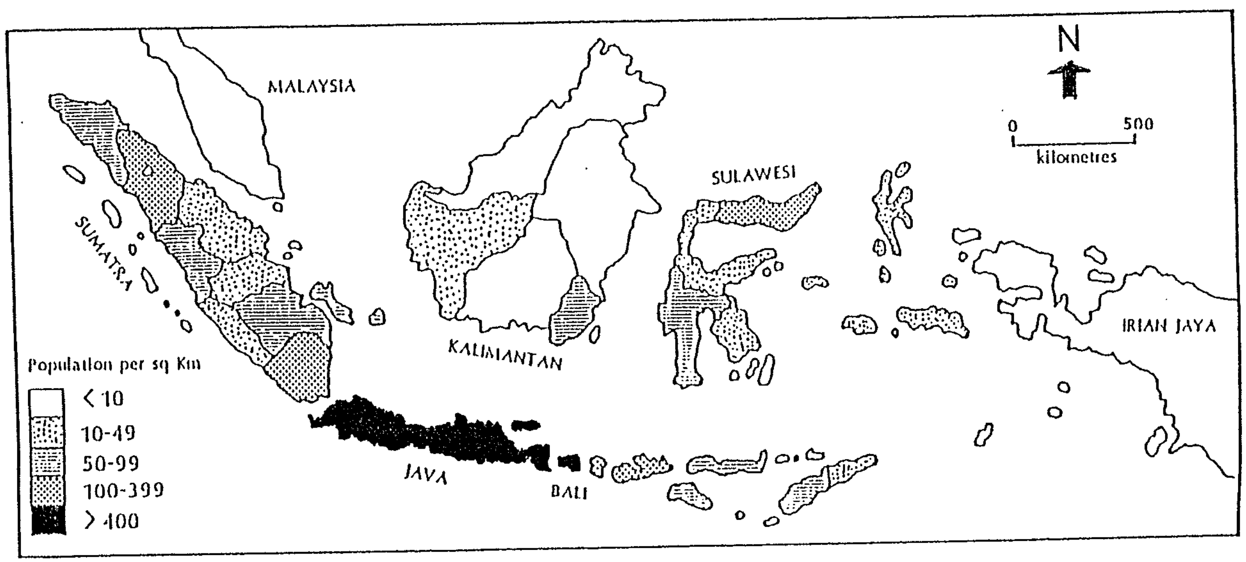
Province/Island	Est.1986 population (million)	Area ('000km^2)	Population% density Cap./km^2	Farm House hold ≤ 0.5 Ha (%)	>2 ha (%)
The Inner Islands					
Java/Madura	102.2	132	774	63	4
Bali/NTB □)	5.8	26	226	46	10
Total	108.0	158	685	62	4
The Outer Islands					
Sumatera	33.0	474	72	27	23
Kalimantan	8.0	540	15	19	39
Sulawesi ○)	13.5	264	51	25	40
Other Eastern Islands ▷)	4.1	60	68	-	-
Irian Jaya	1.4	422	3	-	-
Total	60.0	1,760	34	26	30
Grand Total	168.0	1,918	88	-	-

Notes:
○) *Includes the Maluku (Moluccas islands)*
▷) *Other eastern islands which have not been Transmigrant Receiving Areas.*
□) *NTB = "Nusa Tenggara Barat" (West Nusa Tenggara).*

Source: *Statistical Year Book of Indonesia, 1984, as quoted by the World Bank (1988), from the 1983's Agricultural Census.*

Figure 1.1

INDONESIA: GENERAL MAP OF POPULATION DENSITY



Source: Indonesian Statistic, 1985

transmigration is not going to have much of an impact on overall population distribution.

The concept is not new to Indonesia, having been started by the Dutch at the beginning of the century as a way of supplying cheap labor to the estates in Sumatra, while simultaneously relieving the population pressure in Java. In total, the Dutch Colonial Government managed to move about 144,000 families between 1905 and 1941 *(Swasono, 1985:82,* as quoted by *Tirtosudarmo, 1989: in Table 1.)*. Both the Dutch resettlement program *(the Colonization)* and the Indonesian policies in the *Transmigration* aimed essentially at demographic change.

After independence, the resettlement program was resumed by the government of Indonesia under a new name, the "Transmigration Program". After a number of experimental years, which increased experience in implementation, the transmigration program is now considered to be an integral part of the national development plan. A separate ministry, the Department of Transmigration is responsible for the execution and coordination of program activities.

Transmigration is now also seen as an instrument of rural community development. The focus, which originally was purely demographic, has shifted to broader socio-economic targets in that the transmigration projects are intended to sustain regional development, increase job opportunities, raise the people's standard of living and reaffirm national unity and integrity.

From the outset of the First PELITA 1969-70 up to the end of the third PELITA 1979-84, some 457,612 families were resettled: 39,511 families during the first PELITA; some 52,084 families during the second PELITA; and about 365,977 families during the third PELITA. Including the resettlement during the Dutch colonial period and the period before PELITA, an overall total of about 839,320 families or about 3,436,000 people were resettled between 1905 to 1986 *(Table 1-2.)*.

In recent years the resettlement effort has increased. Some 275 new villages were established under this program in the fiscal year of 1987-88 in order to accommodate about 134,411 transmigrant families. This achievement was possible because of various improvements made during the preceding period, both in technical provisions such as the construction of road networks, the surveying and allocation of land, and the construction of houses for transmigrants and other provisions such as development of public facilities (school, rural cooperative, bank, community buildings etc.) which are increasing from year to year.

Under the transmigration program of the Fifth PELITA, 550,000 families are scheduled to be resettled in the Outer Islands. For that purpose, 275 new settlements are expected to be prepared, each absorbing around 2,000

Table 1-2. Number of migrant families resettled under the Colonization and The Transmigration Program (1905-1986)□)

Period	Total Families Settled	Total People Settled	Remarks
1905-41*)	144,000	576,000**)	Colonization
1950-69■)	102,648	424,000	Pre-PELITA
1969-74■)	39,511	176,000	PELITA-1
1974-79■)	52,084	228,000	PELITA-2
1979-84■)	365,977	1,492,000	PELITA-3
1985-86○)	135,100	540,000**)	PELITA-4 (1st year)
Total	839,320	3,436,000	

Notes: □) *The figures vary widely in government publications due to different practice of counting the transmigrant by fiscal year.*
*) *Swasono, 1985:82 (in Tirtosudarmo, 1990: Table 1.)*
**) *Estimated at about 4 people per family.*
■) *The World Bank, 1988: xxi (Table 2.)*
○) *Ministry of Transmigration (Facts and Figures).*

families. Nevertheless, due to the most recent shift of economic policy of Indonesia with the decline of all prices in the late 1980's the transmigration program in recent year has been slightly winding down.

With improved transportation facilities as a whole, the flow of spontaneous transmigrants to the Outer Islands also increased markedly and has become a characteristic of the transmigration program that is likely to feature significantly in the future after the existing problems and constraints have been resolved.

1.3 THE PROFOUND NEEDS FOR INTERDISCIPLINARY STUDIES OF THE IRRIGATION-BASED TRANSMIGRATION RESETTLEMENT PROGRAM

Despite the very limited success of transmigration in easing population pressure in the Inner Islands, the program is still considered by the Indonesian Government to be an important development tool. It increases the labor force in the sparsely populated Outer Islands and it is considered to promote national security and integrity, thereby improving the welfare of Indonesian people as a whole. The program is therefore expected to be continued and it is important that errors of the past not be repeated.

Experience teaches that the implementation of transmigration project takes a long time, that it involves several disciplines and that it must take cultural as well as technical and economic factors into account. Solutions of the problems that have been experienced in the past can only come from a multi-disciplinary approach.

Earlier studies of the transmigration problems have been conducted mainly from the perspective of a particular discipline and as a result the conclusions were satisfactory only to special interest groups involved in the formulation of the implementation policy.

The present study aims at improving the implementation by an integration of all disciplines that should be involved in policy formulation. The main disciplines are Engineering particular Irrigation Engineering and Agricultural Engineering, Sociology, in particular Demography and Economics, in particular Agricultural Economics.

Five important topics will be addressed in the Thesis. They are:

(1) the human responses to the newly established irrigation-based transmigration project;

(2) the implementation experience with regards to the the assistance that was provided as compared to what was needed;

(3) the optimum sizing of land allocation from the view point of agricultural economics;

(4) the irrigation problems encountered in newly established agricultural areas, in particular; the larger water requirements;

(5) the socio-cultural, economic and demographic problems encountered in the adaptation of the transmigrant to new conditions.

Field information was obtained from two selected areas in Indonesia, the Way Rarem Irrigation Project in the province of Lampung, Southern Sumatra and the Luwu Irrigation Project in the Province of South Sulawesi.

CHAPTER TWO

REVIEW OF LITERATURE AND RESEARCH HYPOTHESES

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2.1 INTRODUCTION

The pertinent literature was reviewed for the purpose of bringing the concepts developed by other investigators and their experience to bear on the problems of irrigation-based transmigration. The review was also used in the formulation of research hypotheses to be examined in the thesis.

Three main subject areas relevant to the irrigation based transmigration problems are dealt with in the literature. The first is the general topic of migration and resettlement. The second concerns the subject of rural development, since this is an integral part of transmigration objectives. The third area is irrigation development as it pertains to small land holdings, which must be studied from a technical, an economic and a social point of view. The pertinent findings and their relevance to transmigration research are discussed in three separate sections.

In the final section of this chapter a number of research hypotheses to be addressed in the study are formulated.

2.2 MIGRATION AND RESETTLEMENT

2.2.1 GENERAL CONCEPTS

Migration theory was originally developed by E. G. Ravenstein in 1889, over a century ago *(Grigg, 1977:41-31)*. Following this initiative a number of important studies were conducted by *Dorothy Thomas (1930's)*, *Bogue* and *Hagood (1940's)*, *Otis Durant Duncan (1940's)*, and including the study conducted by *Stouffer, (1940)*. Since World War II, numerous additional studies on migration have been published in many parts of the world.

In many respects the basic theory of migration is still relevant for the Indonesian transmigration. For instance, *Ravenstein (1889)*, stated in his general conclusion that "the main causes of migration are economical". In his conclusion about migration towards the cities *Ravenstein* also considered it likely that the *"push"* factor, which was the increasing poverty in the country-side, was as important as the *"pull"* factor which was exerted by the higher wages in towns *(Grigg, 1977:42)*.

Migration is defined as:

> "....a permanent or semipermanent change of residence. No restriction is placed upon the resistance of the move or upon the voluntary or involuntary nature of the act and no distinction is made between external migration....... . However, not all kinds of spatial mobility are included in this definition. Excluded for example, are the continual movements of nomads and migratory workers, for whom there is no long-term residence, and temporary moves like those to the mountain for

the summer........ *(Lee, 1970:290)*"

Voluntary migration is often distinguished from semi-voluntary migration in terms of its processes, consequences and to some extent its geneses (*Oliver-Smith and Hansen, 1982: 2-4*). Involuntary migration is usually induced by natural hazards or is causally linked to ecological, social and or political circumstances.

According to *Petersen, (1958:257-260),* there are five categories of migration:

(1) primitive, resulting from ecological push, or natural forces;

(2) forced, in which the migration process is implemented in the sense that people are forced to move without having power to make choices;

(3) impelled, when people are coerced to move by the state, but still have power to make choices whether to move or not;

(4) free, in which the will of migrants is by decisive element; and

(5) mass, in which migration becomes an established social momentum.

In relation to the above categories, the Indonesia transmigration program is most likely to be a combination of the last three categories. Therefore, the term "*semi-voluntary*" migration is adopted in this research to refer to the transmigration movement.

The concept of resettlement is closely related to but distinct from the concept of migration. The following definitions are used for resettlement.

> (1) "Resettlement is the transfer of population from one area to another on a planned basis, the purpose being to raise living standard" *(Bridges, in Moore, 1979)*;
>
> (2) "Resettlement is the project involving the planned and the controlled transfer of population from one area to another" *(Belshaw, in Moore, 1979)*.

Both definitions involve the notion that resettlement is a form of planned social change that entails population movement, population selection and most likely, controlled change of way of life which may be in terms of sedentarization or villagization of farmers or cultivators.

2.2.2 REASONS FOR MIGRATION AND RESETTLEMENT

The purpose of a resettlement program is in most cases the establishment of a more habitable area for people in terms of an individuals' total physical, biotic and social environment. Experiments show that through proper planning, timing and proper techniques, it is possible to develop a more habitable area and to increase per capita income without depleting local resources such as soil fertility. In the African experience however, problems were faced because the planners had overemphasized the tangible benefits or the material aspects of growth as opposed to the development of more habitable areas from a human point of view *(Brokensha, 1970)*. In essence the planners eventually forgot the people that were undergoing the relocation or resettlement.

Population resettlement under the Transmigration Program has long been practised in Indonesia. The movement has been partly "voluntary", in that many transmigrants moved on their own decision. In part the movement must be termed "semi-voluntary", since many were to a degree impelled to move. Semi-voluntary resettlement usually results from unavoidable government decisions following the development of compelling circumstances such as: (1) natural disaster, (2) a threat to national security, (3) the threat of volcanic eruption, (4) environmental degradation, (5) the pressure of urban development, and (6) loss of arable or inhabitable land as a result of engineering projects.

According to *Oliver-Smith*, a number of resettlement experiences have indicated that although the places and people differ culturally and geographically, and the cause of resettlement varies, there is a clear indication that similar concerns, processes, and human responses are often involved *(Oliver-Smith and Hansen, 1982:1-5)*.

Government policy on population resettlement, for instance, is always associated with the administrative authority over people residing in the region they administer. Governments have the power to instruct or to relocate people when necessity arises. According to *Chambers (1969)*, when government policy on resettlement reflects political ideology rather than the population's way of life, then the settlers tend to view the program as involuntary. There are several factors which influence the decision to migrate: the conditions in the area of origin, as compared to the conditions in the area of destination, personal circumstances, and external factors that may stand in the way or that may favor migration. The decision to stay or to migrate, always entails uncertainty and risk, since there are advantages and disadvantages either way. This uncertainty is an important factor to consider. As was pointed out by *Lee (1966:51-57)*, people are instinctively reluctant to trade an old familiar environment for an uncertain destination.

2.2.3 RESETTLEMENT IN ESTABLISHED COMMUNITIES

The living space still available for resettlement is continually being reduced by the frequent population displacement that arises from natural disasters or regional conflicts. There are, therefore, fewer and fewer areas that are suitable for accommodating future resettlement programs. One way of solving this problem is by attaching settlers to existing communities. This approach, however, requires careful consideration before actual implementation. Rogge (1981) suggests that the following points should be taken into consideration: (1) the need for a basic level of ethnic compatibility; (2) sufficient availability of land to provide economic opportunities for the settlers; (3) a sufficient water supply; (4) the commitment of local authorities to support the resettlement program; (5) the establishment of a resettlement approach that is targeted to the entire area rather than only to the specific group of settlers; and (6) the relative size of the displaced community vis-a-vis the local community *(Rogge, 1981:200-206)*.

2.2.4 RESETTLEMENT PLANNING AND STRATEGIES

Past experience with resettlement demonstrates that planning is the prime factor in determining the failure or the success of a resettlement project. An interdisciplinary orientation and approach is called for since modern strategies for human resettlement must cope with complex phenomena *(Mangalam, 1968:3-5)*. Thus proper attention must be given to (1) physical environment of the resettlement area as compared with the place of origin, in particular the physical infra-structure, the roads, the public facilities, schools, markets and so on; (2) social development of the new area, the development of new institutions and the encouragement of new attitudes, the provision of teachers, of medical aid, of agricultural extension and of technical guidance; and (3) the implementation of moving the people, the immediate adaptation, and the reception, and (4) the measures that are taken to maintain a socio-ecological balance and to promote the complete adaptation of the settlers to their new surroundings.

The technology for the planning of human resettlement has often in the past been hampered by the tendency of technical and economic planners, as well as the political leaders, to overlook, underestimate or even ignore the socio-cultural and social costs of resettlement *(Chambers, 1969)*. Understanding the way of life of both the settlers and the local people is crucial in all human resettlement planning. Equally important is a study of the degree to which the settlers can be expected to adapt to the new conditions and the time this may take. Every planner must realize that the implementation of human resettlement is always accompanied by conflicting interests in people's lives. In the initial stages there is usually a sacrifice in culture, in convenience, in human rights and in economic advantage.

People tend to resist change and adhere to familiar ways when it comes to environment, tradition and culture. Yet, resettlement requires them to change to a greater or lesser degree. What motivates them to change can be either a "push" or a "pull" factor. It is important for the planner to identify the factors that could turn out to be either push or pull factors. For successful resettlement adaptation, the motivation by "push" factor, must be minimized or avoided altogether.

In practice, development of a well planned implementation strategy is often hampered by the fact that accurate data pertaining to population structures, social organization, values, and required resources have not been obtained from existing projects. As a result planners often take earlier assumptions for granted although these may, in fact, be invalid.

Collecting proper data and applying the information to new projects will increase the time required for the planners. On the other hand, *Brokensha (1970:24)* pointed out that resettlement implementation should always consider the urgency to resettle people as soon as possible.

2.2.5 RESETTLEMENT IMPLEMENTATION

It is evident from the literature that successful implementation of resettlement implementation requires proper preparation. This involves: policy formulation, decision making, establishing channels of authority, and recruiting capable staff for organizing and actuating the settlement policy on a consistent basis. Recruitment of personnel who are capable of planning and executing the resettlement is the most immediate concern. Many resettlements in the past were less than successful in their implementation because of a failure to recruit capable, mature and experienced staff *(Oliver-Smith and Hansen, 1982, du Toit, 1982, Chambers, 1970:228)*.

By its interdisciplinary nature the resettlement implementation requires sophisticated inter-agency coordination. This relationship between authorities must include a consultative mechanism in the form of an overall advisory body to control the process and to ensure a clear working responsibility in the bureaucratic structure.

It is important in the implementation stage to establish and maintain reliable channels of communication and consultation between the settlers and the authorities, because a lack of communication, even in minor matters, may jeopardize the entire project. It is vitally important to inform the people about the overall government resettlement plan, the provision of land and other facilities, and other relevant arrangements, prior to the start of the actual implementation. In addition, the success of moving people to a new destination with a minimum of distress depends in a large measure on the coordination of the physical move and on the degree and the quality of the communication and the contacts previously established between the settlers and the resettlement agencies.

It is also important to maintain a proper balance in the provision of assistance to settlers. Assistance continuously provided over an extended period may cause settlers to develop an attitude of dependency on the government. Local initiatives may then decline and future resettlement projects have difficulty in encouraging participation and self-reliance from the people.

Implementation problems are often associated with land allocation and siting, land clearing and preparation, house allocation, water supply and distance to agricultural land. It has also been noticed that in the initial stage most agriculturally based resettlements are hampered by adverse environmental impacts, crop losses or crop failures in the early years, overfarming, lack of firewood, and a general deterioration of the land due to poor agricultural practices *(Moore, 1979, McCall, 1982:128)*.

Resettlement schemes frequently increase the pressure on the natural resources. This has, in the past, caused severe environmental problems if the schemes were not implemented properly. Moreover, diseases like dysentery and measles sometimes spread quickly in the suddenly concentrated population *(Fernea, 1966: P.350)*. It is therefore necessary to pay special attention to maintaining a healthy and balanced habitat while working on the physical implementation of resettlements. In addition, the development of a suitable habitat must be compatible with two important social goals: (1) the building of the new settlements as suitable social systems, and (2) the building of suitable houses for individual families.

The size of the housing plots and the dwellings should also be planned to meet the needs of the settlers' growing families by taking into account the immediate requirements of the first and the second generation of settlers *(Drabek, 1986:215-247)*. It also is essential for the success of resettlement schemes to ensure the provision of the social infrastructure, including schools and health services.

2.2.6 SOCIAL CONSEQUENCES OF RESETTLEMENT

Resettlement, for whatever reasons, is always a socio-cultural and economic process that happens first to people rather than to their physical environment. This feature requires an understanding of the sociological nature of the process and the consequences which are required to maintain a desirable social cohesion. By its nature, human resettlement is always an extraordinarily disruptive and painful process, socially, culturally, and economically.

There are a large number of social consequences that should be considered before any attempt is made to implement a resettlement program. These are: disorganizing of traditional settlement, dispersal of kin, changing alliances, attempts to maintain old associations, family crises, material losses, loss of ritual security, and need to adapt. It is necessary, therefore, to prevent as much as possible the introduction of a radically new or foreign social system in the resettlement implementation.

2.2.7 NECESSITY FOR RESEARCH AND EVALUATION

For proper "environmental" or sociological management of a resettlement project, the maintenance of a balanced ratio between the incoming and the host population is necessary to insure a balanced population density. In addition, the impact of resettlement on social and environmental aspects, as well as the settlers' adaptation to the resettlement need to be monitored, to evaluate, to improve and to solve underlying problems.

An overall evaluation of the resettlement is important to ascertain that the program is conducted in accordance with the original plan. In this way, lessons can be learned for future improvements and prospective resettlement schemes can take advantage of previous experience so that mistakes of the past are not repeated.

An evaluation of African resettlement schemes *(Chambers, 1970:268)*, shows that individual small holder schemes are more effective than compulsory marketing schemes or scheduled production and communal economy schemes. Politically simple schemes appear generally preferable to more complex schemes also. Complex schemes tend to create rather than resolve political and socio-economic problems.

Social scientists still know relatively little about how people behave under different types of resettlement. Relocation usually results in multi-dimensional stress which is psychological, physiological and socio-cultural *(Oliver-Smith and Hansen, 1982:269-270)*. This stress can only be understood through research, by comparing theory and practice in the attempt to identify the most effective strategy of coping with the problems of resettlement that are related to human behavior under conditions of stress caused by social and cultural change.

2.2.8 RESETTLEMENT TRANSITION AND ADAPTATION

Resettlement strategy attempts to achieve that the settlers reach a self-sustainable stage within the shortest possible transition time. One problem in this objective is that this transition time is not the same for everyone. Another problem is that there is not a single set of criteria that is suitable for judging whether the transition stage has ended. The adaptation process is multifaceted and differs significantly from person to person and from scheme to scheme. Oliver-Smith and Hansen has tried to develop a rough set of indicators that would help to determine when the majority of settlers have adapted to the new resettlement area:

> ....In terms of activities, the turning point comes when the majority have regained at least

> their former standard of living and degree of self sufficiency. People supported by food relief or welfare are obviously still in the transition stage, no matter how long they have been living on the new site. In terms of initiative, the turning point is when the conservative stance and closed-system behavior are replaced by at least a pre-relocation degree of risk taking..... *(1982:280)*.

The above indicators are related to economic activity and initiative. Another indicator, mentioned by Oliver-Smith and Hansen, is that the settlers have adapted when the majority of them feel at home at the new habitat, in both the physical and biotic environments. Oliver-Smith and Hansen admit that "feeling at home" is an amorphous concept, but it can still be assessed in a number of ways. For instance, the emergence of local leaders that look after local and new settlers' interest is one measure, while familiarity with the landscape and the production techniques for gaining a living are further measures. The re-establishment of household and community rituals are especially important since this indicates a symbolic affirmation of the integration within the new environment and community formation. Other form of symbolic behavior such as house decorations, gardens, household animals, and other evidence of re-established identity in the form of language, dance and so on may be evident in this stage.

As a rule, the transition stage will last more than two years, but this depends on the socio-cultural background and the nature of the resettlement processes. In exceptional cases it may last longer than one generation. Oliver-Smith and Hansen *(1982:281)* mention an extreme case in Peru where the transition period continued as long as seventy-nine years after resettlement. This delay was partly due to difficulties with the resettlement scheme in creating an appropriate physical and biotic environment. It was also due in part to the inability of the settlers to regain their former standard of living on a sustainable basis.

Regarding the settlers' adaptation, Sorbo *(1972:22-28)*, in his study of Kashm El Girba, Sudan addressed the problem of irrationality, which he investigated, from an anthropological perspective, but also using economic criteria. The settler's adaptation was difficult to measure using socio-cultural indicators. The reason is that the value judgments of the settlers are based on their traditional culture. The traditional beliefs and values are often irrational, superstitious and employ a mystical rather than a logical way of thinking. On the other hand, adaptation criteria that stem from a modern culture tend to take the merit of rationality, equality, economic planning etc. for granted. The measurement of the socio-cultural adaptation that is used may therefore be irrelevant in judging the success of the resettlement process from the perspective of the settlers themselves.

The evaluation approach often fails also because planners easily become cultural imperialist, who are unwilling or unable to understand the traditional society. Thus a gap is created between planners and the settlers they plan for.

Sorbo also concluded that economic mal-adaptations to resettlement schemes are closely related to agricultural problems that were not expected by the settlers. These prevented them from securing a stable income from their farm land and this turned out to be the main barrier to adaptation.

2.2.9 PROBLEMS OF HUMAN RESETTLEMENT

There is a large variety of problems and constraints that accompany human resettlement, ranging from social, economic and cultural to political. For one thing, many schemes in the past failed because of over-ambitious planning that was too difficult to implement.

From experiences at the Mwea Irrigation Resettlement Schemes in Kenya and the Volta River Resettlement in Ghana, *Chambers (1970)* identified many problems. Resettlement was hampered by the neglect of important factors in planning, such as the problem of departmentalism and associated inter-departmental friction, as well as organizational conflicts. The administrative problems are accentuated when the project planning involves heavy administrative staffing. A very significant factor is the dilemma between the technical aspects, which require time for careful planning and the socio-political considerations which demand immediate implementation.

Other significant problems are caused by the absence of security of land tenure *(Reining, 1966:207)*. This is often the result of unclear demarcation of land plots immediately upon arrival. Failure to clearly and definitively assign individual plots, creates the fear that the host population will usurp the right to cultivate after the land has been broken by the settlers. Without land security and legal ownership assurance, settlers live in uncertainty and fear because the land is their only asset that guarantees their livelihood at the new location.

In planning, as well as implementation of resettlement, any indentified problems or potential problems with inappropriate motivation, reluctancy, apathy, and/or dependency attitudes, need to be identified and solved immediately. This step requires an implementing organization with qualified and highly motivated personnel who maintain effective inter-agency working relationships amongst the relevant institutions that are in charge of the resettlement.

Previous experience suggests that there is no single way of effectively implementing resettlement because of the wide variation of political and administrative policies involved. Resettlement programs are a formidable task, even under the most favorable conditions. However, a number of common features exist. Most implementing agencies tend to underestimate the potential of populations undergoing resettlement, just as they often have underestimated the difficulties involved in preparing new areas for large numbers of people.

2.3 POPULATION RESETTLEMENT AND RURAL DEVELOPMENT CONCEPT

Human resettlement in association with rural development, has frequently been in the form of agricultural development of small land holder schemes. Thus one can find a wide range of models for agricultural development schemes that are, or were, part of rural development programs. Most of these programs required a rearrangement of traditional rural economies. Some also included the physical relocation of people through resettlement programs. Most often the problems of resettlement under such situations were associated with goals of modifying or reconditioning traditional economies and ways of life.

2.3.1 CONCEPTUAL DEFINITION AND APPROACH

There are several definitions that have been formulated by the scholars in an attempt to standardize what is understood as the term "rural development". Among those scholars, Poostchi is prominent:

> ....Rural development has been defined as a process of endless variety having as its main objective the overall balanced and proportionate well-being of rural people. How it works, and the shape it takes, is determined and influenced by many factors in the rural areas of the country. Factors such as the stage of economic development of the country, the humanitarian attitude of its people; the sincerity, skill, wisdom and all-round knowledge of its planners, administrators, and implementers at all levels; the relevant educational institutions; the extent to which its citizens are informed, consulted and encouraged to participate; and other factors of varying importance at the local, village, area, regional and national levels, all affect its direction, its magnitude, its success and also its failure *(Poostchi, 1986:1)*.

Poostchi further explains:

> .....that the development is a complicated pattern of economic, social and political change that takes place in a community or a society as it changes from traditional status. The transformation to modern status includes social and political consciousness, division of labor, literacy, urbanization, industrialization and a broad general participation in the overall development activities at national, regional, local and village levels *Poostchi, (1986:1)*

UNESCO *(1986:2)* states that the goal of development is to develop human beings, not to develop things. It states further that the ramifications of this approach are that, "development must be aimed at the spiritual, moral and material advancement of the whole human being, both as a member of society as an entirety and from the point of view of individual achievement".

Since the transmigration program is in large part a rural development program, it must concern itself with the well-being of rural people in spiritual, moral and material terms. Because of the focus of this study, the rural development problems will be examined only in so far as they are relevant to the establishment of a new living environment (in terms of physical, moral, and spiritual advancement of settlers) in the irrigation-based transmigration areas.

A. Assessment Indicators for Rural Development:

In the study of rural development, it is essential to understand the major indicators that could help to identify any problems with the development. There are several commonly used indicators for this purpose:

- change in agricultural productivity, which is usually expressed in yield per hectare,
- changes in employment opportunity, either in terms of unemployment or underemployment,
- changes in the income distribution, wealth, facilities, and other amenities,
- changes in the socio-political structure as measured by the influence rural people have in decision making at the village, the regional and the national levels,
- changes in social mobility in the rural community which

relates to the extent to which individual achievement is reflected in the distribution of position, power, status and prestige, and

o change in the attitude, values and beliefs of the people in terms of their willingness to adopt modern and new societal values.

B. Changes in Development Policy

The discussion of rural development, especially in the developing world, began in the 25-year period after World War II *(Galbraith, 1989:23-25)* when considered rural development followed independence and the implementation of economic planning policies for the newly independent countries. During the 1960's the subject attracted the attention of many scholars and agencies, private, governmental as well as international. Most studies concluded that rural development that was aimed solely at economic development had failed. In fact, Galbraith pointed to evidence that the socio-economic conditions of millions of poor and jobless people in the rural developing countries had not only failed to improve, but had actually deteriorated substantially *(Galbraith, 1978:Ch.2)*.

Early in the 1970's, a new approach to rural development, was introduced *(Galbraith, 1978:Ch.2)*. This approach focused on socio-economic development and has been widely accepted by both international and national development agencies. Its principal objectives are not only the encouragement of rapid and sustainable economic growth, but also a reduction in unemployment and rural poverty, as well as encouraging rural people to participate in the development process through a systematic approach aimed at attaining self reliance.

It is of interest to observe that in the Third United Nations Development Decade (1980-1990), the elements of full participation of the rural people, proper distribution of the fruits of development, and the promotion of human dignity are as strongly emphasized as the other components of socio-economic advancement in the developing countries *(Poostchi, 1986:3)*.

C. Current Approaches to Rural Development

There are two main current approaches to rural development. The first one is called "Extended Rural Development" and refers to a series of coordinated and comprehensive efforts to improve rural welfare through improvement of agricultural productivity by a modification of central and local activities. In order to succeed this approach depends on a high degree on participation and organization at the local level, in addition to the service and policies of the central government. The reason why local participation is vitally important is that it is one of the most reliable means of dealing with the problems of scale, resource scarcity, and more importantly, the adaptation of development efforts to local situations and conditions. It also requires that the utilization of the available resources be intensified.

The second approach to rural development is "Integrated Rural Development". This approach focuses both attention and resources on predetermined groups and regions. The resource allocation, provision of goods, services, and information is most often implemented by a top-down delivery rather than on the basis of recipient response, which would be the bottom-up approach. The disadvantage of this approach is that it can discourage local participation if it is not implemented carefully.

In principle, the integrated rural development approach makes a special effort to pursue involvement of all rural people as much as possible in all phases of rural life. This process is undertaken by trying to move, to the extent necessary, traditionally and conventionally oriented rural cultures toward the adoption and acceptance of science and technology in order to support the development endeavors.

D. Rural Areas and Villages

In a study of rural development the terms rural area and rural village should be clearly defined. So far, however, no clear-cut definitions for rural areas or villages have found wide acceptance *(Hudson, 1977)*.

The phrase rural area is used here to refer to a geographical area away from large urban settlements and it includes towns which are inhabited by rural people. The term "village" will not be used since word village in some developing countries connotes much that is contemptible: ignorance, disease, filth, dirt, crude industries, poverty, unsanitary conditions and so on.

E. Rural Communities

In general, people in rural communities differ from people in urban societies in their family composition, kinship and family structures. Rural families are larger and more extended compared to urban families. Rural people and rural communities also give higher priority to the family as the most important social and organizational institution. For most rural people, the cultural norms for the significant events in life are rooted in the family. This deep sentiment not only exists within the family but exercises its influence also within the ethnic community, clan or other traditional rural grouping.

In traditional agricultural societies, there is usually a considerable resistance to change and innovation, to new technology, ideas and to the use of improved practices. This is often accompanied by a fear of innovative, resourceful, ambitious persons, as well as a fear of people with a different societal background. This fear may originate from a traditional belief that the total sum of wealth is fixed and that an individual can become rich only at the expenses of other members of the community who are then deprived of the common wealth or exploited in one way or another.

2.3.2 PARTICIPATION IN THE IMPLEMENTATION

One of the most important international issues associated with rural development is that rural development in the developing countries must be implemented with greater equity with regard to the distribution of its fruits in the form of physical and social resources, and services *(Chambers, 1983)*. In order to achieve this equity, universal participation of all segments of the rural communities, especially women, must be secured in decision making and in the implementation of rural development projects. It is well known that that unless rural people are involved through their own organizations, they will not take full advantage of the technology, resources and know-how offered, nor will the goods and services produced be equitably distributed.

At the national as well as the international level, several points regarding the implementation of the programs deserve special attention:

o each developing country, and each province or region within such a country, must plan its own approach and implement its own policies for rural development;

- the direction and flow of authority must be based on an understanding of the goals and on cooperation with government agencies rather than on a politically and administratively directed mobilization of resources;
- rural development policies, project feasibility studies and specific research should be based on existing needs. For example, research is needed for agricultural technology that can increase the per-hectare production of crops and animal products, but also to develop alternative employment opportunities besides agriculture.

In all developing countries, agriculture is an integral part of rural life. In Indonesia, as in an other countries, the large population growth that started several decades ago presents special problems for there comes a time when the ratio of non-productive members of the family (children and old people) to the adult productive members will be very high. The productive adult must then work harder to produce more food in order to survive. The possibility then exists that members of the family will consume all their produce, leaving no surplus to be sold. If this situation is predominant all over the country, then there is literally no surplus. Under a condition where all gains are being consumed, national and rural economic development becomes impossible unless outside capital is made available.

Where outside capital has been invested in agriculture, food production may increase without a corresponding need for a larger work force. Should such development cause a surplus of labor in the rural areas then this surplus will migrate to the towns. However, no matter which outcome occurs, at the rural level increased food production is needed to create the surplus that is needed for continuing agricultural and national development.

2.3.3 SELECTION OF THE SETTLERS

In resettlement, people are moved from their traditional homesteads to government sponsored development projects in new areas. One important question in this process is which people are selected for relocation. Often the resettlement is the inevitable results of projects such as the construction of a reservoir, the creation of a man-made lake. People then are forced to resettle because they happen to be where they are not wanted; the resettlement is then not for the purpose of improving their economic position.

However, this is not always the case. Chambers (1969) notes that for rural development purposes, efforts were made in several African countries to modify the village settlement approach by voluntarily deciding to farm cooperatively. This entailed a voluntary moving of the homesteads into a concentrated area so as to facilitate the new economic arrangement.

In a similar vein, Smock *(1972:245)*believes that resettlement may be required to achieve a more rational utilization of land. The resettlement would lead to a farm arrangement that is:

- economically attractive to the settlers;
- successfully integrated in the hope that the community will remain unified;
- in the interests of both landowners and settlers for having secure land tenure arrangements; and
- encouraging social, economic and geographic integration.

An important example of sociologically based success in a resettlement process is integrated settlement in the Egyptian Nubian resettlement project. This project provided the people with the opportunity to visit friends and relatives, who had previously been separated by miles of desert and water. This opportunity resulted in an expansion of the range of day-to-day social interactions which helped to unify the newly established communities *(Fernea, 1966:352)*.

According to Chambers *(1986:352,* is is important that this type of organized voluntary settlement should be based on the simplest type of implementation. The simpler approaches, he says, are relatively undemanding of scarce administrative and technical capacity and are implemented over shorter periods involving lower risk and lower commitment. Schemes with individual land holdings exploit the desire to own property, creating individual incentives that make labor more productive.

Lewis *(1954:4)* believes that for agricultural-based resettlement project the settlers should at least consider the following criteria:

o no person should be accepted until his record as an agriculturist has been checked and found satisfactory; this is not always easy;

o persons with a similar social background should be chosen, if possible they should have the same language, be from the same tribe, religion, group of villages and so on, thus, reducing sources of social tension; and

o only settlers who have some capital of their own should be selected.

Care in the selection of people is of immense importance for the success of a scheme. It has been claimed that the selection of the settlers and their recruitment is the single most important decision of settlement authorities *(Christopoulu, 1965, in Morris, 1968:85)*.

In Tanzania, Morris *(1968:85)* stated that the original recruitment goals were:

o to have had farming experience;

o to be committed to farming as a profession;

o to be receptive to new ideas and methods;

o to be willing to do hard work;

- to be married and have children;
- to have already been in contact with a money economy;
- to be willing to live in a community; and
- to be be between 25 and 40 years of age.

Age and sex are important in determining attitudes toward resettlement. For example, in the case of the New Nubia the younger people tended to be the most optimistic about relocation. They looked forward to a more exiting life and a broader range of economic and social opportunities whereas the older people were less optimistic. Women anticipated speedy marriages or, if married, anticipated more frequent reunion with their husbands in order to be able to feel a more exciting life *(Fernea, 1966:350)*.

In pre-war Indonesia, a method that proved to be successful was to move people into resettlement areas before harvest time through "pre-resettlement adaptation". The new settlers were attached to the established settlers and helped with the harvest in return for wages. The money thus earned, plus the experience and friendship proved invaluable when the settlers started their own farms the following season *(Lewis, 1954:5)*.

At times people are forced to move in a situation that does not permit any selection of the participants. This was the case in the Volta resettlement *(Lawson, 1968* and *Rogge 1979:2)*. This project had a high rate of desertion, and a few cases of total abandonment of the settlement villages. The much lower rate of desertion from the lake Kainji resettlement villages has been, at least in part, attributed to the much more localized nature of the resettlement undertaking *(Mabogunje, 1973* in *Rogge, 1987:2)*.

Problems also occurred at Kariba and Aswan, where the huge development projects necessitated large scale resettlement of people. These requirements were hampered by a variety of problems such as a devastating drought, serious problems of adaptation, and considerable desertion or absenteeism. Careful planning is needed to make rural development and settlement schemes less subject to frustrations and difficulties, and to improve the process of rural development *(Rogge, 1979:2-3)*.

2.3.4 LAND DISTRIBUTION PATTERNS, TENURE AND CONTROL SYSTEMS

A large volume of literature on land distribution patterns, property rights and control systems emphasizes the interaction between population growth and agricultural output *(Booth, 1988:20)*. Other literature emphasizes the impact of population growth on the changing structure of land ownership. Booth suggests that the size of the land holding, the distribution, and the status of ownership are vitally important for efficient water management and productivity.

An agrarian economist suggests that a reduction in the average size of land holding does not necessarily lead to greater equity since it may be accompanied by growing inequalities in the distribution of the land holdings. Poostchi *(1986:114-115)* believes that one possible means of maintaining equity in the distribution of land holdings is by introducing land reform programs.

Land reform in the framework of national or rural development can serve both as an instrument for the redistribution of wealth and as a means of achieving increased productivity.

Experience with land reform in many developing countries indicates that land distribution by itself without increased productivity, will achieve only modest and temporary benefits. However, land reform enhances the opportunity for increased productivity as a more equitable distribution creates new incentives for increased labor and investment.

A. Size of the Holding and System of Control

There are many variations in size of land holdings between developing countries. In Latin America, the size of land holdings varies enormously and distribution of income is quite uneven. In Asia and the Middle East, an unbalanced land distribution is reflected in landlord-tenant problems even in areas where the population is more evenly distributed, but where the right of access to land is restricted *(Framji and Mahajan, 1969)*.

The land distribution systems and the system of land control in developing countries may be classified into six types. These types are not peculiar to any particular country since it is possible to find examples of different types in a single country. Of the six types, three are traditional forms and three are modern. They are: (1) the feudalistic landlord and tenant system which is found in some Asian countries; (2) the feudal Latin American system consisting of large farms; (3) the communal land ownership of many tribal groups found in Africa; (4) private land ownership; (5) collective or state ownership as in the former USSR; and (6) plantations or ranches *(Boss and Nugtern, 1974)*.

The pattern of land ownership in different parts of the world is the result of complex factors. These factors are related to: (1) the political system and ideology of the country; (2) the demographic situation in the country; (3) the general social system; (4) the state of the economy; (5) the available national resources and their potential for development; and (6) the agriculture and the supply food production *(Framji and Mahajan, 1969)*.

B. Land Tenure

Land tenure is a complex system of relationships between man and land. The rights and obligations of landlords and tenants in a tenure arrangement differ according to the status of the parties. Numerous categories can be distinguished: landlords, owner-farmers, part-owners, part-tenants, tenants, share-croppers, farm laborers, farm managers, intermediaries (rent collectors) and so on.

Basically, tenure systems aim at the efficient use of human and physical resources, land, labor and capital, that are engaged in the production of food and other farm commodities. In addition, tenure systems are intended to promote stability in agricultural productivity. By the same token, inadequate tenure systems contribute to economic decline and hardship. High rent, high taxes and rigid tenure arrangements may reduce a tenant's capability to compete in the market and may force him to sell at a loss, which further depresses prices.

C. Land Settlement

Land settlement is generally defined as the planned, organized or spontaneous movement of people to areas of under-utilized agricultural potential. It includes the development of completely virgin land. This definition includes the settlement of shifting cultivators and nomadic herdsmen. It requires in general an improved system of food production and the establishment of the necessary infrastructure such as roads, marketing facilities etc. According to Mabogunye, when planned settlement is the objective, it implies that an organization of an administrative body controls the movements and provides, in varying degrees, assistance to the settlers assistance *(mabogunye, 1973:25)*.

The aim and purpose of settlements in different countries are: (1) to create employment and thus generate equitable income and welfare for all settlers; (2) to create the atmosphere and conditions required for the implementation and maintenance of social justice; (3) to ensure that efficient and permanent productivity is attained in agriculture and other natural resources in the area covered by the resettlement project.

Approaches to organized settlement in rural areas vary widely. According to Galtung *(1978)* they range from efficient development of natural resources in a project area by means of highly organized, relatively capital-intensive projects, to simple low cost projects which are intended to create employment for more people.

The strategy of settling people in a new area depends on the objectives. When the main objective is efficient and speedy development of an area's natural resources, then capital-intensive development and production technology may be used to ensure high yields in as short a time as possible. With this approach, production efficiency and attractive financial returns are the main objectives; employment creation and human resource development are secondary. When the main objectives are socially oriented and center on job creation and a more balanced income distribution, then the pace of the development may be much slower. With this approach the settlers are usually given a much greater part in the decision-making process and in the implementation. Cash input and yield per hectare can be expected to be lower. However, agricultural and social support services provided by the authorities are usually minimal and may even be inadequate, while the public sector cost per settled family or beneficiary is also relatively low.

2.4 IRRIGATION DEVELOPMENT FOR SMALL HOLDERS

2.4.1 DEFINITIONS

In many parts of the world, irrigation is an ancient art; in others it is considered to be a modern technology of survival. The *Encyclopedia Britannica (1981)* defines irrigation simply as:

> Irrigation is the artificial application of water to the land *(Volume 9:899)*.

The *Encyclopedia of Science and technology (1977)* is somewhat more elaborate when it stated that irrigation is:

> ..... the artificial application of water to the soil to produce plant growth. Irrigation also cools the soil and atmosphere, making the environment favorable for plant growth *(vol-7)*.

A third definition is given by *Clark (1970:1)*:

> .... the application of water, by human agency, to assist the growth of crops and grass. In general the word does not cover the other objects for which man stores and controls the flow, that is to say, for household and industrial water supplies,......

A fourth more comprehensive and technical definition of irrigation by *Israelsen and Hansen (1962:4)* reads as folllows:

> ......the application of water to soil for the purpose of supplying the moisture essential for plant growth..... However, a broader and more inclusive definition is that irrigation is the application of water to the soil for any number of the following six purposes; (a) to add water to soil to supply the moisture essential for plant growth, (b) to provide crop insurance against short duration droughts, (c) to cool the soil and atmosphere, thereby making more favorable environment for plant growth, (d) to wash out dilute salt in the soil, (e) to reduce the hazard of soil piping, and (f) to soften tillage pans.

In principle, irrigation may be accomplished by four different means: (1) flooding, (2) furrow irrigation, (3) sub-surface irrigation, and (4) sprinkling. The present study deals with small-scale agricultural land-holdings which are flooded to produce low-land paddy rice as the major crop in order to support human resettlement programs.

2.4.2 THE NEED FOR BETTER IRRIGATION MANAGEMENT

The history of irrigation in the last forty years exhibits dramatic changes. Soon after World War II, there was a vast expansion of irrigated areas in many parts of the world, especially in developing countries which were faced with exploding population and were attempting to stave off food shortages.

During this period of expansion, much new technology became available. In the developing countries, however, irrigation remained largely as traditionally practiced from generation to generation. Moreover, when modern technological advances were adapted, the new technology was not always appropriate. This brought about a new set of difficulties in the operation and maintenance of the irrigation systems.

There are several reasons why the management of irrigation has become increasingly more complex. First, the pressure for increased agricultural productivity leads to increased cropping intensities and the desire to obtain higher yields; this increases the water demand both in terms of quantity and dependability. Secondly, technological developments in agriculture have resulted in new high yielding crop varieties which demand more water and better control over the timing of delivery. Thirdly, there is an increased demand for irrigation of agricultural lands to meet the increased demands for food by a rapidly growing population *(Rydzewski, 1977)*.

2.4.3 CONSTRAINTS ON THE IMPLEMENTATION OF BETTER IRRIGATION MANAGEMENT

There are considerable variations in the way in which irrigated rice culture can be practiced. However, most systems have similar features, namely:

- irrigation application in the form of flood irrigation with a continuous flow of water distributed from plot to plot within the paddy field bounded by low dykes;
- water deliveries take place through minimum control structures;
- water deliveries during the wet seasons when there is an abundance of rain water, are not properly controlled, while in the dry seasons, paddy crops often suffer from insufficient water;
- during the rainy season rice is grown exclusively despite the fact that other cash crops may command a high income potential; and
- during the dry season rice culture is farmed if, and in so far as, water is available. Only when water is not sufficient for rice culture are other crops grown *(Rangeley, in Rydzewski: 1989:22-23)*.

Rice cultivation in Asia has a long history that can be traced back to ancient human civilizations. The fact that the same rice cropping methods have been practiced from generation to generation makes it very difficult to institute changes even if such changes are needed to adjust to contemporary agricultural demands and policies. Efforts were made in Southern India, for example, to make use of new water management methods through the introduction of *"Warabandi"* farmers' association. These were unsuccessful because of difficulties of the traditional farmers to adjust to the new water management practice. The traditional irrigated rice culture in South East Asia still strongly adheres to the system of continuous flow in a rice mono-culture. The result is that the systems are confronted with water management problems in the dry season when crops are cultivated under substantial water constraints *(Booth, 1977)*. It is apparent that the introduction of new agricultural practices must take the underlying traditions of the farming community into consideration. New irrigation technology should, therefore, be introduced gradually to overcome farmer resistance that could jeopardize the development efforts.

2.4.4 PRIORITIES FOR BETTER IRRIGATION MANAGEMENT

To improve irrigation management, three basic activities are required: (1) sound operation and maintenance of the existing system; (2) implementation of training programs to improve the human resource factor in water management, and (3) continuing research and development efforts aimed at improving the technology of irrigation, which is one of the most important prerequisites for efficient and effective irrigation water management.

Considering the current low efficiency of irrigation practice in Indonesia, it is essential to implement scrupulous water control in the canal networks. There is an associated urgent need to replace traditional irrigation practices with more effective techniques that increase the overall efficiency and productivity of paddy rice crops. The formulation of the new technology should be kept simple so that it can be comprehended by the farmer and still meet the requirements of modern agricultural practice.

There is an urgent need for an "holistic approach" to improve irrigation water management. Experience has demonstrated that improving farm level water management alone will not guarantee successful irrigation practice. For example, the traditional rice culture in southern and eastern Asia urgently requires adjustment of the dry season irrigated-agricultural practice. Crop diversification may be required in the dry season. This, however, requires judicious field experiments before changes are implemented. Experience in Japan and elsewhere has shown that changing the approach to irrigation practice without considering how the necessary adjustment of the existing traditional irrigation practice will take place, tends to create rather than solve irrigation management problems. *(Rydzewski, ed.*

1989:25).

A change in irrigation technology in developing countries away from traditional conventions, requires special developmental research. Unfortunately, research in the field of the inter-relationship between hydraulic/hydrologic engineering and crop water demands, is almost negligible in most developing countries. With the present economic hardship, most developing countries are still focusing their attention on the more immediate necessities, that is to say, on securing an adequate food supply for their populations.

2.4.5 THE ECONOMICS OF IRRIGATION

A huge investment must be made before any farm land can be provided with irrigation water. From the standpoint of pure economic justification, any irrigation project should produce direct benefits that are proportional to the capital invested so as to serve the economy of the nation as a whole. This is not always possible especially for small land holder irrigation because the ultimate objectives are usually associated self sufficiency in food production, and secondly because of the assumption that the projects themselves are too small in relation to the whole economy to have significant effect on prices.

The principal goals of the Government of Indonesia in irrigation development are the improvement of the quality of life in the nation as a whole, the achievement of a more equitable income distribution, and the reduction of rural poverty by providing assistance to poor farmers. It is not simply to maximize profit. Therefore, in many cases irrigation projects are often undertaken even though they are not justifiable on the basis of pure economics alone.

Unfortunately, irrigation water still remains a costly commodity considering the average income of farmers. Farmers have difficulty paying for irrigation to the extent that full capital recovery is attained. However, a no-charge policy for water, although preferred by the farmer, is not desired by the Indonesian government.

If the main objective of providing irrigation water is the acceleration of economic development, then this tends to encourage a no-charge irrigation policy. Indeed, irrigation facilities not only benefit farmers, but also the community, because an increase in prosperity among the farmers leads also to increases in taxes and in local purchasing power which simulates local business.

Since farmers are not the only ones who benefit from the irrigation project and thus should not be solely responsible for the entire capital cost recovery, the World Bank suggests that the projects it assists plan to have only the operation and maintenance costs paid for by the farmers *(IBRD, Duane, 1975:i)*.

Many unsubstantiated claims have been made or are being made with respect to the economic viability of irrigation projects. *Haven (1963)*, stated:

> Because water supply decisions are largely made in the political arena rather than in the market place, there is a great incentive for special interest groups to obscure the real issues involved in government-subsidized water projects and to exploit public romanticism for 'making the desert bloom even as the rose', thus obtaining public support for their own financial gain *(Haven, 1963, as cited by Clark, 1970:vii)*.

However, not all irrigation is uneconomical. *Clark (1970)* states that irrigation from wells has proven economical for a number of crops provided power pumping is possible and the wells are not too deep. Except from very shallow wells, the lifting of water by man or bullock labor is uneconomical even under condition of abundant manpower. Small dams, if carefully designed, usually prove economical, but the economic viability of large dams, which serve usually water supply as well as power generation is extremely variable. Some are economically justifiable while others are clearly not economically viable *(Clark, 1970:vii)*.

Having the nature of irrigation projects mentioned above, minimum criteria for the justification of irrigation project should be: (1) a significant increase in agricultural production, (2) greater stability and self-sufficiency in food production, and (3) stable social gains for the rural areas through increased productivity, higher income and a better standard of living of the farming community *(Are, 1977, in Rydzewski, 1977:119)*.

2.4.6 PROBLEMS OF IRRIGATION DEVELOPMENT

Irrigation development, especially when associated with small land holdings in developing countries, continue to face many problems *(Gany, M.Sc. Thesis, 1979)*. Common problems that often do not receive sufficient attention are the following:

(1) Impoverished local farmers, who are unable, as well as unwilling, to abandon their traditional agricultural practices.[▹4] Their means of production, their tools, as well as their skills, and agricultural practice must be modernized. This may mean that other aspects of their lives need to be brought in line with the introduction of new practices. It will require years of research, effort and patience to educate and to motivate the traditional farmers before they can be expected to fully participate in development efforts *(Are, 1977, in Rydzewski, 1977:120)*.

(2) Problems of land acquisition for irrigation projects may conflict with other uses of the area. There may

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4 ▹ *In addition, considering the question of "risk" -- a person living at the extreme margin of subsistence cannot afford to take the risk of trying a new method. The consequences of not succeeding are so dire that he does not want to experiment.*

be valuable trees or the land may be used as dry season grazing for cattle. While land may appears to be unused, it may have an important value and use in conjunction with other traditional rural ways of life. These may be cultural or ritual.

On the other hand, established irrigation land is increasingly being subjected to non-agricultural pressures such as expansion of settlements or transportation activities *(Frederiksen, in Rydzewski, 1989:4)*. It is expected that in the next twenty years much of the expansion of urban areas will be in established farm lands near urban centers. For example, Egypt is currently using 0.5% of its prime agricultural land each year for urban expansion *(Frederiksen, in Rydzewski 1989:4)*. Even more pressing is the fact that rural lands are rapidly deteriorating because of fragmentation of land holdings due to the explosive increase in the number of farm families and other rural dwellers.

(3) Water availability is another constraint to irrigation development. Water supplies are subject to increased demands for non-agricultural purpose. This trend means that water allocation for irrigation per-se is increasingly jeopardized.

Other problems related to the availability of water are inherent in the process of establishment of new irrigation areas. This tendency is most obvious in new land development schemes for paddy fields. Land preparation in virgin land requires excessive initial water use due to the high percolation rates of new and porous soils. Experience in Indonesia indicates that it takes several years before the excessive water consumption for flooded paddy fields reduces to stabilized operational levels.[▷5] This phenomenon was described for the Lampung Province, Southern Sumatra, by *Whelburg (1935)*. This issue creates a number of technical problems for water allocation, and structural design. It also creates problems related to the time required for completion of the land development process, and hence problems of project achievement and completion.

(4) Turning from technical to social problems, poor operation and maintenance of irrigation facilities is a problem that has hampered irrigation development in many developing countries. While the quality of planning, design and construction leaves much to be desired at times, the situation is greatly aggravated by poor operation and maintenance. This may occur because often insufficient funds are allocated for the training and motivation of the irrigation staff to operate and maintain the systems.

(5) Labor problems are also encountered by

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[5] ▷ *This tendency is reflected in the explanation on the Standard Design Criteria of irrigation in Indonesia, "Irrigation Design Standard", Volume Canals KP-03, 1986:8.*

irrigation schemes. The remoteness of some irrigated lands, for instance, limits the availability of agricultural laborers to work on farms. Experience has shown that large-scale irrigation projects often fail to attract a sufficient number of farmers to make use of the newly available facilities *(Are, in Rydzewski, Ed. 1977:122)*. As a result, farmers are recruited from outside of such areas. However, importing immigrants to farm irrigated lands not only involves resettlement, but also requires programs of integration with the local farming community.

(6) Crop storage and marketing pose additional problems that sometimes hamper the efforts to sustain irrigation development. Marketing of agricultural production is often hampered by the fact that an expanded system of storage, processing, transport and marketing is needed to handle the large crop surpluses which occur during harvest time. On the other hand, during the season of scarcity, no crop products may be available at all to the farmer.

Marketing facilities are not usually taken into account when designing irrigation projects. If they are set up then they are usually organized by government marketing organizations which create significant discrepancies with real market prices *(Are in Rydzewski, Ed. 1977:123)*. Farmers are understandably not interested in producing more if no market is available for the surplus. Conversely when government marketing institutions pay less than the farmer can get from the independent market, then the crops tend to be sold outside.

2.5 RESEARCH HYPOTHESES

Previous experience with transmigration implementation demonstrates that the development of new irrigated agricultural areas through transmigration has met with varying levels of success. The resettlement does not generally progress in accordance with the original implementation plan. The reasons for the delay in achieving the objectives are at times related to budget constraints; however, the disappointing achievement may also be caused by specific technical and non-technical development problems *(Arndt, 1983:67, in Otten, 1988:214.).*

The experience with irrigation-based transmigration resettlement in Indonesia as well as the general information obtained from the existing literature, strongly suggest that there is reason to believe that the success of resettlement programs depends greatly on an inter-related factors that must be addressed by several disciplines since they involve engineering, economics as well as socio-cultural considerations. In other words, the problems are basically interdisciplinary. Four interdisciplinary hypotheses that will be addressed in this thesis are therefore presented below.

2.5.1 HYPOTHESIS ON RESETTLEMENT PLANNING

Better pre-resettlement preparation and consistent follow-up extension services will help to reduce the frustration that farmers often experience in starting up new agricultural operations in irrigation projects. It will thereby maintain a greater level of commitment and cooperation on the part of the settlers.

2.5.2 HYPOTHESIS CONCERNING THE SIZE OF LAND HOLDING

The allocation of land for the transmigrant household in Indonesia is seemingly inadequate for a reasonable living standard or to maintain a sustainable irrigation operation. The current allocation should be reconsidered since a viable size of land holdings is vitally important in encouraging and supporting the settlers' adaptation and participation in the irrigation-based resettlement schemes.

2.5.3 HYPOTHESIS CONCERNING THE IMPACT OF EXCESSIVE WATER REQUIREMENT

The excessive water requirement in the first few years of paddy type irrigation application appears to be an unavoidable problem which causes a substantial prolongation time required for full development. This issue needs be addressed in the design and in the resettlement time schedule if disappointments are to be avoided.

2.5.4 HYPOTHESIS ON THE SOCIO-ECONOMIC AND CULTURAL ASPECTS OF LAND DEVELOPMENT

A. The ability of the farmer to perform the initial land development is dependent upon the level of farm income: the higher the income of the farmer, the greater the percentage of land development achievement.

B. The status of land ownership is related to land development performance. The more uncertain the land status the more reluctant the farmer will be to perform the initial land development.

C. There is a relationship between land development progress and the type of transmigration program attached to the resettlement implementation in the newly established irrigated lands. The place of origin of the transmigrant, the irrigation location and the adequacy of irrigation water at the site are also related to the ability and the willingness of the farmer to perform land development.

CHAPTER THREE

THE TRANSMIGRATION RESETTLEMENT SCHEME IN INDONESIA AND ITS IMPLEMENTATION

3.1 INTRODUCTION

As noted earlier, the Republic of Indonesia is the fourth most populous country in the world; its population reached about 168 million in 1986 and is estimated to be 185 million at the present time. According to a census undertaken by the Dutch Colonial Government in 1930, the total population of the country at that time was 60,727,233 *(Wijoyonitisastro, 1970:106)*.The rapid increase in population in the last half century has caused serious problems.

What makes the problem especially acute is the fact that 100 million people, or more than 60% of the total population, live in Java, which constitutes only about 7% of the country's land area.

As one response to the problem of overpopulation, the government of Indonesia re-instituted what is presently known as the transmigration program. It is a resettlement program that aims at creating a more even distribution of the population, while at the same time providing a fuller exploitation of of the country's resources and opening up new opportunities of employment in the more sparsely populated parts of the country.

The resettlement program was initiated by the Dutch Colonial Government in 1905, as an instrument that served a number of colonial goals and interests by moving people from Java (the *"inner"* island) to the less densely populated areas in the *"outer"* islands.[6] The program was interrupted by Second World War but resumed five years after Indonesia obtained its independence. At that time it aimed primarily at two goals, namely, increasing the labor supply in the areas of resettlement for an intended early industrialization and to create a more even population distribution between the Inner and the Outer Islands.

The present transmigration program is a multifaceted economic and social program with two major objectives: (1) employment creation and (2) poverty alleviation.

During the long history of the program more than two million people have been resettled. In terms of demographic impact on the population of Java this figure is rather insignificant. However, a report by the World Bank (1988:iii) stated that according to some studies, the transmigration had a significant beneficial effect on local

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6 ▷ *At that time, the program was referred to by the Dutch Colonial Government as "Colonisatie", known in Indonesia as "Kolonisasi", then later changed to "Transmigrasi" or transmigration after Indonesia obtained its independence from the Dutch Colonial Government.*

employment and regional development. The implementation of the program, however, has not been without serious unforeseen problems related to both planning and execution. These problems are the subject of this research.

3.2 HISTORICAL BACKGROUND

The problem of over population in rural Java had already become noticeable when the population of the island approached about 30 million people early in the 19th century. At that time, two direct causes of poverty in Java were identified, the fragmentation of agricultural lands, and the continuing growth of the population beyond the agricultural resource base. But during the 19th century nothing was done about this problem by the Dutch Colonial Government.

In the meantime, however, events took place that gradually brought a change in the colonial policy, which until then had caused serious and persistent impoverishment of the population, especially in Java. The changes were in part an attempt to improve the social and economic conditions of the people. For this reason the new policy was called the the "Etische Politiek", or the ethical policy. The new welfare program had as its slogan "Irrigation, Emigration and Education".

There were also political reasons for the change: From 1840 onward -- after recovering from the costly Java

War *(Diponegoro War 1825-1830)*,-- the Dutch Colonial Government began to pay more attention to the Outer Islands, if for no other reason than to prevent other European colonial powers from intervening *(Tirtosudarmo, 1990:2-3)*. By the end of the 19th century, the Dutch Colonial policy was firmly committed to expanding Dutch control over the entire archipelago.

In 1902 the Dutch Colonial Government commissioned a study to examine the possibility of solving the problem of over-population and land fragmentation in Java where the large local population surplus was regarded by the Dutch as a potential source of political tension and unrest. This study recommended moving people from Java to the sparsely populated areas in other parts of Indonesia. In response to this recommendation, the first resettlement experiment was carried out three years later by moving 155 families from Java to South Sumatra. This was the start of an unprecedented human resettlement program in Indonesia.

The objective of the resettlement program was not only to reduce the population pressure in Java but also to contribute to the development of the sparsely populated "Outer Islands"[7] by providing more manpower for

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7 ▷ *The term "outer island" was first introduced by Geertz (Geertz, 1963) to refer to the islands in Indonesia other than Java, Madura, Bali and Lombok, which are referred to as the "inner islands". The outer islands are predominantly the transmigrant destination areas, while the inner islands are the transmigrant source areas.*

agricultural development.

A number of stages can be distinguished in the history of the resettlement program. The first stage started in 1905 when, under certificate of approval #46. dated October 19th, 1905, migration was initiated by H. G. Heytings who, with the help of two assistants and two water masters,[8] moved 155 families from Java to Gedong Tataan in the South Lampung District of Southern Sumatra.[9]

The second stage of resettlement, from 1911 to 1929, was called "The Lampung Bank of Credit" period. By the end of 1911, there were only 4,818 Javanese migrants in Lampung *(Heeren, 1979:10)*. At that time the Bank of Credit was established by the Dutch Colonial Government to provide the transmigrant families with a cash bonus of 22.5 Gulden and credit to a maximum of 300 Gulden.[10] The credit carried

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8 ▷ *This information was supplied to the author in 1970 by Sabikoen (Ex chief of Central Lampung Public Works Service), and also in his unpublished report, "Historical Background of Irrigation in Lampung". Sabikoen was involved in the preparation of irrigation infrastructures for this pioneer settlement.*

9 ▷ *The exact location was in the Gedong Tataan area in the Lampung District of Southern Sumatra. Since 1964, the Lampung District has become an independent province separated from the South Sumatra Province.*

10 ▷ *Based upon information obtained from interviews by the author with some retired land surveyors. The value of Gulden (the Dutch Colonial Government currency) was estimated by means of comparing the price of white rice, at that time about 10 to 15 kg per one Gulden, to a current exchange rate in Indonesia of about US$5.5 per one Gulden.*

an annual interest rate of nine percent with a two-year grace period.

The third phase occurred between 1929 and 1941, coinciding with the the Great World Depression and the beginning of the Second World War. In this phase the rate of settlement increased. According to Heeren, (1967:8), a total of 189,983 people were resettled to the Outer Islands in the period from 1905 to 1941.

Some time after the country had obtained its independence, resettlement was resumed. Between 1950 and 1974, some 500,518 people, averaging 24,021 people per annum were resettled in the Outer Islands. It was predicted by Jones that the overall achievement of the transmigration program since its early implementation until 1974 would be slightly less than one million people (991,000), *(Jones, as quoted by Heeren, 1967:ix)*.

In the third five-year development plan (Repelita III, 1979-1984) the transmigration program was increased substantially. While by 1980, a total of about one million people had been resettled in the entire program, during Repelita III 366,000 families, and nearly 1.5 million people were sponsored for resettlement in the outer islands. During this period, transmigration was the largest voluntary government sponsored settlement program in the world (World Bank, 1983:3). Nevertheless, it has been argued that population rerdistribution role of transmigration has been exaggerated due to the fact that there are also some movement from Java to the Outer Islands outside of the transmigration program.

3.3 AN OVERVIEW OF TRANSMIGRATION PROGRAM

3.3.1 DEFINITION OF TRANSMIGRATION

Transmigration is officially defined in the *"Basic Transmigration Acts [1972]"* as:

> "...the resettlement and/or relocation of population from one region to another within the territory of Indonesia in the framework of national development or for other reasons considered necessary by the government......".

The program is aimed at creating a more even population distribution over the country's territory, while at the same time promoting regional development in the resettlement areas and the areas of origin, as well as fostering national integration and unity and strengthening national security.

3.3.2 CATEGORIES OF TRANSMIGRATION

Indonesian transmigrants are classified into four broad categories:

(1) general transmigrants, consisting of landless agricultural laborers or subsistence farmers who are supported by the government through agricultural land, transportation, housing, social services, and initial

agricultural equipment and other inputs;

(2) local transmigrants, consisting of local people originating from the resettlement areas, who are given the same facilities and supports as general transmigrants;

(3) registered spontaneous transmigrants, which are those who move at their own expense, or are partly assisted by the government and settle where they prefer. Registered spontaneous transmigrant is referred to as *"swakarsa berbantuan"* or partly assisted spontaneous transmigrant *(Otten, 1980:41)*; and

(4) unregistered spontaneous transmigrants, who are the unassisted and unregistered transmigrants, that join their relatives in the resettlement locations.

Resettlement under the transmigration program has been based on at least four types of projects:

(1) so called irrigation-based projects, which were developed earlier in the history of transmigration. This development gradually slowed down in 1970 when government investment in irrigation was sharply reduced due to financial constraints;

(2) swamp-reclamation based projects, mostly in Kalimantan and the eastern part of Sumatra;

(3) rainfed based projects, which are intended to support rainfed agriculture in the Outer Islandswhere irrigation is not possible or not economically feasible; and

(4) cash-crop based schemes, conducted under the Nucleus

Estate and Small-holder Program (NES)[11], and which cultivate palm oil, rubber, coconut, sugar cane and cotton for the production of cash crops *(World Bank, 1988:xix)*.

3.3.3 OBJECTIVES OF THE TRANSMIGRATION

The objectives of the transmigration program are demographic, political and economical in nature. Three demographic parameters must be considered in the justification of the need for, and the goals of, the transmigration program. These are: the size, the growth, and the distribution of the population.

With regards to the size, in 1987 it was projected that the population in 1990 would be 172 million. The actual population in 1990, however, was about 175 million people *(Indonesian Statistic 1990:28)*. The most recent (1992) estimate puts the total population of Indonesia at 184.5 million people *(see the Population Reference Bureau, 1992)*.

This population pattern of size, growth and distribution is seen by the government of Indonesia as crucial obstacles to the country's development. The transmigration is therefore regarded as an important tool in the attempt to reduce land and population pressure and to obtain a better demographic balance.

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[11] ▹ *This program began in 1978 and was mostly based on tree crops plantation* (World Bank, 1988).

The transmigration program is also considered to be a means of "national integration" of the 370 ethnic groups that live in Indonesia and that speak 67 major languages.[12] This integration is pursued by including and integrating the local people into the new communities and by structuring the settlement pattern so as to promote sedentary agricultural practices thereby reducing shifting cultivation and hunting and gathering that is still practiced in the sparsely populated areas. By thus striving for what is called "national resilience", the transmigration program is regarded as vital to Indonesia's national security.

Finally, economic development is also a major objective of the transmigration program. This objective iis pursued by reducing the negative impacts of the population in Java as well as by providing the Outer Islands with more adequate manpower in the agricultural sector.

3.3.4 DEVELOPMENTAL CONCEPTS OF THE TRANSMIGRATION PROGRAM

The success of a transmigration project depends on its ability to create new settlements and villages which form rural communities that are both economically and spiritually sound and that maintain a stable and balanced utilization of natural and human resources.

Five stages can be distinguished in the development

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12 ▹ *Iwan Gayo, 1990. "Buku Pintar Indonesia" :p.9.*

of stable settlements. These are: (1) the period of survival, (2) the stabilization period, (3) the period of becoming self supporting, (4) the period of development, and (5) the completion period in which the project development sustains itself *(Directorate General of Transmigration, 1970)*.

The most critical stage is the survival period, followed by the stabilization period. If the transmigrants survive the first five or six years, then their settlement can most likely be termed a success.

The five development stages are shown diagrammatically in *Figure 3-1*. This figure indicates that a high resource input is needed during the early stage of settlement, when the resource output is still low. This implies that during this critical stage the transmigrants should receive significant support to meet their basic needs while they are pursuing their initial resettlement activities. No revenue can be expected from the transmigrants until they become used to the new way of life and the new environmental situation. The most important requirement during the "survival stage" is to achieve initial adaptation[▹13] and a dependable food supply as well as

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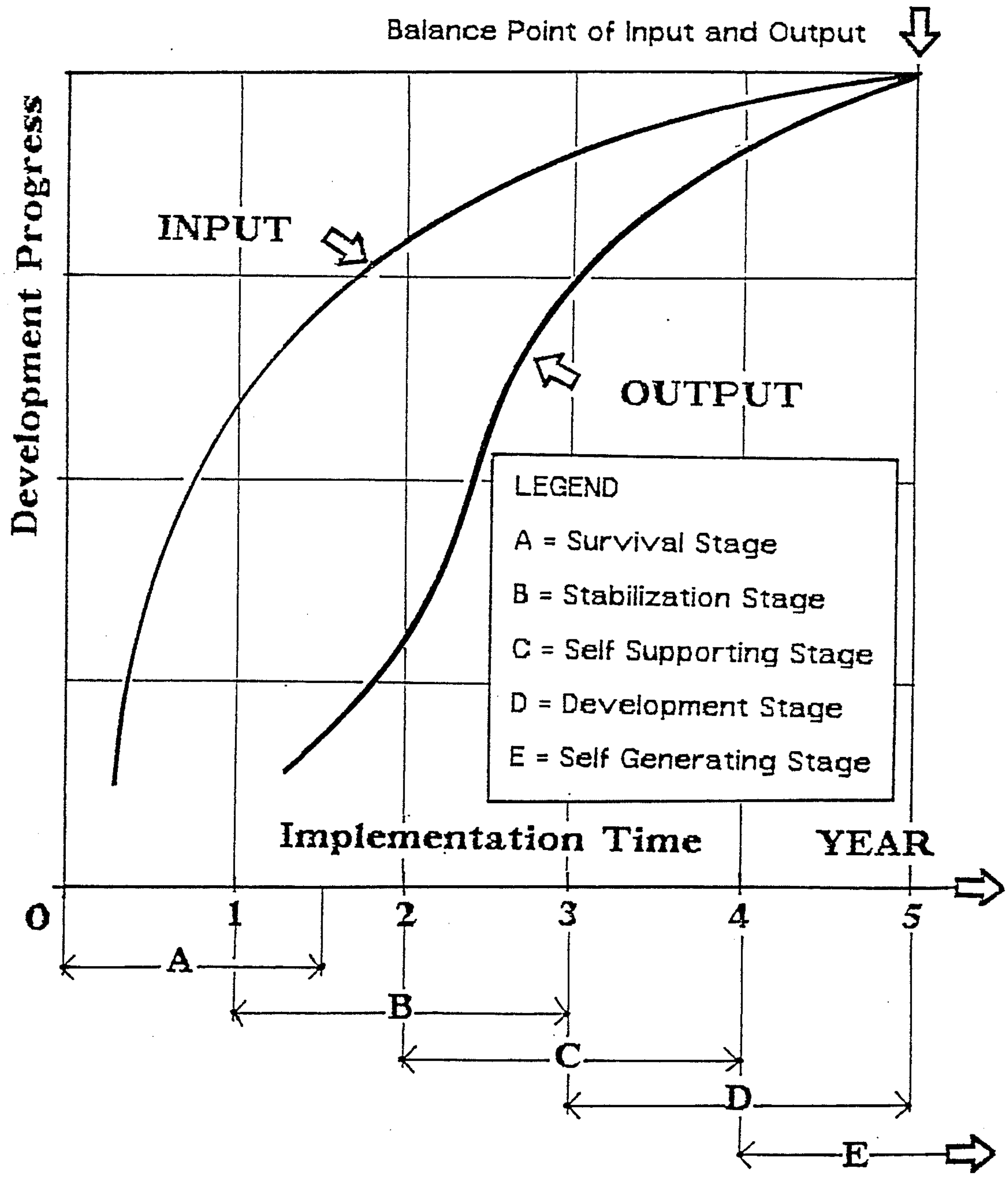
13 ▹ *The importance of initial adaptation to resettlement is also pin pointed by Fernea based upon experience in the Egyptian Nubian Resettlement. (Fernea, R.A. and J. Kennedy, 1966).*

Figure 3-1. Development Stages of the Transmigration Resettlement



Source: Directorate General of Transmigration, 1970 supply of other necessary agricultural inputs.

The second and third years, which constitute the "stabilization period", should also be carefully observed, because in many instances the first and the second crops suffer from problems such as agricultural pests and nutrient deficiencies. If the first two stages are successful, then the farmer will most likely get substantially more revenue, which he needs to carry him through the third or "self supporting stage".

At the fourth stage, the period of "development", the transmigrant should be encouraged to implement a saving plan, to begin family budgeting and to establish, with other farmers, a cooperative marketing system to deal with crop production. Toward the last phase, which is the "period of sustainable development", the transmigrants should have the ability to sustain themselves and to be no longer dependent on the implementing agencies.

3.3.5 ADMINISTRATION OF THE TRANSMIGRATION PROGRAM

Resettlement through the transmigration program requires a good deal of inter-agency coordination. The Ministry of Transmigration has a major responsibility for the physical implementation. This ministry has regional offices that are scattered over all provincial government administrations. However, the Ministry of Internal Affairs is responsible for coordinating and organizing the people that are involved while the Ministry of Public Works is responsible for land clearing, irrigation substructure and for road construction. The Ministry of Agriculture together with several other ministries are in charge of natural resources. The Agency for Economic Planning, the Ministries of Health, of Education and of Community Development, as well as the ubiquitous Treasury Board, are other departments involved. These authorities should establish a working relationship through a consultative mechanism. This usually takes the form of an "advisory body", which ensures that a clear working responsibility, which can operate in accordance with specified schedules and terms of reference, exists in the bureaucratic structure.[14]

Since the third Five Year Development Plan, various mechanisms have been established in order to promote coordination and integrate the activities. Among the important measures was the appointment of a Junior Minister of Transmigration who reports directly to the President.
The role of the Ministry of Transmigration has itself recently been redefined to reflect that policy initiatives

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14 ▷ *According to Presidential Decree No.59/1984, regarding inter-agency coordination for transmigration implementation. "...transmigration implementation is solely the jurisdiction of the Ministry of Transmigration, but the execution should be coordinated with the other relevant ministries, the Ministry of Public Works, the Ministry of Agricultures, the Ministry of Forestry, the Ministry of Transportations, the Ministry of Cooperative Affairs, the Ministry of Healths, the Ministry of Environment, and the Agency for Economic Planning and other government institutions..." (Article 1.).*

are to be implemented as part of broad spectrum of inter-agency programs that foster labor migration and promote regional development.

3.3.6 SELECTION AND CARE OF THE SETTLERS

Implementation of the transmigration program starts with the recruitment of transmigrants in rural areas of Java, Madura, Bali and Lombok. There are several criteria for the selection of participants, but in most cases they must at least meet the following conditions: (1) they must be married; (2) they must have a good personality and character; (3) they should have previous farming experience; and (4) they should not be associated with the communist party or any other kind of extreme organizations.

Each family receives from the government a small standard house on 0.25 ha of land in the newly established village, together with 1.00 ha of cleared land that can potentially be used for an irrigated paddy field and another 0.75 ha of upland for orchards and other upland crop cultivation. The location of the agricultural land is presumed to lie within a reasonable walking distance from the village. The transmigrants are also provided with supplies of food and other necessities for one year, until the first crop is harvested. In addition to the above supplies and facilities, the transmigrants are also provided with planting materials for orchards and minor crops, with small livestock, and with the agricultural equipment and facilities they need.

3.3.7 ACHIEVEMENT OF THE DEMOGRAPHIC OBJECTIVE

In terms of the resettled number of people the transmigration program has achieved a degree of success. It managed to resettle 52,000 families during the second Five Year Development Plan (1974-1979), a figure which rose to 366,000 families or nearly 1.5 million people during the period of 1979-1984.

While by 1980 about one million people had been resettled through sponsored transmigration, the population of the Outer Islands has increased by about two million people as the combined result of migration and the natural increase associated with it. The total resettlement figures are presented in *Table 3-1*, and the resettlement distribution is presented in *Table 3-2*. *Figure 3-2* shows the flow of transmigrants graphically.

In terms of its effect on the over-population, the results of the program are not spectacular. The data indicate that over 34 years about one million five hundred thousand people were resettled. From the view point of demographic impact, this represents only 1.5% of the total

Table 3-1: List of Achievement of Semi-voluntary assisted migration in Indonesia, 1950-1984○]

Year of arrival	Five-year plan	Total families moved	Local families □}	Families Resettled ■)	Total families settled	Total people settled
1950-54	-	21,037	0	1,280	22,317	87,000
1955-59	-	32,114	0	128	32,242	134,000
1960-64	-	26,456	0	0	26,456	111,000
1965-69	-	21,633	0	0	21,633	92,000
1969-74	(I)	39,436	0	75	39,511	176,000
1974-79	(II)	44,484	7,600	0	52,084	228,000
Subtotal		185,160	7,600	1,483	194,243	828,000
1979-84	(III)	301,279	22,284	42,414	365,977▷)	1,492,000
Grand Total		486,439	29,974	43,987	560,220	2,320,000

Notes:

○] Settlement figures varied widely in government publications.
□} Indigenous families who have been settled in transmigration sites.
■) Resettlement of sponsored or spontaneous migrants from within the province
▷) Government also found about 170,000 families moved spontaneously

Source: Official Summary of Pelita III, Ministry of Transmigration as quoted by the World Bank (1988)

Table 3-2. Resettlement Distribution of Transmigration (1950-1986)

Year	Resettlement Distribution (Families)				
	Sumatera	Kalimantan	Sulawesi[o)]	Irian Jaya	Total
1950/54	20,400	1,400	500	-	22,300
1955/59	28,900	2,600	700	-	32,200
1960/64	21,000	4,500	1,000	-	26,500
1965/69	16,500	2,100	2,700	300	21,600
1970/74	22,000	6,000	11,400	100	39,500
1975/79	33,000	11,000	9,000	2,000	55,000
1980/84	227,000	70,600	51,700	16,600	366,000
1985/86	58,200	42,000	21,700	13,200	135,100
Total	427,100	140,200	98,700	32,300	698,200
Percent	61%	20%	14%	5%	100%

Notes:

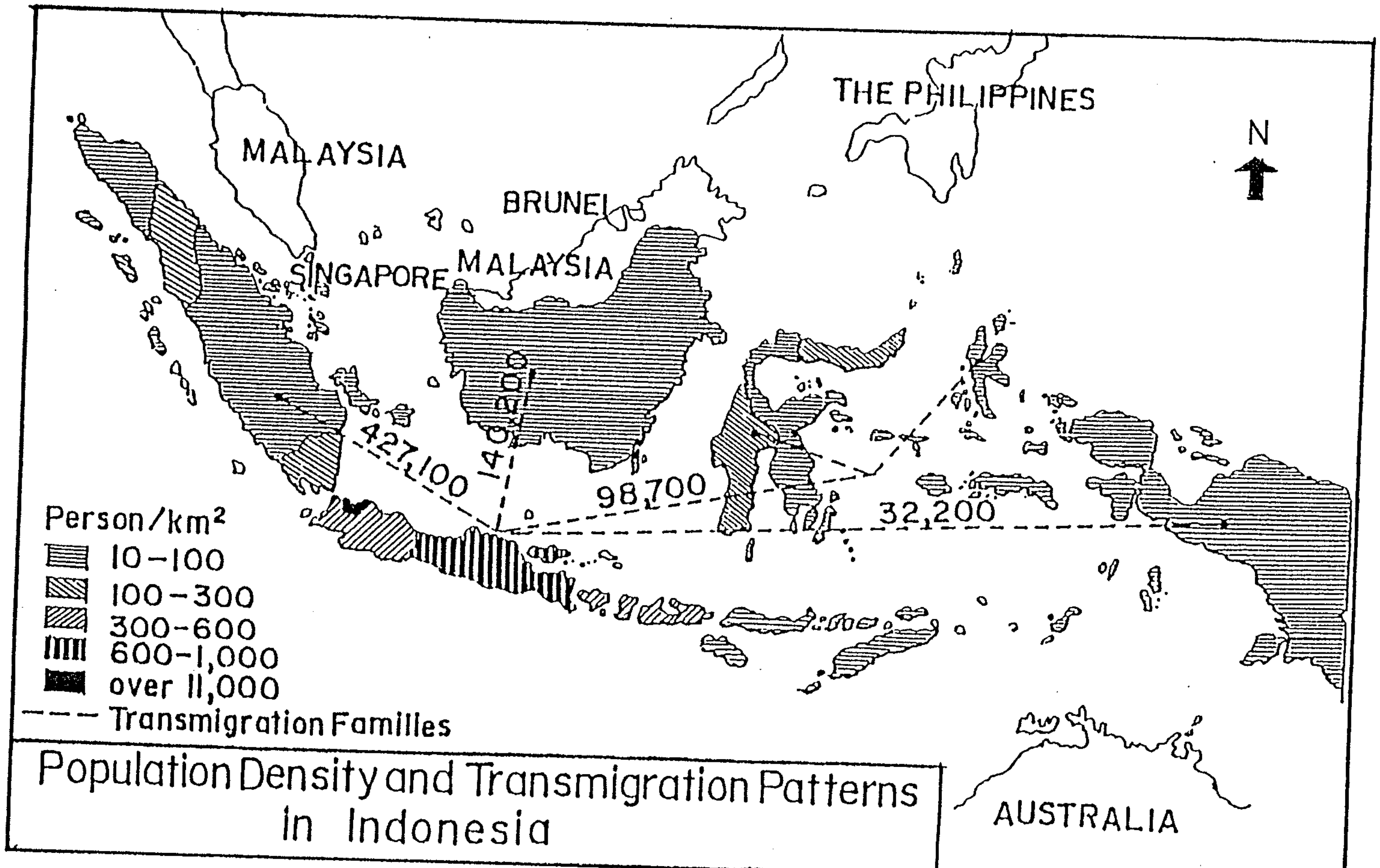
o) *Includes the Maluku (Moluccas) and other small eastern islands*

Source: Ministry of Transmigration

inner islands' population or only 15% of the population growth during that period *(World Bank, 1988)*.

Nevertheless, the cumulative effect of the resettlement even at these rates is still significant. According to the projections of the World Bank, the population of Java will be 9% less by the year 2020 than it would have been without the program and the increase in the

Figure 3-2 POPULATION DENSITY AND TRANSMIGRATION PATTERNS IN INDONESIA



Source: Dept. of Transmigration, Indonesia 1988 labor force will be 19% less. The sponsored migration alone, without the accompanying unassisted spontaneous migration would reduce the expected 2020 population in Java by 3-4% and absorb 7-8% of the increase in labor force *(World Bank, 1988, p.p.iii-iv).*

3.3.8 EMPLOYMENT CREATION AND TRANSMIGRANT WELFARE

In terms of employment creation, significant achievements can be attributed to the transmigration program. It is estimated that the transmigrants created about 18 million man-days of work. This amounts to 63,000 man-years of full-time work, which is roughly 100 working days in a year for 240,000 workers *(World Bank, 1988:xxiv).*

Within the third Five Year Development Plan about 500,000 to 600,000 permanent jobs were created by the program, at a cost of US$3,000 to US$4,000 per job in rainfed food crop schemes, and US$3,500 to US$4,500 per job in orchard-based settlements. These figures do not include the indirect job creation occurring as a result of the transmigration program. The cost figures of the employment rates created by the transmigration program are relatively high in comparison to the employment income level in the services sector in Indonesia but low in comparison to the level of income the in industrial sector which is averaging about US$ 10,000 - US$20,000 per job.

A comprehensive income survey by the Indonesian

Bureau of statistics showed the average income of a transmigration family to be somewhat lower than the average income of families in rural Java, and significantly lower than the average family income in the rural receiving provinces. These findings, however, are not surprising because the study was undertaken during the development phase of the transmigrant settlement. During this stage, the transmigrant income is continuously growing. In addition, the buying power of money is higher in the rural transmigration areas than in rural Java. The transmigrants themselves, are therefore relatively better off than the figures indicate since they are mostly economically secure and self-sufficient, having agricultural lands and houses, assets which they did not possess in their areas of origin. The transmigrants are also reported to have obtained some off-farm work which enables them to earn more than is needed to meet their subsistence food requirements.

3.3.9 SOCIAL AND ENVIRONMENTAL IMPACT

One of the most sensitive issues in the transmigration program is the social impact of the resettlement. On the whole, the transmigration program has brought about significant advantages to the region and it has mostly received a positive reception. In some instances, however, the fairness of land acquisition has been a major if not the major social concern. Rapid land clearing without adequate planning has in the past created conflicts between transmigrants and local people.

The environmental impact of transmigration settlement have been positive in so far as it has reduced demographic pressure on critical areas in the places of origin. This has in some instances made reforestation possible with view of reducing erosion. In the receiving areas forests have been cleared, however.

One should keep in mind, however, that the total land allocated for transmigrants is less than one percent of the total forest area of the country. The government policy in land allocation has also been adjusted to place greater emphasis on the optimum use of grass-land. Greater attention is also given to providing adequate compensation to local people for improving the use of unforested land as well as the previously under-utilized lands. Efforts have also been undertaken to reduce the environmental problems associated with the increasing spontaneous migration. Government policy with respect to protecting the environment aims at retaining about 57% of the Indonesian land area under forest cover. The ecologically most important areas are given first priority in protection from encroachment.

3.4 THE SOCIAL PLANNING ASPECTS OF TRANSMIGRATION

3.4.1 EARLY IMPLEMENTATION POLICY

As a result of the colonial legacy, the Indonesian government faced three major problems in developing the country socially and economically. The first problem was that the colonial government had never established an indigenous socio-economic system. An economic system, including irrigation, transportation and other public works facilities existed, but it served primarily the need of the colonial masters.

The second problem was that the economic substructure was totally destroyed when the Dutch were forced to leave the country. At that time, the people generally had incomes that were insufficient to meet their basic needs.

The third problem was that the newly established government had no experience in social and economic planning nor in the implementation of social change. As a result considerable emphasis was placed on the physical and economical aspects of the planning while the social aspects were largely ignored.

Recently the social dimensions of development have become a major concern of the government and more emphasis is being placed on social policy and planning in the transmigration program. Until now, however, the social aspects have been studied in the relatively narrow context of direct past experience. A more systematic approach to the social implications of the development is needed.

3.4.2 SOCIAL PLANNING OF TRANSMIGRATION

As with other other programs, proper social planning is crucial to the failure or success of a transmigration program. The planner should consider three aspects:

(1) the physical environment for the transmigrant, that is their new habitat, the resettlement area, the roads, the buildings, the schools, the markets and so on;

(2) their social development, in terms of the development of the new institutions that are needed, encouragement of new attitudes, the provision of teachers, medical aid, agricultural extension officers and the like; and

(3) the actual transfer of the people, including transportation, moving of livestock and belongings, reception and settlement in the relocation areas, and measures to maintain socio-ecological balance at the time they arrive and are adjusting themselves to the new area.

A crucial aspect of the actual planning of a transmigration project is the time required for the planning activity. On the one hand, considerable time is needed for the collection of the necessary data and their incorporation in planning. On the other hand, there is usually a great urgency to start the resettlement as soon as possible. A compromise between these conflicting demands is evidently necessary.

A wide range of surveys are necessary for planning. It is important to include in these surveys, "baseline" or "benchmark studies" which allow a specific comparison and evaluation of the conditions before and after resettlement. These studies must be broadly based and include environmental assessments, hydrologic surveys, demographic assessments, surveys of public heath, education and livestock, etc. Understandably, such broadly based benchmark studies were largely lacking in the past.

The social surveys that were conducted in the past depended mostly on old human and animal census data. Consequently, many problems were hidden and conclusions were often substantially biased. When foreign aid was involved, the planning policy was often dictated by expatriate consultants and the planning rarely included the local citizens. As a result the approach of the planners was usually far too academic. They frequently neglected the most important information such as (1) present settlement pattern; (2) housing types; (3) the social networks between dwellings; (4) the existing land use system; (5) the attitude of people toward farming and toward past attempts of the government to introduce agricultural innovation; (6) the leadership structure and the relevant aspects of the social organization and social values; and (7) the attitude of the local people with respect to the influx of people from outside the area.

A successful transmigration project should link the civil and agricultural engineering (technical) solution and the social engineering solution and aim at a harmonious equilibrium as well as an optimization of the achievement.

In addition to the necessary physical and social surveys, the planning should also include economic and ecological surveys. The following aspects should be considered: (1) the nature of available resources including natural vegetation, animal habitat, river fish populations etc.; (2) the length of the agricultural season; (3) the present economic situation of the people to be resettled; (4) division of labor forces by gender and age; (5) the amount of time spent by each type of laborer for different crops and activities throughout agricultural cycles; (6) new techniques and agricultural implements; (7) the abilities and interests of the local population in implementing new techniques; (8) the nature of community development services; and (9) credit and marketing facilities.

While the the social planning process is by nature inter-disciplinary, it has been argued that the social planning methodology applied to transmigration has not met that criterion. The resulting planning was intra-disciplinary and provided only partial insights. Some planners focused on the application of cost benefit analysis to justify the social expenditures; others focused on social goals without considering economic justification.

One of the difficulties of fostering development in Indonesia through the transmigration resettlement program is the ethnic diversity of the people. There are 370 ethnic groups with 67 major languages a feature which demonstrates the extent to which the country is multi-dimensional in culture and traditional heritage. This makes social planning difficult. Values which apply to a particular ethnic group but may be inappropriate in other groups. Before deciding on the resettlement location, the socio-cultural dimensions and values of the ethnic groups that will be affected by the resettlement program should be clearly understood. Otherwise, the resettlement may create more serious ethnic problems instead of achieving the development objectives. This problem is aggravated by the fact that the transmigration is based on small land holding practice. The multitude of farm units means that more people are involved, a feature which increases the social problems.

3.4.3 URBANIZATION, POVERTY AND RURAL DEVELOPMENT

Third World urbanization is much more rapid than in the industrial countries. Preston *(1979)*, demonstrates that the urban growth rates of the Third World today are more than twice as high as they were in the industrial countries at their urbanization peak in the latter half of the nineteenth century *(in Hardiman, 1989)*.

In Indonesia migration to the urban areas has been rapid. The growth of the cities caused by migration from the country was accelerated because of mortality rates, especially in the urban areas, are decreasing while fertility rates remain relatively high. The social problems associated with urbanization hve not yet reached an alarming stage in Indonesia. The problems have, however, become more and more significant. Rapid urban growth has greatly increased the demand for housing, water, electricity, transportation, and for health and social services. These demands could not always be met adequately. Urban growth has also resulted in widespread unemployment and urban poverty. The Government of Indonesia, has, therefore, paid considerable attention to both family planning and the transmigration program as measures to alleviate the serious impacts of urbanization.

An attempt to limit or to slow down urbanization requires the development of rural areas. Rural dwellers can only be discouraged from migrating to the cities by improving rural facilities, social life and employment opportunities, so as to create a better quality of life in the rural areas. The transmigration policy fits well into that objective.

3.5 TRANSMIGRATION COMPARED TO OTHER RESETTLEMENT EXPERIENCES

Resettlement is planned social change by moving people. It may be undertaken for the purpose of sedentarization or villagization of cultivators or other community members. It may also be for other reasons such as: (1) national security; (2) threat of epidemic diseases; (3) environmental degradation; (4) urban development; and (5) environmental alteration as a result of engineering projects.

To some extent, the general policy of the Indonesian government in transmigration is comparable, to other resettlement policies elsewhere in the world.[▷15] For instance, the general pattern of resettlement in Africa could be categorized into several types: (1) individual agricultural holdings; (2) compulsory marketing system; and (3) scheduled production schemes. Transmigration is mostly associated with small individual agricultural holdings. However, some resettlements adopt cash crop scheme but do not implement these in accordance with compulsory marketing systems found elsewhere.

The type of resettlement scheme can be

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[15] ▷ *This discussion is merely intended to give general comparison of experiences in terms of salient features, settlement costs, means of mobilizing people, size and location of agricultural lands for resettlement project.*

characterized by the crops planted, such as rice, cotton, sugar, tea, and tobacco. Although the transmigration cases are dominated by rice, other cash crops have recently been raised in conjunction with the project.

Based upon the resettlement experience in Africa, Chambers *(1969:261)* stated that the most effective projects have been individual small-holder resettlement schemes. Compulsory marketing, scheduled production, and communal economy schemes, have been less effective in Africa. Such schemes have not been adopted in transmigration settlements in Indonesia. The general lesson from the experience in Africa is that it is best to rely on the simplicity of schemes and on approaches involving low risks and low capital commitments. Schemes with individual holdings that exploit the incentives produced by property ownership which makes labor more productive *(Chambers, 1969:261)*, tend to be the type implemented by the transmigration program.

As noted previously, the decision to migrate is influenced by several factors in transmigration as in many other resettlement programs, for instance, interested to the agricultural land received, successful example of previous transmigrant, following the extended family and so on. The program is considered as semi-voluntary, because there are a number of external aspects, which are seldom exact and could never be completely rational, that contribute to the decision to migrate. For instance, the transmigrants do not always reach the decision themselves. They are often very reluctant to leave the old familiar environment. They have traditional philosophy *"mangan ora mangan asal ngumpul"* which means "we have to be together all the time to share the good and bad experiences of life". Most would prefer to move in groups as a social/cultural unit (e.g. as an entire kin group, extended family, ethnic group, neighborhood, hamlet or village, etc.) in order to become more quickly socially organized and economically productive.▷[16]

Transmigration is, therefore, always accompanied with its social complications. Such accompaniment adds to the cost of the undertaking, depending on the nature of the policy and the objective of the resettlement, especially if it includes the cost of prolonged food relief, the loss of human productivity, low motivation and so on.

There are other resettlement programs which can provide some comparison in terms of costs. Chambers (1970) indicates that in the case of Kariba (Zimbabwe), where the government made no major attempt to transform the settlement pattern and the agricultural economy, the scheme was

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16 ▷ *An approach called* "Transmigrasi Bedol Desa" *of whole village transmigration is one alternative that could be considered for allowing the movement as a social-cultural unit. However, it is not easy, in practice, to organize such a simultaneous movement, especially in the process of convincing people to move together as a community unit unless the settlement results from a natural disaster or is another type of involuntary migration.*

implemented at about £50 per capita. In the case of Aswan Dam resettlement, where the government saw the relocation of the Nubian population as an opportunity to transform their social and economic organization, the scheme was implemented at £250 per capita. In the case of Sudan, the resettlement scheme for displaced from Lake Nasser was implemented at about £500 per capita due to the construction of a modern irrigation system for the production of cash and subsistence crops, as well the construction of planned communities with extensive social services *(Chambers, 1970)*. Other sources indicate the following cost figures: Sudan (US$1,900), Egypt (US$2,000), Nigeria (US$500), Zambia (US$220), Simbabwe (US$160) and Ghana (US$650) per capita respectively *(F.A.O., 1971:4)*. In the case of transmigration resettlement based on small-holdings, the initial costs are estimated by Arndt at about US$ 15,000 per family *(Otten, 1980:33)*, which is equal to about US$ 2,500 per capita. (Unfortunately, the data do not indicate the year when the figures were quoted. They also do not indicate the amount of support the settlers obtained, so they can not be compared directly with the transmigration figures.)

In the case of Volta Resettlement in the 1950's, the physical problems of resettlement were tremendous, because the people, livestock, household effects and food had to be moved from perhaps hundreds of scattered isolated and inaccessible sites within a short time▷[17] and because some people refused to move until water had reached their houses. In the case of the transmigration program, the transportation of people is often carried out by ship or military aircraft *(Otten, 1986:95-97)* with only the minimum household effects required immediately upon arrival. Housing in villages, agricultural equipment and facilities including the initial food supplies are provided upon arrival.

The villagization program in Tanzania managed to resettle over five million peasants from their former scattered homesteads into nucleated settlements of approximately 8,000 villages *(Vijijini vya maendeleo)*. This villagization program, however, has been condemned as authoritarian state intervention *(Moore, 1979)*.

The size of land-holdings that are allocated to settlers varies from place to place. This is because of enormous differences in the quality of land, geographic locations and so on. For example, according to Chambers *(Chambers, 1969:86)*, land allocation in Africa for resettled families ranges from 2 to 5 acres (or 0.8 to 2 ha), depending upon the type of soil. Other examples, given by Lewis *(Lewis, 1980:8)*, suggest that land holdings in

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[17] ▷ *(e.g. The case of Volta involved the evacuation of a total of 2,954 cattle, 11,600 chickens, 42,000 sheep and goats, plus about 1,000 pounds of baggage per person,* Chambers, 1970.*)*

Malaysia, the West Indies, and Sri Lanka, are between 5 and 12 acres (between 2 and 4.9ha), and in Nigeria they range between 30-50 acres or 12-20ha. In the Philippines, the average land allocation is between 6 and 12 ha per household *(Pelzer, 1945 as quoted by Heeren, 1967:167)*. In the case of the transmigration program, however, land allocation is standardized at a total of 2 ha per family, including irrigated land, non-irrigated land and household plots.

The principle of "self help" among the settlers in performing their activities is an important cornerstone that gives the settlers a capacity to stand on their own feet. The problem in many African settlement schemes was that too much was done for the settlers, which created dependency on outside help *(Chambers, 1969:178)*. In Indonesian transmigration program, however, the self-help or "mutual-aid" principle is traditionally known as the *"gotong-royong"* system. It has been effective in encouraging sense of pride in possession, a sense of participation and sense of responsibility in maintaining the rural infrastructure (irrigation canals, roads etc.). Some transmigration schemes have been identified as being successful because of the involvement of a high degree of mutual-aid or *gotong-royong* system and limited official interference and assistance.

3.6 PROBLEMS AND CONSTRAINTS

3.6.1 STRUCTURAL PROBLEMS

A. Problems of Land Allocation

One of the most significant problems of transmigration implementation is land allocation and compensation for property lost by the local inhabitant.[▷18] Often, the land is undervalued while the compensation claimed by the local people is unjustified. This is the more serious when the implementation is poorly or hurriedly undertaken because of inadequate funds or inexperienced personnel.

Unclear land ownership is another problem that besets the settlers. This problem is especially complicated when dealing with "absentee land ownership" (i.e. when land owners do not reside in the area where the lands are administered). The problem is acute since, at the present time in Indonesia, there is no affordable land registration program that is responsive to the needs of small-holders *(World Bank, 1988)*.[▷19]

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18 ▷ *The problem of land allocation and land compensation also hampered a number of large dam displacements in India* (Singh, in Fernandes, 1989:91-103).

19 ▷ *Based upon experience in the difficulty of solving land problems in the past, the Government of Indonesia has paid special attention to the importance of proper land administration. This is evident from the establishment of State Ministry of Agrarian Affairs in the Sixth (1993-98) Development Cabinet of Indonesia (Jakarta Post, March 18, 1993).*

An important contributing factor to the problems of land allocation is inadequate site preparation and poor logistic planning prior to the arrival of the transmigrants. Very often the construction of new settlements, including land clearing, provision of facilities and housing and land administration, is still incomplete when the transmigrants arrive. Site selection and clearing is often done on a "plan-as-you-proceed basis" so as to give the migrants a quick start in the settlement process. As a result, the implementation is often hampered by serious problems concerning the demarcation of adequate and suitable land for agriculture.

B. Irrigation-Based Resettlement

A careful distribution of land for agricultural and household use is especially critical for irrigation-based migration because of the work the farmer has to do to develop the land for this purpose. Appropriate distribution and utilization of the land requires, however, completion of the engineering aspects of the underlying irrigation project, which can be very time consuming. It is not uncommon, however, that the pressure to "get on" with the transmigration causes people to be moved to the designated area when the irrigation canal alignment, the village location, and the allocation of irrigation land-plots are yet undecided let alone complete. In these cases there are three possible and not mutually exclusive scenarios.

(1) The transmigrant is resettled prior to the establishment of irrigation infrastructures and has to wait for the construction of irrigation facilities.

(2) Much of the land allocation is inconsistent with the subsequently developed structural irrigation design.[▷20]

(3) Later, at the construction stage of the irrigation works, the canals and other facilities must then, for engineering reasons, often trespass over allocated transmigrant land.

With any of these scenarios the land problem is by no means easy to resolve.

C. Size of Allocated Land Holding

The transmigrant source area is Java where the average land holding in irrigated areas is only between 0.25-0.30 ha. This compares with a national average at about 1.00ha per holding. The holdings on Java, however, are highly productive because of the high fertility as resulted from occasional precipitation of volcanic ash and the intensive cultivation. Most of this type of agricultural land is suitable for double cropping or even multiple

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[20] ▷ *For example, there are many cases where transmigrant villages overlap lands which are supposed to be irrigation areas. Alternatively, the proposed irrigation areas are often allocated for public facilities or for other non-agricultural purposes.*

cropping. In the Outer Islands, however, most of the land has poorer fertility and requires more fertilizer and water. It is thus not correct to use an allocation pattern that is based simply on average land holdings.

The question of how large a holding should be allocated per family must be answered in the light of two conditions: (1) the holding should be large enough to produce an adequate living standard for the family, and (2) the size must not be more than the settlers' family is able to cultivate.

In the past, the agencies involved in resettlement had a tendency to allocate less land than was required for the settlers to make an adequate living. An impressions held by author on the basis of his experience with this type of project that some of the schemes were unsuccessful for this reason and that economic necessity caused settlers to drift into other employment. This impression, however, is subject to further research and analysis.

D. Land Preparation for the Newly Established Irrigation Area

Land preparation for newly established irrigation schemes is one of the most important structural problems as far as transmigration implementation is concerned. Long term records show that land preparation tends to lag behind schedule. This is often a direct consequence of the fact that the initial water requirement for the preparation of lowland paddy fields is extremely high, much higher than the amount needed when land development is complete and irrigation practice has become stabilized. This fact complicates both engineering and social planning.

The specific reasons for this complication are as follows: (1) although technically possible, it is not economically feasible to construct an irrigation facility that satisfies the highly varying water demand and as a result the development must be implemented in stages; (2) the high water consumption required for preparing the land lasts for for about four to five years; this is just the period of time over which the transmigrants are expected to become self-sustainable and this expectation is frustrated by water shortages; (3) the newly resettled transmigrants face water shortages at the very time that he needs to be reassured that the agricultural practice is worthwhile and can permanently support them; (4) during the critical settlement period, the transmigrant farmers may still be suffering from mental stress as a result of resettlement, and can hardly be expected to participate fully in development activities; (5) being in a highly stressful condition, the transmigrants need reassurance, particularly regarding their legal land ownership status, which may not be forthcoming. At the same time, they also need financial support for their subsistence, which may not be adequate;

and (6) too long a period of extension of external assistance can lead the transmigrant to develop attitudes of dependency.

3.6.2 NON-STRUCTURAL PROBLEMS

A. General Planning Problems

The most common problem in the transmigration program is the time it takes, and the difficulty settlers have, in adapting to their new surroundings and way of life. This problem is usually rooted in the weaknesses of planning.

Often, the planning of settlements reflects little knowledge or experience about migration. For example, many problems arose as a result of the the failure of social planners to translate social sciences into institutionalized policy and congruent operational procedures. This fault often resulted in the exclusion of social issues from the planning process.

Similarly, the non-technical aspects of resettlement infrastructures are often simply overlooked or neglected by planners. For the sake of simplicity the infrastructure, such as housing or other facilities, was often standardized. This was done, however, without considering what the settlers were used to and what matched their life style and habits. As a result, the settlers had to struggle to make use of the facilities that appeared unfamiliar and therefore unsuitable to them. This in turn increased the time required for a successful adaptation.

The issue of planning and policy formulation in the transmigration program is particularly crucial because it has to be undertaken through inter-agency coordination. The World Bank pays special attention to this matter as is evident from the the following suggestions.

> "To enhance the quality of new settlement mechanisms must be developed within the Ministry of Transmigration to review management issues on a regular basis and to improve policy formulation and inter-agency coordination. Action plans should also be developed to overcome the most serious problems encountered in implementation. These should be focused on settlement design (including selection of farm model, farm layout and incorporation of spontaneous migrants), physical development (land clearing, road construction and maintenance, and contractor supervision), the provision of agricultural supporting services, and program planning and coordination (planning, budgeting, monitoring and evaluation). Steps are also required to establish a system for assuring the orderly transfer of settlement to provincial governments" *(World Bank, 1988:xii)*.

Unfortunately, the resettlement and relocation approach to transmigration has often been and, in many cases, still is handled as "salvage and welfare" operations rather than as development operations. As suggested previously, much of this is the direct result of not allowing enough time for proper planning before the actual movement of people takes place.

Another major shortcoming of the planning process is the very low priority the implementation agencies place on consistent monitoring and evaluation of the post resettlement performance of the scheme, if indeed, it is considered at all. It is therefore difficult to assess the actual performance of the project in terms of the settlers' success in adaptation, the standard of living they have achieved, their wage, farm income and so on. The absence of this important information has an apparent adverse effect on the planning of future programs. In other words, problems which were experienced in the past will be repeatedly encountered in future programs.

B. Rural Development problems

In Indonesia, the majority of the people are rural dwellers. Some 82.2% of 147,387,075 people in 1980 lived in rural areas within 60,415 villages (1980 Indonesian Census, published in Kompas, January 9, 1981). The rural population is frequently beset by problems of unemployment or underemployment. Where irrigation is not available during the dry season the rural farmers usually move to the cities to seek seasonal jobs as daily laborers. There is evident need for the agricultural resource base to be further developed, which can be done more readily in the relatively undeveloped Outer Islands than in the Inner Islands.

Additionally, the inadequate resource base and facilities in the rural areas has also tended to have the effect of accelerating the out-migration of the educated members of the rural communities. This often leads to the notion that education in rural areas is a means of escaping from the village to seek a better life in the cities.

The transmigration program is intended to promote the creation of employment as well as resource development in the Outer Islands, and at the same time to absorb current rural unemployed and underemployed from the Inner Islands.

The strategy of planning for transmigration as a rural development program has been referred to as both *the improvement approach*, through the encouragement of agricultural development, and *the transformation approach*, through the establishment of new forms of agricultural and social organization.

C. Socio-cultural Consequences of Transmigration

One of the most sensitive issues in the transmigration program is the cultural impacts of resettlement. Transmigrants are usually moved to regions where the population is racially and culturally distinct. This complicates the adaptation process since the cultural identity of the local people should be respected.

The engineering bias in past planning of the new infrastructure was reflected in a lack of attention given to the integration with the host population. Several transmigration settlements in the past were hampered by the problems created by the lack of consideration. The problems were especially serious if the local people were excluded from participating in the resettlement scheme and remained as a small scattered minority group. However, in the most recent transmigration programs this problem was solved by an integration approach. In this approach, the small local minority groups are included in the transmigration program and given the same treatment and support as the general transmigrants.

Other often encountered problems stemmed from an inappropriate selection of transmigrants in terms of the previous socio-cultural background. Adaptation problems resulted from failure to consider the previous experience and level of knowledge of the transmigrant. For instance, many transmigrants came from non-farming communities such as those who previously resided in urban areas. These migrants often have the greatest propensity to return to their area of origin rather than trying to integrate themselves into the social and cultural practices of the host rural population. Integration is essential or the project will suffer from potential conflict with the host population.

Other social problems associated with resettlement are: (1) the disruption of the traditional local settlement and the difficulty to meet the requirements of both the transmigrant settlers and the local people. This condition often creates by social or cultural conflicts;

(2) disruptive stress resulted from the separation of kin due to the dispersion in scattered sites; this aspect causes considerable time and effort being spent in maintaining emotional relationships rather than in the pursuit of adaptation to the new social system.

(3) disorientation of social relationships due to changing alliances in the new destination;

(4) individual reluctance to establish new social networks due to the human tendency of attempting to maintain old and defunct associations;

(5) family crises associated with the move and prolonged anxiety due to the difficulties in establishing a new productive system;

(6) distress as the result of material losses suffered in the move from area of origin to the settlement area; and

(7) disorientation of routine ritual ceremonies due to ad-hoc changes in alliances with people belonging to the same religion, culture or belief.

These factors produce social stress and a feeling of powerlessness and alienation. Such conditions will persist till the settlers are able adapt to the new environment. These socio-cultural consequences of the transmigration program must be considered by the planners, as well as the implementing agencies, in dealing with the adaptation problem in future resettlement programs.

D. Political Implications

Despite the fact that resettlement programs are primarily aimed at solving the problem of over-population, at improving quality of life, and at encouraging rural development, many examples of resettlement projects give evidence that a resettlement program can be and has been undertaken for other reasons. It can serve political goals.

Political ends can quite legitimately be included in resettlement purposes provided that they do not interfere with human rights and are not to the detriment of the people that are moved or that are in the receiving areas.

However, previous experience shown that political reasons can be, and have been, to detriment of the people concerned. For example, Fernandez (1989) alleges that in the Large Dam Displacement Program in India, many cases indicate that national political interests tended to create a kind of "enslavement of indigenous people" in the resettlement process *(Fernandez, 1989, 35-36)*.

When the primary reason for resettlement is political then the danger is great that insufficient attention will be given to the technical, the economic and the socio-cultural aspects. In such cases, the simplest and cheapest form of resettlement have usually been adopted. As a result, the resettlement schemes are hardly expected to achieve significance enhancement of the quality of life.

In the case of transmigration program, population resettlement is primarily aimed at relieving demographic pressures and at enhancing social and economic conditions. However, there are a number of examples which indicate that transmigration resettlement programs have also been used for other reasons *(Tirtosudarmo, 1990:10)*. For example, some involuntary resettlement is conducted under the transmigration programs due to the inundation of lands by large dams, natural disasters such as volcanic eruptions, land slides and earthquakes. Some resettlement also involves retired army personnel, civil servants, marines, and police officers *(Otten, 1988)*. In addition transmigration serves the national aims of nation building through integration reducing ethnic disparity, regional development, national unity and security, particularly in securing borders in Irian Jaya and Kalimantan.

3.7 INTERNATIONAL AID IN TRANSMIGRATION

As noted previously in the third Five Year Development Plan of Indonesia, (*Repelita.* III, 1979-1984), 366,000 families or nearly 1.5 million people, were settled under the government sponsored program. During this period, transmigration was the largest voluntary government sponsored settlement program in the world *(World Bank, 1988:3)*. Experience in the past indicated that such large programs have been hampered by a number of problems and constraints which require international aid to help to solve the problems.

In order to strengthen the ability of the implementing agency of the transmigration program to coordinate, monitor and evaluate these large projects, the United Nations Development Program (UNDP) and the World Bank provided technical assistance at the beginning of the third Five Year Development Plan.

International aid was needed especially in Repelita III for two reasons: (a) the inability of the government to finance the transmigration program at the projected scale; (b) the need for institutional strengthening of the planning and implementing agencies.

Since 1976 the Word Bank has been involved in financing the transmigration projects. At the initial stage, five transmigration projects, two swamp reclamation projects and several Nucleus Estate and Smallholder (NES) projects were assisted by the World Bank. Some projects received financial assistance from International Fund for Agricultural Development (IFAD), others from both IFAD and the World Bank. The bank-supported projects have provided a number of innovative features, including assistance for program management, site screening and evaluation, and implementation and evaluation of farm models *(World Bank, 1988:159)*.

While the program has profited from the aid, problems were still encountered.

(a) The involvement of expatriate consultants has at times imposed planning and implementation targets that turned out to be unrealistic in the Indonesian situation.

(b) The donor countries tended to use their own value judgments in the decision as to what projects to fund and what criteria a project must meet in order to receive funding. At times this resulted in project features that were not in accordance with the best judgment of the decision makers in the developing countries themselves.

(c) Aid for social development is difficult to obtain because it is difficult to quantify the benefit of such a program.

(d) Much of the money available for aid goes to the salaries of foreign experts or teachers or to fellowships of students who attend study programs in the donor countries. While these are necessary expenditures, the amount of the available funds consumed by them often reduces the effectiveness of the direct aid to the projects.

(e) The foreign aid policy needs to be reviewed and improved. More emphasis should be placed on rapidly the increasing indigenous competency to deal with problems in accordance with the policies and priorities of developing countries.

Despite the fact that a number of problems were experienced in the implementation of international aid for the transmigration program, on balance, it is believed that the transmigration program has both merited and profited from Bank support *(World Bank, 1988:159)*.

As far as international aid (particularly in the transmigration program) is concerned, there is a need to seek alternative strategies for future improvement. Much more attention should be given to the administrative capacity of the country to absorb aid and also to train local personnel for an effective use of counterparts *(World Bank, 1988)*.

3.8 FUTURE TRENDS, PROSPECTS AND PROBLEMS

Concerning the long term development prospects, it is probable that the transmigration program will be continued in the future. It is, therefore, essential to consider and clarify the policy objectives of the resettlement programs. These objectives must take into account the constraints imposed by the prevailing social values and norms of the settlers as well as the socio-economic conditions of the region in which the transmigration program is undertaken.

It is essential for the success of future programs that the implementation is accompanied by consistent monitoring and evaluating of actual conditions in the resettlement schemes from phase to phase. To date this has not been done in a systematic way, and without significant improvement in this respect, future development of the transmigration program will continuously be hampered by unforeseen problems and constraints.

It is not easy to set a clear policy that governs what should be done to make future settlement schemes more successful. Much depends on the agricultural potential of a project. This factor largely determines the choice between farming systems, i.e., whether the project is to be based on a "food crop system", a "swamp reclamation system", a "tree crop development" or whether some form of non-agricultural resettlement must be chosen.

Rainfed agriculture seems to have poor prospects, due to low productivity, soil limitations and limited market prospects for the food crops produced. Irrigation-based resettlement, on the other hand, requires a high capital cost and a long development because of the inherent problem of high water requirements for the newly established paddy type projects. This issue still needs further research.

Swamp reclamation schemes on the other hand, have good prospects but also require careful studies of the agricultural prospects and the human settlement environment. Tree crop development and cash crop systems also have good prospects, but the tree crops require a long time to become productive and also great skill in the post harvest operations, including secondary processing, storage, and marketing. Increasing production and reducing marketing constraints -- including crop diversification and encouragement of poultry, livestock and fish ponds operations -- are basic requirements for sustainable agriculture. This, however, is not just time consuming, but also requires active participation by the farmer.

With continuous financial constraints, the danger persists that the transmigration programs of the future will be dictated by a higher priority on the number of settlers than on the quality of the resettlement. Such a resettlement implementation could not be expected to achieve a self-sustainable level of development. Moreover, a resettlement implementation that aims at achieving rapid results will lack the required capability to properly plan, implement, monitor and evaluate the resettlement projects which is essential for their success.

Proper planning of the transmigration is crucial. It should ensure that agro-ecological conditions in the transmigration sites are well suited to food crop production especially since land availability will be a serious constraint in future resettlement programs. For instance, resettlement areas in some provinces of Sumatra are already fully occupied and only limited prospects remain for large-scale settlement. There is still an opportunity for large-scale settlements in West, Central and East Kalimantan albeit with some limitations imposed by forestry constraints. In Irian Jaya, the prospects for resettlement are still considerable provided that due consideration is given to social and environmental constraints.

The social dimensions of transmigration have in the past been studied in a relatively narrow context. Because of the interaction between the social and technical problems it is essential to use an integrated approach, incorporating the social aspects in conjunction with the technical and economic dimensions of the development projects.

Land allocation for transmigrants is another aspect from which a number of problems arose in the past. Because of the urgent requirement to resettle people as soon as possible, the masterplan for the future land use in the resettlement area was frequently modified or abandoned. In these cases, human settlement tends to cause an imbalance between the productive functions and the ecological aspect of the land. Additional land allocation problems stemmed from the fact that the government did not immediately provide security of land tenure upon settlement.

Furthermore, without adequate pre-resettlement preparation by the implementing agency, transmigrants encounter undue stress upon arrival at the site, which retards their development activities.

The interdisciplinary nature of the transmigration program requires intensive interagency coordination. Various mechanisms have been established in the past for this purpose. It is apparent, however, that future transmigration programs require these mechanisms to be further strengthened so as to accommodate better interagency coordination especially for site preparation, movement of settlers and for the technical assistance after the transmigrants arrive at the site. Without such improvement, the interagency coordination will not be capable of successfully administering and controlling spontaneous settlement. Such control is necessary to prevent jeopardizing the proper balance of land use, social impact and the level of productivity.

Monitoring and data collection have been lacking in the past which makes it difficult to correct mistakes and to learn from them. A wide range of surveys and data collections are necessary for planning and policy formulation and to uncover hidden problems which in the past have often lead to erroneous conclusion. For future transmigration resettlement, the problems of research and extension capacities of personnel are still significant. Without adequate attention to strengthening the research and extension capacities, transmigration projects will continuously suffer from unresolved problems, from poor coordination and from inability to learn from experience.

CHAPTER FOUR

IRRIGATION DEVELOPMENT IN INDONESIA, PROBLEMS AND PERSPECTIVES

CHAPTER FOUR

IRRIGATION DEVELOPMENT IN INDONESIA, PROBLEMS AND PERSPECTIVES

4.1 INTRODUCTION

Irrigation has been practiced in Indonesia for hundreds of years, yet current development is still encumbered by several problems. These problems are mostly related to the disparity between modern technology and the traditional practices of the rural population. As a result, many irrigation projects that were undertaken in the recent past have not reach their planned objectives.

Like many other developing countries, the planning policy for irrigation was focused primarily on short range technological solutions to serious subsistence problems. As a result the far more difficult problems of long term implementation and appropriate water management at the farm level were neglected. These problems are the subject of discussion in this chapter.

The critical part of a new irrigation development is usually the farm level implementation. This is called in Indonesia the "tertiary irrigation" system, with the first and the second irrigation system, referring to the large civil engineering works of providing the main and secondary canal system that conveys the water to and over the irrigation district.

There is usually no problem with the engineering aspects of irrigation development in Indonesia because of the advancements in technology and skill in this field. Indeed there are some classic engineering mistakes that have been made in transmigration areas. It is the water management at the farm level which is decisive for the success or failure of irrigation projects. It is therefore essential that at the farm level of irrigation implementation, engineering practice and solutions are matched with, and incorporated into, the practices of the local community so that they form a coherent whole with the existing traditions, behaviors, beliefs and social values.

Such problems of irrigation implementation are more apparent in the new transmigration areas. This is to be expected. First, the farmers are relatively new in the area, so they will need time to make the necessary adjustments in terms of farming conditions and resettlement adaptation. Second, the transformation of the new settlers, many some of whom have no farming experience, into experienced farmers takes time since it takes place through a gradual process that transforms traditionally managed farm practice into more modern agricultural enterprises that are under the control of agricultural irrigation authorities. Third, the provision of irrigation water has been traditionally perceived by farmers as merely a government undertaking aimed at serving the people; therefore, such farmers tend to wait passively for the government to provide the entire irrigation infrastructure on a free-of-charge (no-charge) basis. Finally, the transmigrants are often from different ethnic and societal backgrounds, which is a barrier to immediate integration in the newly established community.

The present chapter addresses the problems of irrigation implementation at the farm level against the background of the newly settled transmigrants. The issues encountered here are of crucial importance in an assessment of the irrigation-based transmigration and the problems experienced with it in Indonesia. Yet these same problems have often been overlooked by the agencies that are responsible for the resettlement.

4.2 AN OVERVIEW OF IRRIGATED AGRICULTURE

4.2.1 GENERAL

With Indonesia being an agrarian-based country, irrigated agriculture has always been highly important to its development. The Indonesian Government, therefore, encourages through The Five Year Development Plans (REPELITA), the development of irrigation systems where this is feasible.

According to the 1980 statistics, about 58% of the low-land paddy fields have been provided with irrigation facilities while 37% of the fields are rainfed. Only 3% of the rice is grown in swamps and 2% in tidal areas. Of the

58% irrigated lands, 45% is served by fully technical irrigation, and 20% by semi-technical irrigation; the remaining 35% is supplied by non-technical irrigation (simple irrigation) that is provided by the farmers themselves.[▹21] *Table 4-1* gives the general pattern of irrigation areas for low land paddy in Indonesia in 1980, making a total of about 7.9 million ha.

From *Table 4-1*, it is evident that irrigation development in Indonesia has its highest concentration on Java, followed by Sumatra which has about 30% of Java's irrigation area. These statistics and the relative size of the islands suggest that there is more irrigation potential in the Outer Islands that could be developed in the near future.

According to the agricultural census of 1983, there has been a significant increase in the amount of irrigated area since 1963. Most of the increase (66.8%) took place on Java. The 1973 census also indicates that out of a total of 190,456,900 ha of Indonesia's land mass, 13,463,906 ha (7.07%) was agricultural land. About 30.5% of this agricultural land was provided with good irrigation facilities.

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21 ▹ *BPS, Agricultural Census 1983 (Preliminary report), and DGWRD, Ministry of Public Works (Unpublished Report, 1984).*

Table 4-1, Low Land Rice Cultivation in Indonesia (1983)

Region	Irrigated rice (ha)	Rainfed rice (ha)	Swamp rice (ha)	Tidal rice (ha)	Total (ha)
Java	2,766,666	1,136,399	58,642	29,283	3,500,912
Sumatra	962,605	947,570	219,059	119,191	2,248,425
Kalimantan	188,218	708,814	60,468	117,897	1,075,397
Sulawesi	388,102	328,103	10,032	9,352	735,589
Bali and NTB	307,100	74,805	1,100	1,571	384,576
Indonesia	4,122,691	3,195,631	349,283	277,294	7,944,899

Source: BPS, Agricultural Census, 1983; and DGWRD, Ministry of Public Works, (Unpublished Data, 1984)

4.2.2 RECENT TRENDS OF AGRICULTURAL DEVELOPMENT IN INDONESIA

Present irrigation projects in Indonesia, with some minor exceptions, are nearly all aimed at increasing food supplies through extending and intensifying paddy rice cultivation, whereas elsewhere in the world, irrigation has mostly been provided to support commercial farming, Yet, agricultural development in Indonesia also plays a very important role in supporting the economy of the country.

In the 1950s and early 1960s, the rate of growth of Indonesia's agricultural production was the slowest amongst the Asian countries, even slower than many countries in Africa and Latin America.

By the 1970s, however, a remarkable acceleration in agricultural development had started in Indonesia. The increased role of agriculture in the economy was even more striking against the background of remarkable improvements in international trade as a result of the oil boom *(Booth, 1988:1)*. In 1973, the agricultural sector contributed about 40% of the national domestic product.

In the same period, however, about 65% of Indonesian citizens were directly engaged in agricultural activities. This indicates that the per capita income from the agricultural sector was relatively low compared to the revenues from the non-agricultural sector *(see Table 4-2 for further details)*.

Between 1975 and 1985, Indonesia's growth in cereal production per capita was the second highest in Asia after Burma *(FAO, 1985:v39)*. As a matter of fact, Indonesia was awarded a special recognition by the Food Agricultural Organization (FAO) at its 40th anniversary in Rome in 1985, for its remarkable agricultural achievement since the early 1970's.

Table 4-2 Comparison of National Domestic Product of Indonesia in: 1939, 1960, 1969, 1973 and 1989

Sector of the economy	Gross Domestic Product				
	1939 (%)	1960 (%)	1963 (%)	1973 (%)	1987 (%) ■)
Agriculture	61.00	54.00	52.00	41.00	25.50
Industry	15.00	8.00	9.00	9.00	13.97
Mining	-	4.00	4.00	9.00	13.14
Others	24.00	34.00	35.00	41.00	47.39

Source: DH. Penny, as quoted by Mubyarto, 1977:12

Notes: ■) Indonesian Ministry of Information, 1989:60-78

4.2.3 IRRIGATION DEVELOPMENT APPROACH

Prior to 1965, irrigation systems in Indonesia were not maintained properly due to a severe economic recession and political instability. As a result, irrigation efficiency quickly deteriorated.

To solve the problem, a rehabilitation policy that set a high priority on the water delivery to irrigation schemes that had previously deterioratedwas instituted. This policy was meant to speed up the recovery of irrigation systems. Under this program some 1.2 million hectares of existing systems were rehabilitated within about sixteen years (1969-1985), *(DOI I, Directorate General of Water Resources Development, 1980).* The results of the development can be seen in *Table 4-3* which presents a comparison between irrigation areas before and after the rehabilitation program.

Table 4-3. Irrigation in Indonesia in 1966 and 1989

Irrigation Scheme	Java and Madura (ha)	Other Island (ha)	Total (ha)
Technical Irrigation:			
1966	1,430,000	274,000	1,704,000
1989	1,977,040	724,725	2,701,765
Semi Technical:			
1966	457,000	301,000	758,000
1989	393,295	878,177	1,271,472
Simple Irrigation:			
1966	920,000	415,000	1,335,000
1989	399,620	446,928	846,548
Total			
1966	2,807,000	990,000	3,797,000
1989	2,769,955	2,049,830	4,819,785

Source: (1966) = Framji, I.k. Mahajan, ICID, 1969
(1989) = DOI I, DGWRD, Report, April 1989

From the development figures presented in the table, it is evident that besides the achievement of additional areas from new irrigation development, a transformation in irrigation classification also occurred. Under the national irrigation rehabilitation program, much of the simple irrigation was transformed to technical irrigation.

Upon the successful achievement of irrigation development and rehabilitation, the government of Indonesia shifted more attention to the operation and maintenance aspects. However, in the early implementation stage in 1979, the operation and maintenance program was hampered by a lack of funds. The government then gradually increased the operation and maintenance budget from about US$2.00/ha in 1979 to about US$10.00/ha in 1985 *(Soenarno, in Rydzewski, 1989:871)*. The latter larger amount is, however, still considered to be inadequate to attain an optimum irrigation efficiency.

While a number of important advantages were realized through implementation of the irrigation development strategy, some negative lessons were also learned from the massive developmental efforts. Most significantly, the development was not applied systematically, owing to the urgent need to achieve tightly schedules ad-hoc targets. Hence, less attention was given to a systematic approach to engineering and coordination problems. The ad-hoc implementation was often accompanied by a tendency on the part of the government officials and the consultants in their employ to measure the success of irrigation projects from a physical perspective only instead of in terms of the ultimate social goals of the irrigation projects.

Learning from the positive and negative

consequences of irrigation development approaches in the past, Indonesia has now been trying to implement a new policy which focuses on the efforts of sustaining the already available irrigation infrastructure through effective operation and maintenance.

With the new development policy, the main effort is now geared towards the introduction of an efficient operation and maintenance strategy through increased reliance on institutional strengthening and effective inter-agency coordination. Among the approaches that are pursued to attain sustainable operation and maintenance of irrigation facilities under the new policy, at least four received high priority:

(1) To encourage "the sense of belonging, of participation and of responsibility" on the part of irrigation water users the small schemes were gradually handed over them for subsequent operation and maintenance with a minimum of interference from the external institutions. The handing over starts with irrigation schemes that have a service area less than 150 ha. This process was later expanded to schemes with a command area of less than 500 ha. The major projects which require a high technical proficiency in their operation and maintenance will not be handed over to the farmers.

(2) To increase the sources of the funding needed for more reliable operation and maintenance, a production-related

contribution is levied from farmer. It is referred to as an "irrigation service fee[▷22]" rather than a "water charge".

(3) A judicious programming, budgeting and control system is established and implemented through systematic financial management. Systematic budgeting allows the irrigation infrastructures to be operated and maintained by means of a constant provision of materials, facilities and skilled personnel so that a self sustainable operation and maintenance is achieved and a high irrigation efficiency is maintained.

(4) A special maintenance program is implemented that aimed at improving existing systems (including supporting facilities, such as offices, housing, communication systems etc.) to the point that the system becomes capable of maintaining its function at a specified level of performance.

4.2.4 LAND HOLDING PATTERN IN INDONESIA

Agricultural practice in Indonesia is primarily shaped by very small land holdings. Under these conditions,

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22 ▷ *The farmers have been accommodated by the traditional perception that irrigation water is a natural resource bestowed by Almighty God, and should be utilized at the maximum without having to pay a water charge. The introduction of "irrigation service fee" is upholding a principle that the water users are not paying for water, instead, they only contribute a "service charge" for sustaining irrigation-schemes, because the water will never serve the farm land without being regulated.*

most of the agricultural production is consumed by farmers and their families. (Some of the land holdings are even too small to provide an adequate livelihood for the land holder.) Thus, unlike much farming in the developed countries, farming in Indonesia is aimed at providing a stable family income rather than at maximizing profit.

According to 1973 statistics, there were 14.3 million agricultural enterprises in Indonesia, including 1.9 million local cattle breeders. The land holding distribution of agricultural enterprises is presented in *Table 4-4*. This

Table 4-4 Agricultural land Holding Pattern Across Indonesia

Land holding Category (ha)	Number of land Holders (in thousand)	Percent
0.10 - 0.49	6,561	45.7
0.50 - 0.99	3,554	24.7
1.00 - 1.99	2,598	18.1
2.00 - 2.99	853	5.9
3.00 - 3.99	336	2.3
4.00 - 4.99	164	1.2
5.00 - >	307	2.1
TOTAL	14,373	100.00

Source: Central Bureau of Statistic, Agricultural Census, 1973 table shows that the size of the holdings is indeed small, the largest land holding category (45.7%) consists of farms that range from 0.10 to 0.49 hectare in size. This means that almost 46% of the farming families had less than 0.50 ha of agricultural land. Only 2.1% had more than 5 ha, while the national average was only 0.98 ha per holding.

The average land holding in the Outer Islands is considerably larger than the average figure of the Inner Islands, as can be seen from *Table 4-5*. This table shows

Table 4-5 Size of Land Holdings Across Indonesia

I S L A N D (Region)	Average Size (ha)	Number of Land Holdings (in thousand)	Percent
Java and Madura	0.64	8,655	60.80
Sumatra	1.34	2,846	19.80
Kalimantan	2.71	689	4.80
Sulawesi	1.52	1,102	7.70
Nusa Tenggara	1.37	951	6.60
Maluku	2.17	120	0.80
INDONESIA	0.98	14,373	100.00

Source: BPS. Agricultural Census, 1973

that land holdings in Kalimantan are the largest, with averages of 2.71 ha per holding; while on Java they were the smallest, averaging 0.64 ha per holding.

Comparison of land holding statistics of 1963 with those of 1973, show quite clearly that within a period of ten years, the number of land holding units increased from 12.1 million to 14.3 million (about an 18% increase). For the same period of time, the average size of land holdings decreased from 1.05 ha to 0.98 ha. in 1973. This trend indicates the impact of land fragmentation, which has also caused a substantial increase in the number of holdings in the category between 0.10 - 0.05 ha, a size which is not viable from an effective agricultural point of view. It could be argued, however, that that it is not size land holding *per se* that is the problem since land quality varies greatly.

Unfortunately, the data do not distinguish between land owned by farmers and land owned by absentee land owners. It is, therefore, not possible to show how much land ownership has moved from farmers to non-farmers because of socio-economic change.

Nevertheless, the above statistics give a strong indication that the problem of land holding size has become increasingly more important. The change in land holding size has a negative economic impact on irrigated agriculture. Moreover, with a smaller size of holdings, more farmers are involved in farm level water management and hence water distribution practice will be more complicated. These trends towards land fragmentation should not be disregarded or overlooked, and should be included in the design considerations if implementation of irrigation systems is to be successful in the long term.

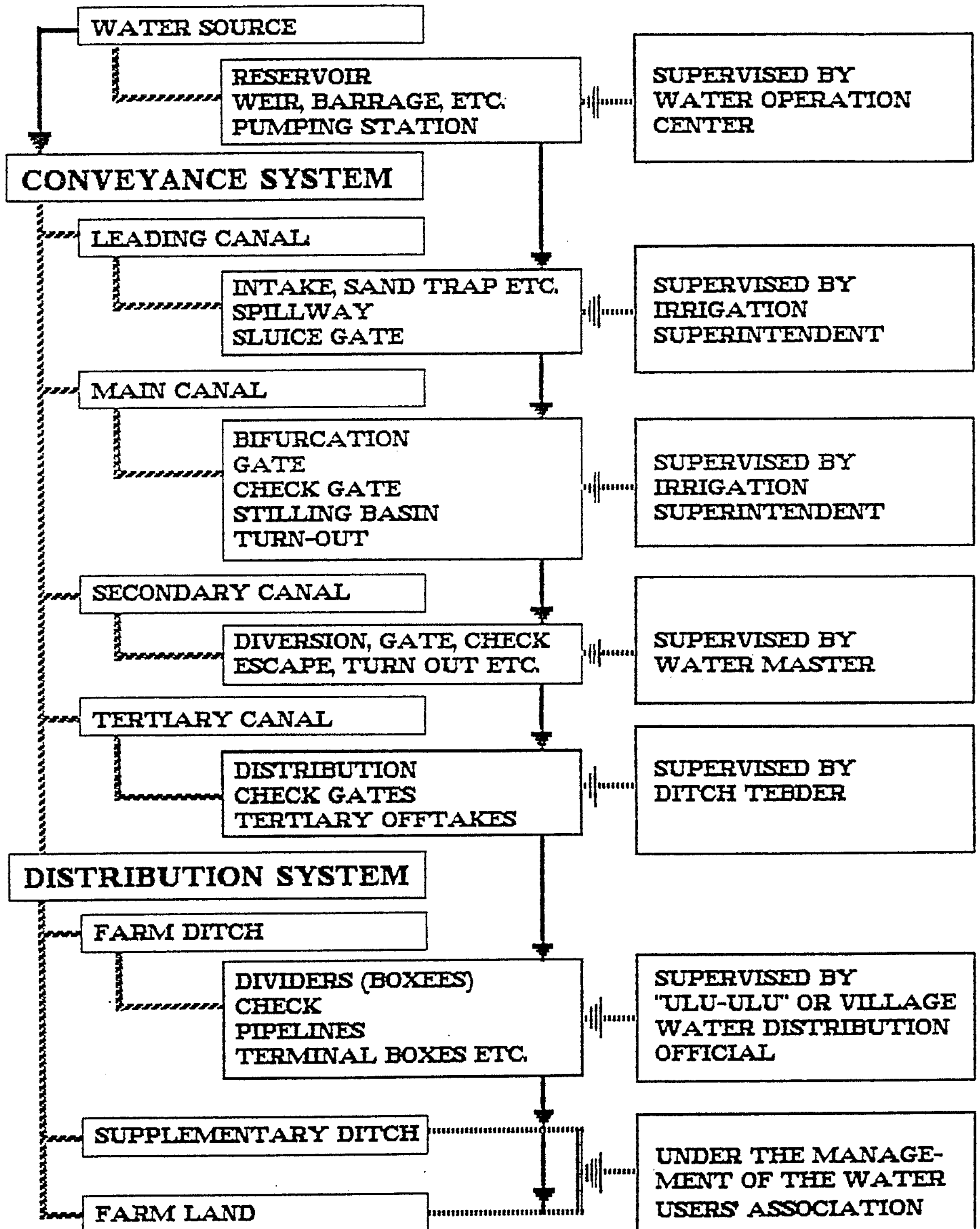
4.2.5 DEVELOPMENT OF THE TERTIARY IRRIGATION SYSTEM

A. The Context

Figure 4-1 shows schematically the water delivery management system that is typical for Indonesia. Two main components can be distinguished: the conveyance system and the distribution system. The conveyance system consists of a leading canal, main canals, secondary canals and tertiary canals, while the distribution system consists of farm ditches and supplementary ditches on the farm lands.

From the point of view of water management by the Irrigation Agency, the conveyance system is commonly divided into three main categories: (1) the main canal system, (2) the secondary canal system, and (3) the tertiary canal system. The Provincial Irrigation Agency is responsible for the management of the water from the sources down through the leading canal, the main canals and secondary canals until it reaches the tertiary turn-outs. The water management beyond the tertiary turn-outs is the responsibility of the farmers themselves and is carried out

Figure 4-1. WATER DELIVERY MANAGEMENT SYSTEM



through an organization called the "Water User Association (WUA)".

The water management at the tertiary turn-outs, which is usually referred to as the tertiary or "farm level water management", plays a very important role in the failure or success of irrigation water management. It is at this crucial level that sound agricultural irrigation practice is to be realized. For at this tertiary level, the efforts of all agencies involved in irrigated agriculture are confronted with actual farm practice and must be blended judiciously with tradition in terms of engineering and economics, as well as culture and policy.

It is a common, but nevertheless a serious mistake, to focus attention entirely on the major technological and economic aspects of the development and to overlook the importance of the problems encountered at the tertiary irrigation level.

B. Problem of Tertiary Irrigation Level

The tertiary irrigation system with its canals and related structures is the last part of the irrigation distribution network. Its task is to convey water from the diversion gates of the primary or secondary canals to the farm blocks. A tertiary canal is typically assigned an irrigation service area of about 100 hectares. In other words, the tertiary system is the smallest unit of an irrigation scheme, consisting of canals, structures and other appurtenant facilities that serve a single block of farm land with a command area of about 100 ha on average *(see Figure 4-2 for a general illustration).*

Within each farm block there is a network of smaller canals that branch from a tertiary canal. This network forms the so-called "quaternary" irrigation system. From there the water goes directly into farm ditches.

During the early periods of irrigation development, the farmers themselves were wholly responsible for the tertiary irrigation network and its related structures. Construction, as well as operation and maintenance has to be undertaken by the farmers themselves in the mutual aid or *"gotong-royong"* system.[▷23] The government provided the main and secondary systems starting from the weir in the river up to the tertiary turn-out. The rest of the irrigation works at the tertiary level were constructed by the farmer, albeit with continuing technical guidance from the government officials. A number of serious problems were encountered with this method of implementing the tertiary irrigation development.

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23 ▷ *The construction of tertiary irrigation schemes under the* "Gotong-Royong" *or mutual aid system was initiated by the Dutch Colonial Government in the early stages of irrigation development in Indonesia. The agricultural tools for conducting the tertiary construction works were included in the packages that the farmer received from the government as part of the Colonization Program.*

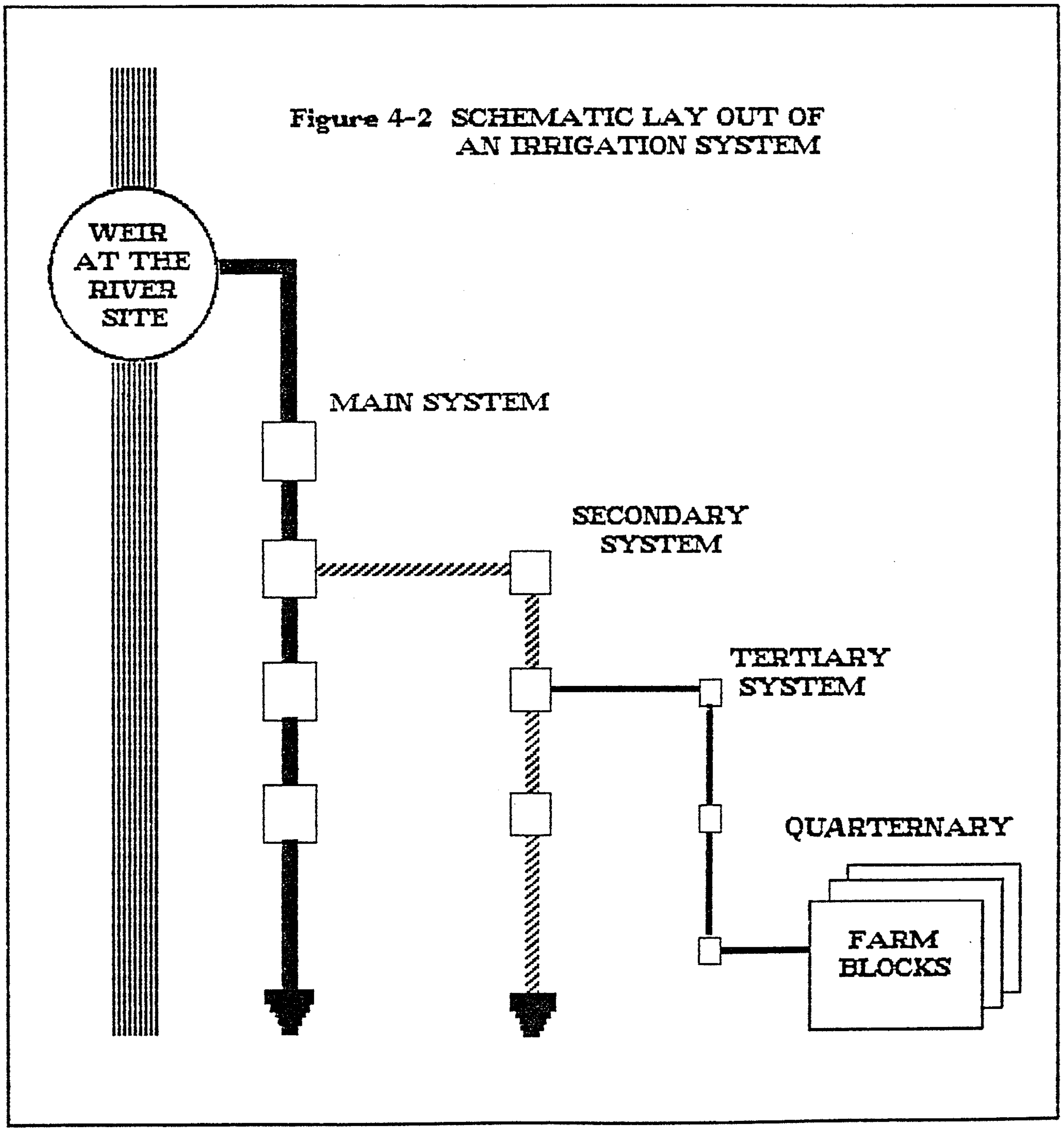

Figure 4-2 SCHEMATIC LAY OUT OF AN IRRIGATION SYSTEM

One of the most difficult problems was the excessive "water-requirement" for the first few years of land development in the newly broken-in agricultural land. Whelburg (1935), noted that the water consumption in such a newly established areas was recorded to be several times greater than the requirement for the developed areas. The the newly broken-in agricultural lands are mostly very porous so that irrigation water will continuously penetrate the soil until an impervious layer below the root zone of the plant is formed. The process of formation of impervious layer is the result of an accumulation of fine soil particles which are transported to the root zone by irrigation water seepage. This process will continue until the soil has become completely stabilized. The time it takes is determined by the soil characteristics and the rate and frequency of the irrigation application. It may take the water requirement ten years to become completely stable.[▷24] The farmers themselves were thus faced with the extremely difficult problem of constructing and operating the tertiary system so that it could cope with the varying water demand.

Another problem was related to the size of the area

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[24] ▷ *The normal water requirement at the stable condition was recorded by Whelburg in the Tataan Colonization Area, South Lampung at about 0.9 liter/second/bahu, or about 1.26 liter/second/ha. (1 ha = 1.41 bahus). This figure is much lower than the maximum requirement at the early phases which was as high as 5 lit./sec./bahu or 7 lit./sec./ha.*

to be served by a tertiary canal. Most tertiary canals were designed to serve a relatively large area, in the range of 300 to 400 ha. As a result, the tertiary canal was often more than 5 km long, which made it difficult for the farmers to participate effectively in the mutual aid program that was essential for the construction of the tertiary canal. In addition, the construction of large tertiary canals, especially with a deep cuts or high embankments, was a very difficult undertaking for the farmer. Upon completion, farmers found it difficult to operate and maintain such a large canal; as a result the tertiary development often lagged behind the planned schedule.

In the 1970's, the government tried different approaches to accelerate the tertiary irrigation development. A special tertiary irrigation development program was set up to provide technical assistance to farmers, as well as materials, tools and food. The project typically constructed 50 meters of canal in the upper reaches of the tertiary turnouts. This gave the farmers a direct example of proper canal construction. It was expected that, with this example and further guidance, the rest of the tertiary canals would be constructed by the farmers themselves. The results, however, were less than encouraging; the progress of tertiary irrigation construction remained quite slow.

Eventually, the tertiary canal development was

CHAPTER THREE

TRANSMIGRATION RESETTLEMENT SCHEME IN INDONESIA AND ITS IMPLEMENTATION

taken over by the government and included in the contracts for the irrigation projects because of the farmers could not perform the work themselves. This was not an ideal solution either. In many cases farmers came to regard the tertiary development entirely as a government undertaking and were reluctant to participate in it. Not having a sense of ownership fostered an attitude of dependency that manifested itself also in a tendency to ignore the necessary operation and maintenance activities for which the farmers remained responsible.

C. The Irrigation Committee Structure

To establish proper working relations between all who are involved in water management at the tertiary level and farm level, Irrigation Committees have been established in most provinces and regions in Indonesia.

The way this committee structure works is as follows. At the grass-roots level, farmers must organize themselves into small groups called *"bloks"*[▷25] to perform the daily activities of irrigation water management. These *bloks* are further organized into a larger group to form an independent Water User's Association. The latter group is

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[25] ▷ *The farmers' groups under one village administration are organized into a body called the village block, chaired by a member, called* **"ulu-ulu vak"**, *who is responsible for operation of all tertiary irrigation structures.*

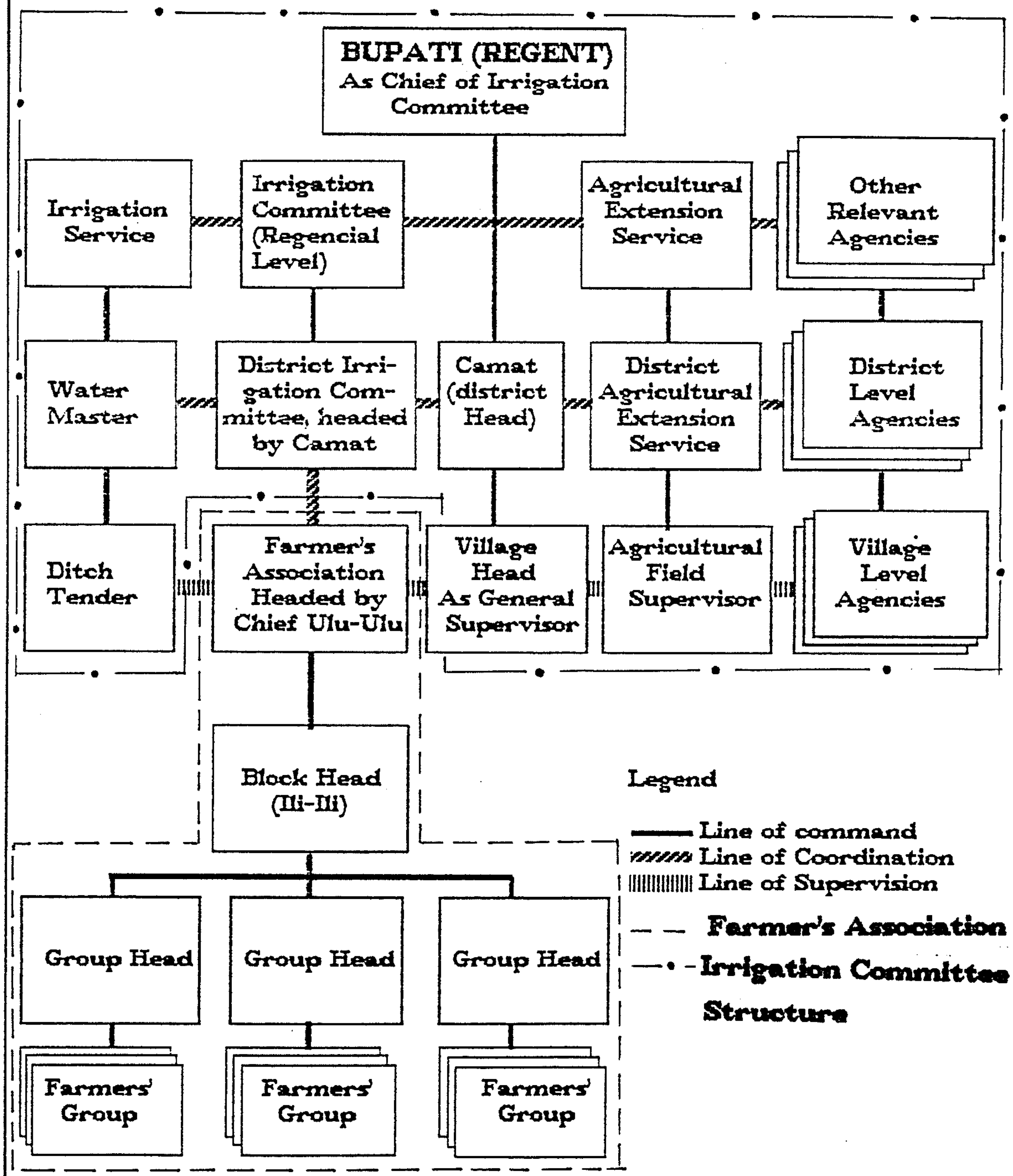
sufficiently independent to act on their own initiative and to make decisions without involvement of external organizations, including the government.

With this type of organization, the government only supplies farmers with the necessary guidance, technical assistance and continuous supervision to make sure that the operations are in accordance with the expected plans. The inter-agency relationship must be interconnected to form a working mechanism. It is coordinated by the chief of the local government, an administrator called the "Bupati" (see *Figure 4-3*).

Each government agency involved is responsible for giving technical guidance under the coordination of the *"Bupati"*. In the inter-agency working relationship, the *Bupati* functions as the chief of the Irrigation Committee, assisted by the Chief of the Irrigation Agency as the executive secretary of the committee. Members of other agencies such as the Agricultural Extension Service, the Cadasteral Agency, the local police, and the Rural Development Agency also serve as executive members of the Irrigation Committee. At the base of this organization, the farmers, as irrigation water users, perform their activities with consistent guidance from the organization's executive.

Through such a coordinative body, farmers are mobilized to undertake tertiary network construction and to organize the operation and maintenance of those facilities.

Figure 4-3 SCHEMATIC CHART OF INTERAGENCY WORKING RELATIONSHIP FOR THE WATER MANAGEMENT



Once the elected president of a farmer's organization decides to undertake a certain activity, the members organize themselves into working groups to perform these responsibilities. The introduction of new techniques in irrigation application follows the same principle. After the technique has been accepted, the leader of the organization approaches a selected farmer (key farmer) to apply the new technique. The leader and the selected farmer then explain the newly introduced technique to the rest of the farmers.

At the level of the water user's association, the *blok* would ideally consist of 10 to 12 farmers, with a total land area of not more than 15 ha for the group. It was found that a *blok* that consists of more than 15 farmers, or that has a total farm land of more than 15 ha, is in fact difficult to organize.

4.2.6 PROBLEMS AT THE FARM LEVEL IMPLEMENTATION

Numerous and diverse problems may hamper the implementation of irrigation at the farm level. Some are situation specific but others are of a general nature. The most important ones in the latter category will be discussed here since they most often stand in the way of a satisfactory development. They are: the inadequate economic strength of the irrigation farmer, the uncertainty of land tenure, the problem of absentee ownership, the negative attitude to innovation in agriculture, and the water deficiency problem for newly broken land.

A. The Farmer's Economic Position

The most obvious problem that will hinder achievement of the irrigation objectives is the lack of economic capacity of the farmer to undertake what is required to make full use of the irrigation potential.

A socio-economic study, conducted by the Bogor Institute of Agriculture and the Way Seputih (World Bank Assisted) Irrigation Project in 1970, concluded that farmer's income coming from agricultural activity constitutes only about 22% of his gross income *(IPB, 1970)*. Most of the farmer's income was earned from a non-agricultural activities, such as food retailing, day-labor, hunting, and a few apprentice jobs.

It was found that low income made the introduction of new technology or better irrigation practice nearly impossible. The fact that farmers were still expected to undertake tertiary network construction made the situation even more difficult. The farmer and his family need adequate financial support during the land development phase and until the first crops are harvested and the farmer has become well established.

The transformation of land from non-irrigated uses to new paddy fields sacrifices one cropping season which means that the farmer must engage in other work to compensate for lost income. Also, the first paddy crop under low-land irrigation conditions is often disappointing. This explains why farmers are often unavailable to participate effectively in the irrigation related activities which they are expected to perform. This condition in turn retards the development. If this situation persists, the irrigation objectives will never be achieved since the farmer is unable to undertake the necessary land development for his farm, even if irrigation water for his fields is available.

B. Land Tenureship Problems

Another significant problem, which often hampers the implementation of irrigation at the farm level, is that land tenure is often not legally certified by the cadasteral administration, particularly in transmigration areas. The problem stems usually from early stage land allocation without issue of land ownership certificate or clear demarcation of ownership. This condition tempts other people to claim land tenure, especially when the land becomes more attractive due to its increasing value. After some unsuccessful attempts to settle land disputes, farmers with similar tenureship status were hesitant to cultivate their land for fear of other claimants of their land. For the same reason, those farmers are reluctant to perform mutual-aid or *gotong-royong* work such as the construction of tertiary network canals or conducting proper maintenance of irrigation facilities at the farm level.

The basic problem is that cadasteral land surveys are costly and require considerable time. Thus they lag seriously behind the resettlement activities. Unclear physical boundaries of village government administrations have also inhibited the mobilization of people for tertiary irrigation construction or facility maintenance under the mutual aid or *gotong-royong* system. Villagers are not willing to construct or maintain irrigation facilities that are located beyond the administrative boundary of their village.

In an attempt to solve the land tenure problems, the Irrigation Committees have attempted to established a more effective coordination between the villages that are involved in irrigation areas where problems of unclear administrative boundaries exist. Similar efforts have also been made to solve the problem of mobilizing people to support irrigation schemes which extend over more than one government administrative unit. In some instances, the coordinative approach has produced tangible progress, while in other places similar efforts have not been successful. It is apparent that standardized approaches cannot be used for heterogeneous village communities. The failure or success of coordinative efforts in irrigation management depends on a sensible approach by the agencies which must take local circumstances into consideration.

C. Absentee Land Ownership

Absentee land ownership ▷[26] in irrigation districts hinders the progress of tertiary irrigation construction as well as land development for new paddy fields. Most absentee land owners are better off than the average farmer. They are usually employed in non farming activities and are living in the cities or in the urban areas. The cultivation of their lands is done by landless farmers through a share cropping agreement.

Landless farmers, who are cultivating the lands on behalf of absentee owners, are generally unwilling to participate in mutual aid for project maintenance. They insist that the obligation to perform such tasks is the responsibility of the land owner.

Learning from previous experience, the government agencies in charge of land ownership have made preliminary attempts to minimize land ownership by non-residential farmers. At the same time, agencies are also trying to regulate the tenant-owner relationship by obliging owners to make suitable arrangements with their tenant farmers to meet

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[26] ▷ *Absentee land ownership refers to the agricultural land that belongs to an owner who does not reside in the area. Otherwise, it refers to cases where agricultural land is not cultivated by or on behalf of the owners who are officially residing in the area where the land is administered, but for one reason or another, are not settled in the area.*

the development requirements.

D. Water User's Response to Innovation

The introduction of new irrigation techniques presents problems and constraints to people that employ traditional farming practices which they have inherited from their ancestors. Government personnel in charge of introducing new irrigation techniques to water users find that farmers adapt slowly to new conditions. Training activities that are specially prepared for farmers seem to have little effect on their attitude towards adopting innovations.

Through a judicious approach, progress has been made in the last decade in encouraging farmers' participation. The slow adaptation to technological change is not due to an unwillingness to participate, but to a lower level of education and skill. Therefore, it takes time, patience and integrity before government officials are able to persuade traditional water users to adopt new technologies.

E. Water Deficiency Problems for the Newly Broken-in Land

The high water requirements for newly opened irrigated land has been identified as another serious constraint on irrigation development.

When new agricultural land is irrigated, much of the water is lost through seepage towards lower strata. The seepage carries fine soil particles further down and also causes chemical changes in the layers that are traversed. One of the results is the formation of a nearly impervious soil layer below the root zone. Thus the seepage losses are reduced over time and the water requirement then decreases substantially.

It is technically feasible to provide the irrigated land initially with the large amounts of water needed but it is not economically feasible to construct the oversize canals and structures that would be needed to supply that water. The result is that the new irrigation scheme is unable to serve simultaneous water distribution for land development in the entire command area, even though the construction of the scheme has already been fully completed.

Taking an example from the previous irrigation experience in the Way-Sekampung scheme in Southern Sumatra, the peak water consumption rate for newly reclaimed paddy fields was at about 5 l/s/bahu *(Sabikoen, 1966 and Whelburg, 1935)* or about 7 l/s/ha; while the project was only designed to accommodate the normal water consumption rate at an average of about 1 l/s/bahu or about 1.41 l/s/ha. This high rate of water consumption is required for several years, until the impervious soil layer under the root zone takes form *(see Table 4-6 for the general propensity of water requirement characteristics in Lampung Province, Southern*

Sumatra). Whelburg (1935) observed that in some districts the water consumption took about ten years to stabilize *(Whelburg, 1935).*

Table 4-6 Typical Irrigation Water Requirements in Lampung, Southern Sumatra

Year of Land Reclamation Execution	Peak Field Water demand (L/S/ha) *)	Design Configuration (l/S/ha)
First Year	5.00	1.41
Second Year	4.00	1.41
Third Year	3.00	1.41
Fourth Year	2.00	1.41
Fifth Year	1.41	1.41

*) *The figures were developed by the author after some estimation by local irrigation staff, (no exact figures were available).*

The tertiary canals and structures are designed in accordance with the stabilized water requirement such as the typical figures presented in the above table. As a result, the tertiary canals cannot accommodate the necessary water discharge during the temporary high water demand. The question of how to provide adequate irrigation water for new land development will be addressed in the engineering chapter of this thesis.

CHAPTER FIVE

RESEARCH METHODOLOGY

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1. INTRODUCTION

The research in this study is predicated on the thesis that the major transmigration problems encountered in Indonesia are of an interdisciplinary nature and must be resolved by a joint effort of engineers, economists and social scientists. The point is not that there are engineering problems, economic problems and social problems but that the basic problems have social, economical and technical dimensions so that all three disciplines must be involved in the identification, the analysis and the resolution thereof.

To demonstrate this intrepretation, and to develop appropriate tools for handling the interdisciplinary problems, the success of the transmigration in two locations will be investigated by analysing the adaptation of the transmigrants to the new living conditions as it is affected by the economic conditions and the techncal conditions they encounter during the adaptation period. Special attention is given to the technical problem of the greatly increased water demand during the start-up period and to the economic position of farmers as imposed on them by the irrigation system of which they become part.

The research is composed of three major parts. The first is an attempt to measure and quantify the degree of adaptation of transmigrants and to relate this to a set of causative and explanatory factors. The second is an engineering analysis of the consequences of increased initial water demand on the irrigation development and of possible means of coping with this problem by improving the water delivery system for new agricultural land. The third is an economic analysis of the value of irrigation water to the transmigrant farmer.

The research approach is designed firstly to examine, by way of a macro study, land development questions for transmigration and other rural settlement projects, and secondly, on a global basis, to obtain baseline data and an understanding of the issues. Then further analyses are undertaken by means of an interdisciplinary approach which leads to the formulation of problems that relate to two main aspects: first, the improvement of water delivery in developing new agricultural land, and second the proper adaptation of transmigrants to the new agricultural system, to a new social climate and to a new environment. From this baseline information, an in-depth micro-study is then carried out in the study areas by conducting surveys and by applying analytic techniques developed in the macro study.

Data were obtained from two major transmigration projects, one in South Sumatra and one in South Sulawesi.

5.2 RESEARCH INSTRUMENT

Models conceptualizing the issues that are related to the socio-economic impact of transmigration resettlement are still in the developmental stage. Accordingly, well defined models and theories of associated phenomena are not readily available for the testing of a set of ordered hypotheses.

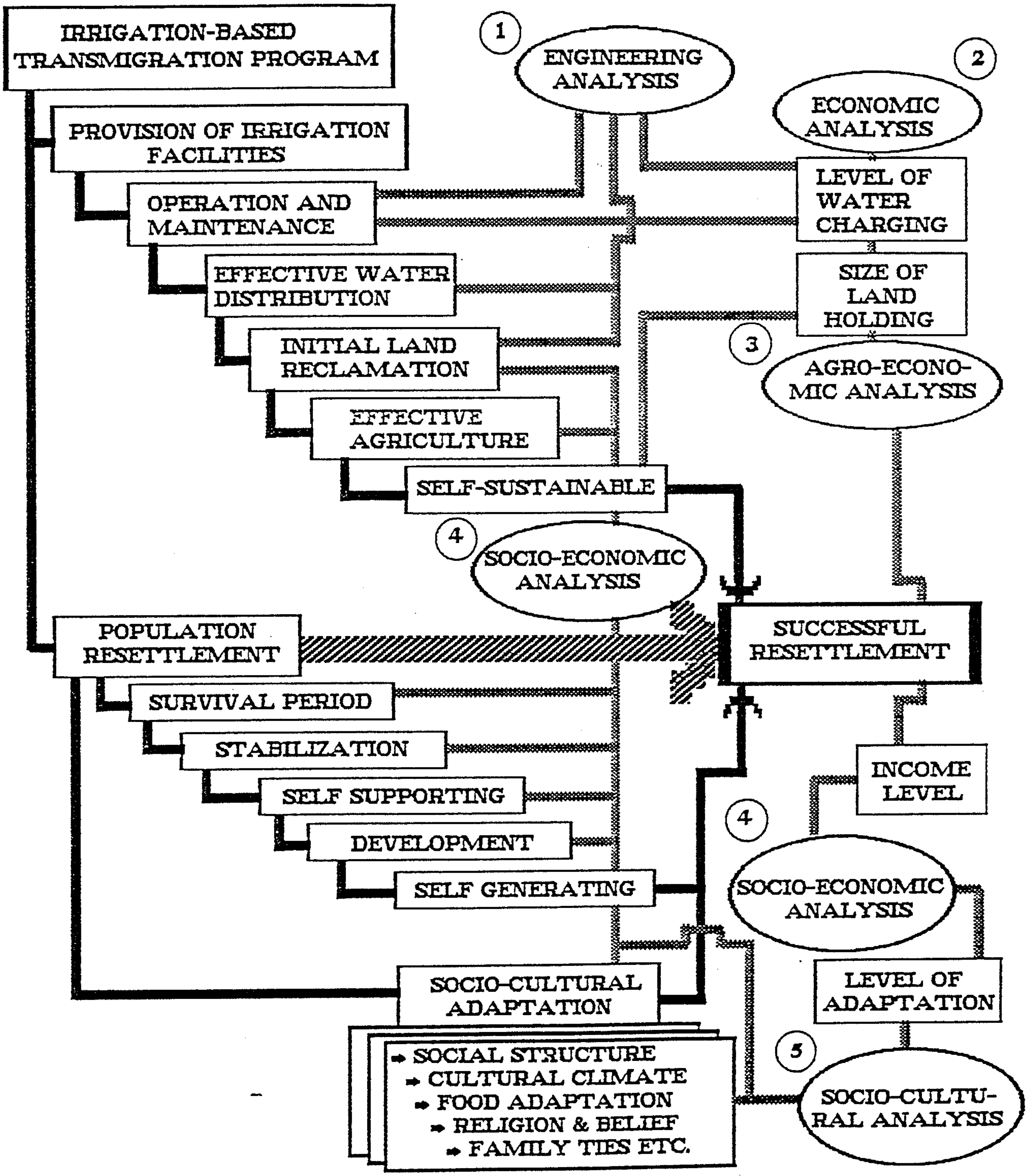
In an attempt to test the relevant hypotheses in an empirical setting, a wide variety of data must be collected about socio-economic and demographic circumstances, about responses and perceptions that are associated with irrigation-based resettlement, and about the dynamics of past experience. The research methodology in this study is complicated by the fact that it employs an interdisciplinary approach, blending analyses related to three disciplines: engineering, sociology and economics as is shown on the schematic chart of *Figure 5-1*.

This figure illustrates the research procedures as follows:

(1) Engineering analyses are carried out for the technical component: project design, water requirement, and water management, in order to investigate technical trends and characteristics.

(2) An economic analysis is conducted to estimate the economic value of irrigation water, and to determine cost

Figure 5-1 SCHEMATIC CHART OF THE INTERDISCIPLINARY STUDY OF IRRIGATION-BASED TRANSMIGRATION PROGRAM



recovery alternatives, taking into account capital investment and available resources for constructing, maintaining, and operating the projects.

(3) An agro-economic analysis is carried out to test the appropriateness of the size of the land allocation for transmigrant farmers, considering their economic conditions.

(4) A socio-cultural analysis is undertaken to test a number of hypotheses with regards to the relationship between social and cultural variables and the success of the transmigration resettlement.

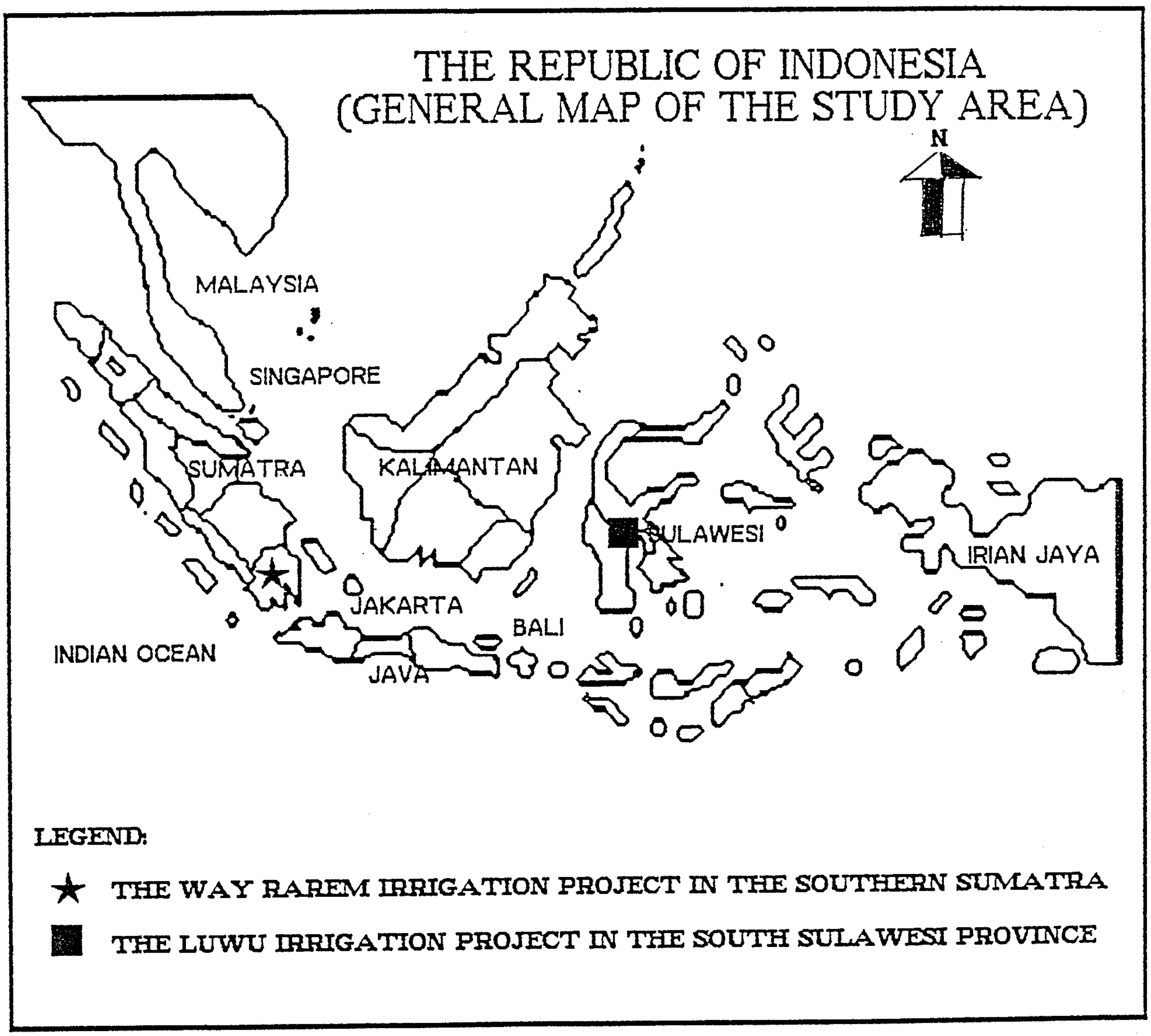
(5) The causal relationship among the levels of income, progress of land ownership status, transmigration status, place of transmigrant origin, irrigation scheme characteristics, adequacy of irrigation water available at the field, and progress of land development are examined through a series of socio-economic analyses.

The methodologies and analyses of these steps of the analyses are explained in the following discussions.

5.3 SELECTION OF SAMPLE SCHEMES FOR THE FIELD STUDY

Two irrigation schemes were selected for a micro-study analysis: (1) the Way Rarem Irrigation Project in Lampung Province, Southern Sumatra, which is located in the western part of Indonesia; and (2) the Luwu Irrigation Project in South Sulawesi Province which is located in the eastern part of Indonesia. *(See Figure 5-2. Location map of*

Figure 5-2.


THE REPUBLIC OF INDONESIA
(GENERAL MAP OF THE STUDY AREA)
N
MALAYSIA
SINGAPORE
SUMATRA
KALIMANTAN
SULAWESI
IRIAN JAYA
JAKARTA
BALI
JAVA
INDIAN OCEAN
LEGEND:
THE WAY RAREM IRRIGATION PROJECT IN THE SOUTHERN SUMATRA
THE LUWU IRRIGATION PROJECT IN THE SOUTH SULAWESI PROVINCE

the study area).

In the selection of the schemes, the following circumstances and rationale were considered:

o *Geographic location.* The Way Rarem scheme is easily accessible from the place of origin on the Inner Islands and has geographic conditions that represent average conditions in the western part of Indonesia. The Luwu Irrigation Project represents the resettlement locations in the eastern part of Indonesia, most of which are not easily accessible from the Inner Islands.

o *Transmigration pattern.* The Way Rarem scheme, implemented in the 1970's, is located in the province where the transmigration program has its start in 1905. The resettlement program there is at various stages; while some transmigrants are already well established, others are still beginning the resettlement process. The transmigrants originate mostly from Java, Bali, and Lombok while others participants are indigenous settlers. Lampung province has recently been closed to new resettlement, while the South Sulawesi Province, where the Luwu Scheme is located, is still open to new transmigrants. The old transmigration resettlement of the Luwu and Way Rarem Scheme has resulted in successful adaptation for some settlers, while new settlers in Luwu scheme are still being introduced to this area.

o *Irrigation condition.* The Way Rarem irrigation project is a single independent scheme with physical and agro-climatological conditions that are typical of the western parts of Indonesia. The scheme is still being developed; however, many completed irrigation schemes in neighboring areas are available for comparative study purposes. The Luwu irrigation project, on the other hand, consists of several independent irrigation schemes with average conditions similar to the irrigation schemes in the eastern parts of Indonesia.

o *Population mobility.* Populations of the Way Rarem scheme area are moderately mobile and occasionally return to their place of origin for a visit. While the transmigrants' mobility in the Luwu scheme is fairly low, there are a number of cases where settlers have returned permanently to their place of origin even after they were economically successful in their new environment *(Otten, 1986)*.

o *Adaptation to the local environment.* The majority of the transmigrants in the Way Rarem irrigation scheme appear to have adapted to the local condition; however, there is an evidence of friction with local people *(Otten, 1986)*. The transmigrants in the Luwu scheme were generally more successful in their adaptation to the local environment; they adapted slowly but with less friction with local people. *(More detailed description of the features related to this question are presented in Appendix 5-1.)*

5.4 DATA SOURCES

Design specifications for irrigation canals and water requirements for developing and sustaining the agricultural land were obtained from the records of the Directorate General of Water Resources Development, Ministry of Public Works in Indonesia. Other related secondary data and information were obtained from relevant institutions.

The primary data to be collected by means of a survey include information on the following: household structures, characteristics of household respondents, migration history, social/economic conditions, response to the engineering, economic and social dimensions of the schemes, perceived prospects and reasoning, interaction with local people, interaction with project management and reaction to the local ecology. In addition, unstructured case study interviews were also conducted in the field with both the transmigrants and the project management respondents.

5.5 DESIGN OF QUESTIONNAIRE FOR OBTAINING PRIMARY DATA

To obtain primary data, a special questionnaire was designed based on previous surveys, seminars and discussions. The questionnaire consists of five parts. The first part is concerned with general aspects of the respondent and focuses on the size of the household, sex, age, birth place, marital status, religion, ethnicity, education, transmigration status, year of migration and residence before joining the transmigration program.

The second part is concerned with agriculture, land use, agricultural inputs and land productivity. The questions focus on previous experience in irrigated agriculture, size of land ownership, location of agricultural land, land ownership status, perception of the significance of having a land certificate, present land use, cropping intensity, crop production, agricultural inputs and the magnitude of agricultural expenditures.

The third part of the questionnaire pertains to circumstances of irrigation water management at the farm level including availability of irrigation water, pre-irrigation ways of life, year of irrigation service, irrigation conditions in the early irrigation stage, continuity of irrigation water, operation maintenance condition and expenses required, water user organization membership, the significance of the water user's association, and problems or opinions about the current condition of irrigation at the farm level.

The fourth part deals with financial conditions and household expenditures, such as non-agricultural income, annual household expenditures and the availability, effectiveness and significance of rural financial institutions. The last part of the questionnaire is concerned with the transmigration history as well as with motivation to join the transmigration program and the individual's adaptation to the program. The questions associated with pre-migration information are as follows: source of information, prospects of joining the program, facilities promised, and decision to participate in the program. Furthermore, the questions are aimed at post-mobilization conditions such as actual conditions of the facilities as compared to the information they previously received, properties at home, communication with their relatives at home, social participation, and availability and conditions of public facilities. At the end of each part, qualitative questions are asked which pertained to problems, comments, or opinions of the respondents on each aspect.

During the pretesting stage, the nature of some questions were found to be repetitive and too complicated for the respondents to understand. These were then deleted or simplified to meet the respondent's conditions.

Some other important aspects which were originally not included in the questionnaire were: the status of land ownership, means of life before joining the transmigration program, effort to rebuild their houses, funds required to rebuild houses and current house conditions by category. Those aspects were later added to the questionnaire since they were considered to be instrumental in determining the relationship between effort expended by the settler and the settler's adaptation to the transmigration program.

The survey questionnaire was translated and conducted in *Bahasa Indonesia*, the official Indonesian Language. To accommodate a small number of illiterate transmigrants who did not understand the language, the survey was conducted through local translators.

Supplementary data and information related to transmigration resettlement were obtained from secondary resources, such as government publications on the transmigration census, feasibility reports, engineering reports, reports on irrigation and agricultural development, statistical reports of the Central Bureau of Statistics of Indonesia, and archival figures, maps and research materials. Some qualitative questions were also asked of resource persons, to confirm quantitative trends which were apparent during the field survey.

5.6 POPULATION SURVEYED

5.6.1 GENERAL

There are several ways of defining "population"; however, in a statistical sense, the term population designates the entire unit to which the survey results are considered applicable (*Moser* and *Kalton, 1977:53,* and *Nawawi, 1987 :140-160, Nachmias 1987:180*). In this study, population refers to all the transmigration households who are resettled and/or assisted fully or partly by the

Government of Indonesia in an aggregate area especially designated for population resettlement, and coinciding within the command area of the irrigation scheme(s) in the study area. The term *target population* refers to the population for which the results are applicable, and *survey population* refers to the population actually covered (*Moser and Kalton, 1977:53, and Nawawi, 1987:141*). In this study, *target population* incorporates all of the transmigrant households occupying geographical space within the irrigation scheme boundary, including the upland (non irrigated) areas where were they referred to. *Survey sampling* is limited only to household *units* located in the particular irrigation areas designated.

Noting the fact that the average characteristic of the transmigrants does not differ much from one place to another within the study area -- having implemented under the small land-holder-- the sample may be assumed to represent the statistical parameters of the population without involving a large number of data. In addition, under the present condition of the study area, taking a large number of samples would be very costly, and yet have not any guarantee of obtaining a better result.

The author, having worked for many years in irrigation areas with transmigrant settlers, selected a random sample of 253 households in the study area. The number was arrived at practical reasons and also by considering cost constraints. Noting the practical reasons mention above, this number was determined without testing its significance by means of quantitative statistical procedure. The 253 households were distributed proportionally by the irrigation command areas covered by irrigation sub-section administration *(see Appendix 5-2)*.

5.6.2 SOME KEY TERMS AND UNITS USED IN SAMPLING DESIGN

The individual household *(rumah tangga)* is used in the present study as the principal sampling unit. In Indonesia, however, the household or *rumah tangga* traditionally consists of a group of persons who are living together sharing the same living quarters and their principal meals. By definition, the household size may vary from a single individual to an extended family. The *rumah tangga* was chosen as the principal sampling unit because the household is the smallest key unit that makes the decision to join or not to join the transmigration resettlement program or that participates as such in resettlement activities. The household also acts as a single decision making unit in the production of goods and commodities.

The respondents in this survey are the household heads or *Kepala Rumah Tangga* as the acknowledged leader of the unit. In case of long-term absence or death of a household head, a substitute, who maintains the household on behalf of the head, was taken to be the appropriate respondent in the study. In some cases, the widow *(janda-ibu rumah tangga)* of a family had been functioning as the household head, and was therefore considered to be the appropriate respondent for the study.

It was decided that the sample irrigation scheme should meet several criteria: (1) it should be an independent irrigation unit (2) it should be settled and farmed by transmigrant or resettled farmers, (3) the command area of the single irrigation scheme should exceed 700 ha, which was the threshold of irrigation size which apply to the water requirement problems identified by the author through previous working experience in the field, (4) the scheme should incorporate different stages of population resettlement and irrigation development. These stages should range from old established and stable areas to newly developed areas that are not yet completely supported by the required irrigation infrastructure, (5) the irrigation scheme should be designed for lowland ponded paddy fields *(sawah)*, and (6) the land should never have been cultivated previously.

The households were chosen within the geographic boundaries of the irrigation scheme, regardless of their affiliation with any local government.

The administration of an irrigation section usually covers a total irrigation command area of around 15,000 to

35,000 ha, depending upon local conditions.[27] Small and medium irrigation schemes (between 500 to 5,000 ha) are usually administered together in one irrigation section, while the large irrigation schemes (over 20,000 ha) are usually divided into several sections. Large irrigation schemes usually fall under more than one local government administration.

5.7 ENGINEERING RESEARCH ANALYSIS

5.7.1 GENERAL PRINCIPLE

Field water requirements for newly established irrigation schemes greatly exceed design requirements that are based on stabilized conditions. This situation creates problems in the initial stages that will impede the physical development of the system. The larger the discrepancy between the initial water requirement and the design capacity, the longer the time that is required for the demand to become stable, and hence, the longer it takes for the irrigation scheme to reach full development.

To analyze this important engineering problem, information was collected pertaining to the actual field

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27 ▷ *This size has been standardized to a degree by the Directorate of Irrigation, Directorate General of Water Resources Development as the proper size of irrigation administration for optimum water management implementation. This standard, however, cannot be applied rigidly because of the wide diversity of irrigation characteristics throughout the country.*

water requirements for each stage of the land development process. Data were obtained from field water distribution records of irrigation schemes in the study areas. In addition, some field tests were undertaken to verify the quality of the records and to evaluate the distribution efficiency of irrigation water that prevails in the areas.

This important information was used to investigate different methods of scheduling the development so as to minimize the adverse effects of the high initial water demand.

5.7.2 THE TECHNICAL ROTATION SYSTEM

It is hypothesized that a step-by-step implementation approach or technical rotation system could be used to obtain a reasonable compromise between the large water distribution capacity that is needed in the initial stages and the time required to complete the land development process.

The total water distribution capacity is determined by the general equation as follows:

$$Q_i = q_i * A \quad \text{....................(5-1)}$$

Where : Q = Total demand, $[m^3/s]$

q_i = Unit demand in year (i), $[m^3/s/ha]$

A = Irrigated area, [ha]

The merit of the technical rotation system will be illustrated with an example that compares it with the system of developing the entire area at once (simultaneous development).

Assume that the irrigated area is divided into five unit areas[▷28] to be developed in rotation, and that the water consumption will decrease to a stable demand after five years of irrigation,[▷29] then the required for simultaneous development in year (i) is given by:

$$Q_i = q_i * (A_1 + A_2 + A_3 + A_4 + A_5 + \ldots\ldots A_n),\ [m^3/s].$$

where A_j = area to be irrigated in sector j (rotation unit) in hectare

n = total number of sectors being irrigated

The water requirement over the successive years with this development procedure is shown in *Figure 5-3*.

With the technical rotation system each rotational

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28 ▷ *Irrigation rotation for flooded paddy fields, in practice, may involve several rotation areas, but applying irrigation rotation to more than five rotation areas is not advisable because it will generate problems for farm level water management.*

29 ▷ *This is based on an example of the land reclamation experience during the early years of transmigration implementation in Lampung, as documented in an unpublished report by Sabikoen, 1966.*

unit will receive irrigation water in accordance with staggered water delivery schedule. The water requirement for the irrigation scheme will then increase gradually, following the increase in irrigated area. After a few years the total water demand begins to decrease in response to the decreased field water requirement until it reaches a stable or normal condition.

To calculate the maximum discharge that will be required by the irrigation scheme in each particular year with this implementation schedule one needs the sequence of field water requirements in successive years after the irrigation has started is needed. The terms in this sequence will be designated q_k where (k) is the number of years the field has been irrigated or $q_{i,j}$ which indicates the field requirement of rotation unit (j) in year (i). Equation 5-1 can then be expanded to:

$$Q_i = \sum_{j=1}^{5} q_{i,j} * A_j \qquad \text{..................(5-2)}$$

Where: Q_i = The required Capacity in year (i), [m^3/s]

$q_{i,j}$ = As previously defined

A_j = The area of rotation unit (j)

Assuming that one rotation unit is added each year,

$q_{i,j} = q_{(i-j+1)}$ when $(i-j+1)$ positive

$q_{i,j} = 0$ when $(i-j+1) \geq 0$

Calculation on the basis of this formulae leads to the water requirement pattern for step-by-step development as shown in *Figure 5-3*.

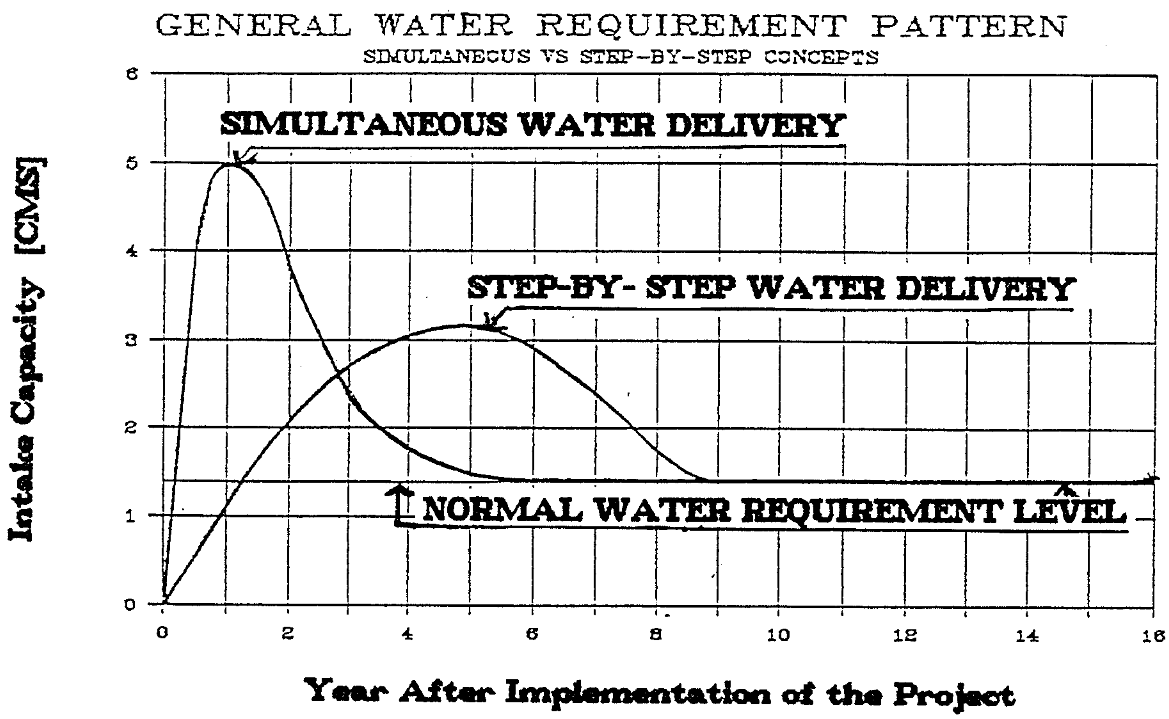

Figure 5-3. Comparative pattern between the simultaneous and the step-by-step development principles

It is clear from Figure 5-3 that all parts of a new irrigation scheme cannot be developed simultaneously on any economically rational basis (They can be physically developed but only at great cost). A gradual or step-by-step development is needed. Even so, it is still clear that both the much larger than normal demand in the early years and the delayed start of the irrigation in parts of the project inherent in the step-by-step method, have important consequences for the ultimate development of the entire project under that type of development.

5.7.3 LAND DEVELOPMENT FOR NEW IRRIGATION

To examine the implications of the varying water demand on the progress of land development a computer simulation model was used to simulate the process of land development for different development schedules using observed data. The impact of the non-technical factors was analyzed by incorporating into the model a coefficient that expresses water distribution efficiency and capacity of the farmer to undertake new land development. It was assumed that the land area R, in hectares, that would be developed in a given year, is equal to the quantity of water available at the field Q, in m^3/s, divided by the rate of water required per ha for land development, q, in $m^3/s/ha$.

The quantity of water actually available at the field is equal to the gross quantity available for the project times the irrigation efficiency, α. The area of land the farmer can actually developed is equal to the land he could develop on the basis of available water times an empirical achievement coefficient β. Thus the land area developed in the first year is given by formula:

$$R_1 = \beta * \frac{\alpha * Q_n}{q_1} \qquad \text{..........(5-3)}$$

Where:

R_1 = Land Development in the first year of irrigation implementation, [ha].

α = Water distribution efficiency, [$\leq$ 1.00]

β = Empirical coefficient of the farmers' capacity to undertake land development, [$\leq$ 1.00]

Q_n = Installed conveyance capacity, [m^3/s]

q_1 = Actual rate of water requirement in the first year of irrigation, [$m^3/s/ha$]

Land development in subsequent years can be calculated in the same way as follows:

$$R_2 = \left[R_1 + \beta * \frac{\left[\alpha * Q_n - (R_1 * q_2)\right]}{q_1} \right];$$

$$R_3 = \left[R_1 + R_2 + \beta * \frac{\left[\alpha * Q_n - \{(R_1 * q_3) + (R_2 * q_2)\}\right]}{q_1} \right];$$

$$R_4 = \left[R_1 + R_2 + R_3 + \beta * \frac{\left[\alpha * Q_n - \{(R_1 * q_4) + (R_2 * q_3) + (R_3 * q_2)\}\right]}{q_1} \right];$$

....

The calculation is repeated until the value of $R_i = A$; i.e. $R_i = (R_1 + R_2 + R_3 + R_4 + R_5 + \ldots\ldots\ldots\ldots\ldots R_j) = A$; and hence the whole irrigation area is completely developed at [i] years after implementation of the project. This process leads to the following general equation for land development capacity:

$$R_i = \beta * \left[\frac{\left[\alpha * Q_n - \sum_{j=1}^{i-1} \left(R_j * q_{(i,i-j+1)} \right) \right]}{q_1} \right] \quad \ldots(5\text{-}4)$$

With technical rotation (step-by-step), the following equation applies:

$$R_{(r,i)} = \beta * \left[\frac{\alpha * Q_n - \sum_{k=1}^{r} \sum_{j=1}^{i-1} R_{(k,j)} * q_{(i,i-j+1)}}{q_1} \right] \quad \ldots.(5\text{-}5)$$

Where $R_{(k,j)}$ = land development for rotation area j within the number of years the field has been irrigated

other terms = As defined previously

Using the above equation, the calculation is repeated until the sum of the successive values of R_i is equal to the cultivable command area. The time taken to get to this point the time that is required to transform the entire area into stable paddy fields.

The magnitudes of α and β are empirically determined by using the model to simulate actual rates of development obtained from the field survey and adjusting the parameters till a good fit is obtained. The values of α and β were then varied to to assess the effect of irrigation efficiency and any socio-economic improvement on farming achievement that affect the progress of the development.

5.8 ECONOMIC ANALYSIS FOR ESTIMATING FINANCIAL VALUE OF IRRIGATION WATER

5.8.1 THE SIGNIFICANCE OF PROVIDING IRRIGATION WATER

Some studies in Indonesia have identified the most significant problem underlying economic development of rural regions to be poor irrigation development which is closely associated with operation and maintenance conditions of the scheme *(DGWRD-Indonesia, 1985)*. This observation is evidence that the water distribution efficiency of most irrigation schemes in Indonesia is generally still very low *(Bogor Institute of Agriculture-IPB, 1972.)*. In order to promote higher water distribution efficiency, the system must be consistently operated and maintained. In reality, however, irrigation water has been traditionally provided to farmers on a free-of-charge basis instead of levying irrigation service charges. On the other hand, if irrigation schemes remain inefficient, it is possible that the irrigation-based transmigration resettlement program will be hampered by the resettlers who persist in a dependency attitude. It is, therefore, very important to consider the possibility of enacting irrigation service fees to the water users, at least the minimum prerequisite for the undertaking of sustainable operation and maintenance of the scheme.

5.8.2 FUNDAMENTAL ASSUMPTIONS OF THE ANALYSIS

The economic analysis of irrigation exercises in the present study incorporate a number of interconnected factors: (1) the nature of water distribution, (2) the construction method of irrigation infra-structure, (3) the nature of irrigation system lay-outs (4) cropping patterns, (5) the amount of capital investment, (6) construction time schedules, (7) the economic time horizon, (8) the operation and maintenance costs, (9) irrigation efficiency, (10) cropping season, (11) agricultural technology, (12) crop production and prices, (13) inflation rates, and (14) discount rates and other such circumstances. The fundamental principle that is employed in the analysis is to assume that the cost of providing irrigation water will be equal to the actual sale of the water up to the expiration of the economic life of the irrigation scheme.[▹30] The magnitude of

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30 ▹ *The assumption is based on the account that the total*

water distribution is the function of several factors, such as the cultivable command area [A], season [SSn], cropping pattern [Cp], cropping intensity [Ci], soil condition [Sc], and distribution efficiency [ξ]. This functional relationship is symbolized by the following equation:

$$Q\ [m^3/year] = f\ [\ A,\ SSn,\ Cp,\ Ci,\ Sc,\ \xi\ ]$$

In the above equation, the magnitude of cumulative water consumption (Q) is determined in accordance with the engineering characteristics of the scheme.

In the successive process, the total construction costs are calculated by taking into account the engineering cost estimation analysis previously prescribed for the project construction requirement. These construction costs [C] are a function of several factors such as construction method [Cm], level of technology demanded [T], type and dimension of the structures [St], construction period [Cp] and type of scheme [Ts], which is represented by the functional relationship as follows:

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cumulative water consumption within the economic life span of the project is sold on the basis of the recovery capital costs of the project and/or operation and maintenance of the scheme.

$$C_{[Rp]} = f\,[\ Cm,\ T,\ St\ CP,\ Ts\ ]$$

[Rp] ▷31

Operation and maintenance (O&M) costs of the scheme were also calculated from the same source of engineering cost estimates. This was done by presuming that the total O&M costs will be adequate to cover the operation and maintenance of the system for sustaining a moderate condition of irrigation efficiency. The magnitude of O&M cost is a function of several factors such as the level of technology required for implementing a proper operation and maintenance [Ct], the degree of water management conditions [Cm], type of structures [St], labor [L]/wage rates [W], material [M], size (acreage) of service area [A], water distribution methods [Im], and equipment and facilities [Eq]. The functional relationship is expressed as follows:

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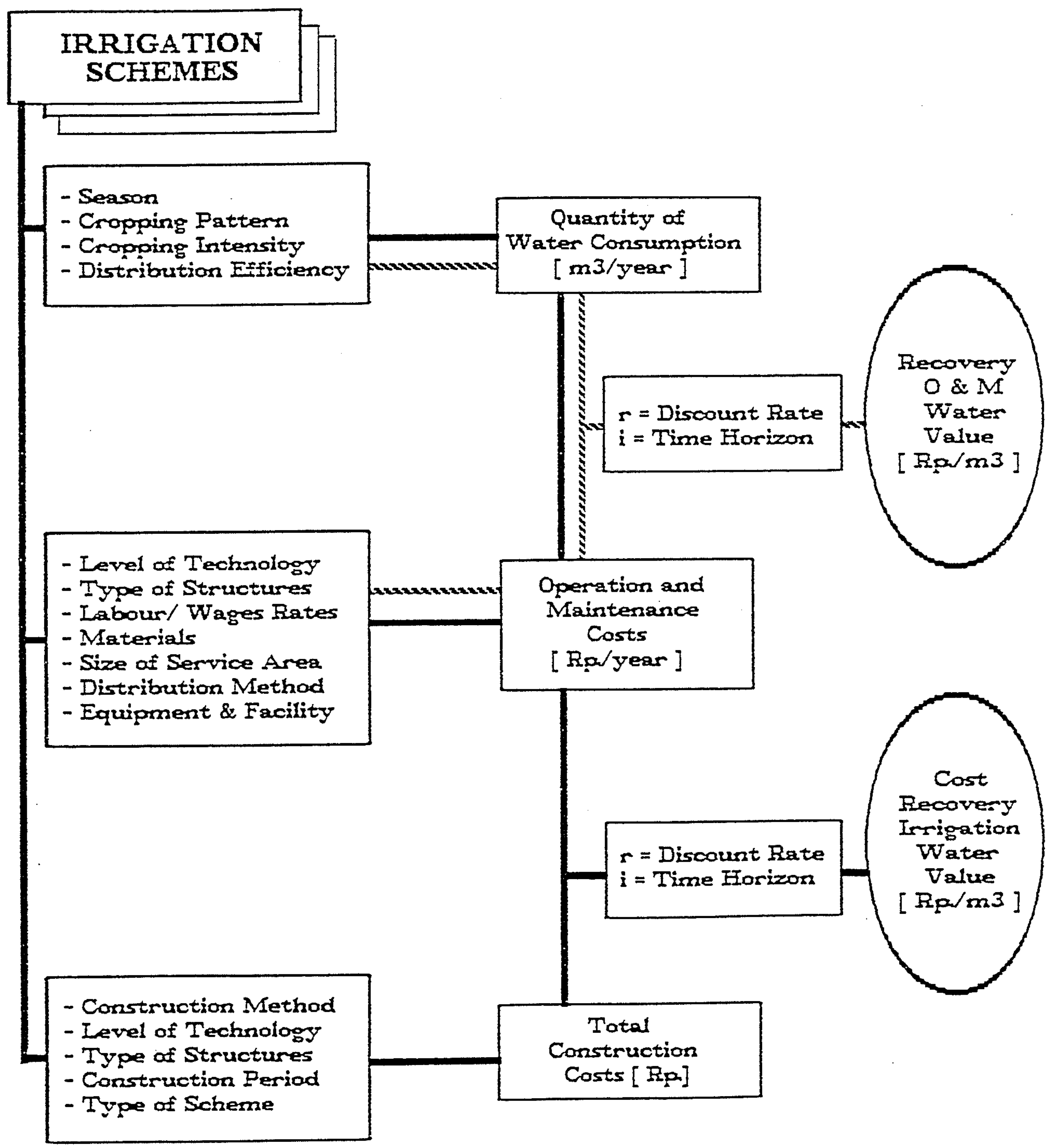
31 ▷ *[Rp] or "Rupiah" is the Indonesian currency. For a comparative figure, at the time this analysis was prepared (April 1991), the exchange rate of the Rupiah was standing at about Rp2,000 per US Dollar.*

$$O \,\&\, M_{[Rp/year]} = \int [\ Ct,\ Cm,\ St,\ W,\ L,\ M,\ A,\ Im,\ Eq\ ]$$

In the proceeding calculation exercises two distinct cost components are analyzed; the first is the recovery of O&M cost, and the second is the recovery of the total investment costs of the project. The analysis procedure for estimating irrigation water value is depicted in *Figure 5-4*, and a more complete discussion is presented in Chapter VII.

Figure 5-4

METHOD OF ESTIMATING IRRIGATION WATER VALUE



5.9 SOCIO-ECONOMIC ANALYSES TO TEST THE HYPOTHESES

5.9.1 GENERAL DESCRIPTION OF THE ANALYSIS METHOD

In this section the analysis of socio-cultural and economic aspects of transmigration focuses on the capacity of the transmigrant to adapt to a resettlement scheme.

The data identifying the socio-cultural aspects affecting the resettlers' adaptation were classified and analyzed through applying both quantitative and qualitative means. Data grouping and classification is based on the socio-economical consequences of transmigration occurring as a result of moving from an old known environment to a new unknown environment. The grouped and the classified data and information was analyzed by employing qualitative and quantitative methods to test the proposed hypotheses.

A number of social values are identified in the study of population resettlement. The important factors according to Appleyard *(1973)* include the following: (1) the need for survival, related to safety, security and health. (2) the need for comfort/lack of stress, such as, spaciousness, cleanliness and ease of movement, (3) efficiency, such as, access to services, recreation, transportation, convenience, orientation and information. (4) personal development, such as, privacy and identity, territorial control and education. (5) Social development, such as, equity, social interaction, cultural expression and resource conservation. (6) administration, such as, adaptability, agency and professional image, and so on (*Appleyard, 1973:16-21*).

For resettlement implementation the land ownership status is one of the most important factors that can affect the settlers' adaptation to the scheme. According to *Smock (1972:245)*, it is important to secure land assurance because it is pointless for a farmer to contemplate permanent improvement to his land or even attempt to increase soil fertility when he is not sure if he will be farming that piece of land the following year.

The capacity of settlers to reach the "stage of potential development" within the shortest possible transition time is another indicator of their adaptation. The progress of land development, for instance, is one aspect that could give indication of settlers' capacity to adapt to a new way of life in resettlement areas. However, it is not easy to judge from this single indicator whether or not settlers have adapted or have ended their transition. According to *Oliver-Smith and Hansen (1982:280)*, the turning point of settlers' adaptation comes when the majority have regained at least their former standard of living and degree of self sufficiency, and when the conservative stance and closed-system are replaced by at least a pre-relocation degree of risk taking.

Another indicator stated by *Oliver-Smith and Hansen*

(1982) is that the settlers have adapted to the scheme when the majority of them feel at home in the new habitat, in termas of both physical and biotic environment. Despite the fact that the "feeling at home" is considered to be an "amorphous" concept, it still can be measured in a number of ways, for instance, when the household and the community rituals have been re-established indicating a symbolic affirmation of their integration within the new living environment and the community formation. Some other symbolic behaviors may be seen, for instance, in house rebuilding, house decorations, gardens, house, ownership of animals, and other customary identities, acquisition of language, intermarriage, dance and so on.

It is obvious, however, that the scope of this study cannot cover such a large area of inquiry. Therefore, only some of the identifiable socio-economical aspects that affect the resettlers adaptation are considered in the analysis.

5.9.2 REGRESSION ANALYSIS

The data that were obtained from structured questions, multivariate analysis were employed to test the hypotheses pertaining to the relationship between socio-cultural and economic variables.

According to *Nachmias and Nachmias (1987:443-446)*, in order to assess the relation between two variables which control the effect of others, regression analysis can be employed. Regression analysis describes the extent of the linear relationship between the dependent variables and a number of other independent variables.

To develop the regression model, the following discussion gives some rationale for the selection of variables that are considered relevant to developing the regression model for the present analysis. For resettlement implementation, the progress of land development undertaken by the settler is one indicator of their ability to farm and to participate in resettlement activities. It is hypothesized that some variables are related to the progress of land development such as household income, category of migration program, place of origin, the geographic location of irrigation project, availability of irrigation water at the field and the variable relating to land ownership status. So, these variables were used in the regression analysis.

Given the above principle, the relationship between variables can be expressed in algebraic equation as follows:

$$LS = \beta_0 + \beta_1 IC + \beta_2 TS + \beta_3 RO + \beta_4 IS + \beta_5 IA + \xi$$

Where:

LS = progress of land ownership status (in %)

IC = aggregate of household income (in Rupiah)

TS = transmigration status

TS1 = colonization transmigrant

TS2 = general transmigrant

TS3 = local transmigrant

TS4 = spontaneous transmigrant

TS5 = other category

RO = region of origin of the transmigrant

RO1 = transmigrant from West Java

RO2 = transmigrant from Central Java

RO3 = transmigrant from East Java

RO4 = transmigrant from Bali and NTB

RO5 = transmigrant from other places in Indonesia

IS = Geographic location of irrigation scheme

IS1 = irrigation scheme in South Sulawesi Province

IS2 = irrigation scheme in Lampung Province

IA = Irrigation adequacy at the site

IA1 = Irrigation at the field is adequate

IA2 = Irrigation at the field is inadequate

β_0 = slope

ξ = residual

A more complete procedure of analysis in terms of simple descriptive statistics and multivariate statistical analysis, as well as discussion of the results are presented in Chapter-VIII.

5.10 INTERDISCIPLINARY ANALYSIS AND PRESENTATION

The data analysis is organized in such a way that the interconnectedness between engineering and non-engineering issues would be maintained at a desirable level of equilibrium. From this multi-disciplinary nature of analysis, the global objectives of the study and subsequent recommendations and conclusions are formulated. It is expected that the presentation of the study formulation would contribute some specific strategies or recommendations for technical and socio-economic interventions. These interventions could improve development of agricultural land through the Irrigation-Based Transmigration Program.

CHAPTER SIX

EFFECT OF HIGH INITIAL WATER REQUIREMENT ON THE NEW IRRIGATION DEVELOPMENTS

CHAPTER SIX

EFFECT OF HIGH INITIAL WATER REQUIREMENT ON THE NEW IRRIGATION DEVELOPMENTS

6.1 INTRODUCTION

Newly broken land requires up to five times more irrigation water than that needed when irrigation is fully established. It is technically not desirable and economically not feasible to design water supply and distribution system for these transient conditions. The result is that in the early stages of development water is in short supply. This slows the development down.

The initial water shortages have therefore a severe economic impact on farmers and reduce their ability to develop their land and to participate fully in the activities that are required to make the irrigation enterprise a success. This in turn has a negative effect on the irrigation development and on the adaptation of transmigrants to their new life.

It takes farmers many years to overcome these initial difficulties. In fact, in several instances projects have failed to reach their full potential more or less permanently because of these circumstances. It was estimated that in 1989 about 550,000 ha of irrigable land in the completed irrigation projects was still undeveloped. With new irrigation projects being undertaken in the current irrigation extension program, the undeveloped acreage is expected to increase unless the problem of under-achievement in irrigation can be resolved.

There are, of course, a number of factors that contribute to the disappointing rate at which irrigation objectives are being reached. Some cultivable land is utilized for urban or industrial development. Lack of data and poor documentation of previous experience has led to errors in judgment or design. A scarcity of adequately trained personnel has caused deficiencies in organization, management and operating skills. Poor facility maintenance and inexperienced farmers have resulted in low irrigation efficiency. In many instances the impacts of these factors can be minimized by instituting suitable policy changes. The initial water shortage, however, is a major contributing factor and the solution to the problem it creates is not obvious. For this reason, it is the primary focus of the study described in this chapter.

6.2 DEVELOPMENT OF A SIMULATION MODEL

The effect of the high initial water requirement on the development is quite complex since it has a technical as well as an economic and a human side. For this reason a computer-based simulation model was developed that portrays a typical irrigation development under current and historical conditions and that is capable of projecting the development into the future. The model is in the first place useful for the analysis of this complex problem. In the second place, the effect of various factors on the development can be studied by making suitable changes in the model parameters and studying the response. In third place, the model is useful for the search for, and the formulation of, strategies that may reduce the negative impact of high initial water requirements.

The model contains both technical and non-technical components. Some of the technical components are the intake capacity, the number and size of the irrigation units in the command area, the water requirement per unit area in the successive years of development etc. The non-technical components are the ability of the farmer to undertake the land development, and the irrigation efficiency, which reflects the ability to manage the available water optimally.

The model was constructed to simulate the conditions in two transmigration schemes. One is the Luwu Irrigation Project in the Province of South Sulawesi, the other the Way Rarem Irrigation Project in the Province of Lampung, Southern Sumatra.

6.2.1 BASIC ASSUMPTIONS AND BOUNDARY CONDITIONS

A study of the underlying concepts and the observed features of the irrigation development in Indonesia, suggests that a model analysis of existing conditions and future performance requires the specification of a number of basic assumptions and boundary conditions on which the generalized conclusions are predicated. These assumptions and conditions are listed below.

(1) Within the first few years of a project, the initial water requirements for the new lowland paddy fields tend to be much higher than the design capacity of the water delivery system. The water requirement will decline to normal rates after the land has been irrigated for several consecutive cropping seasons. The magnitude of the actual water requirement over time is determined by several factors, such as, soil conditions, planting season, cropping patterns, irrigation efficiency, agricultural practices, and irrigation methods. To obtain data that can be used in the model, the requirements experienced in the study area were used. For example, the water requirements for the newly broken agricultural lands in Lampung province are shown in *Figure 6-1*. These reached a magnitude of 5 liters per second per hectare (l/s/ha) in the first year, and gradually became stabilized (1.41 l/s/ha) after five years.▹[32]

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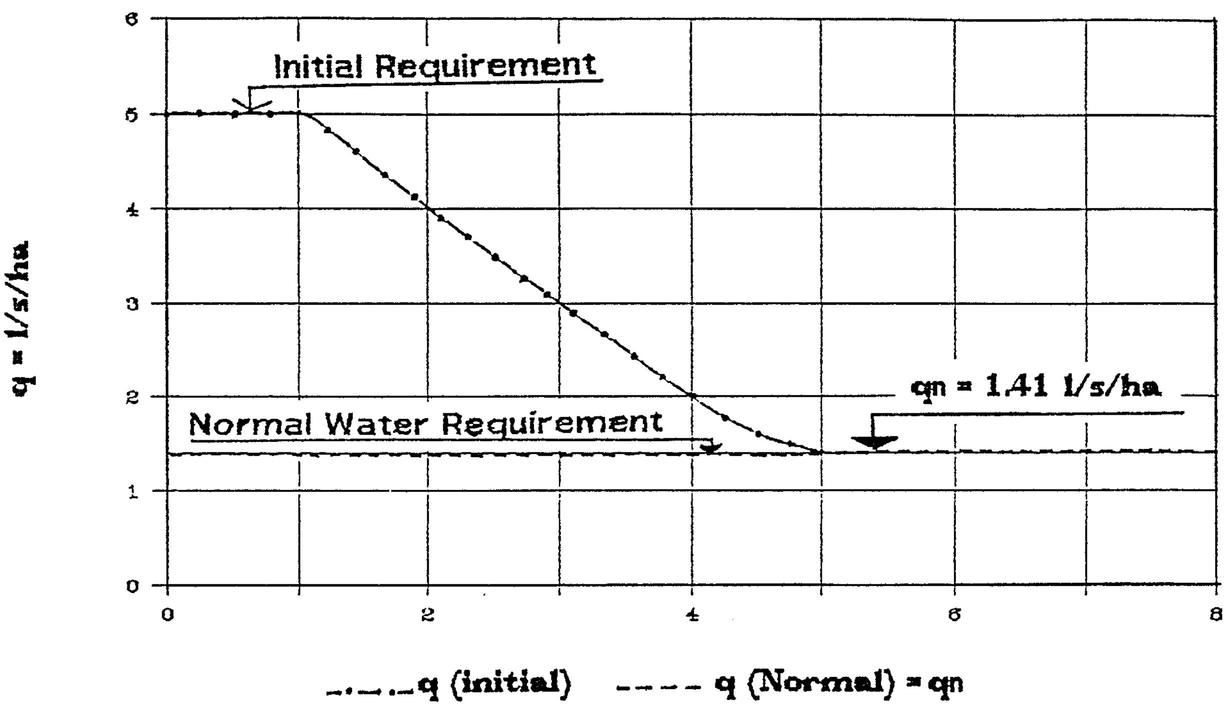
[32] ▹ *The figures in this chart show an average trend of the*

Figure 6-1 GENERAL PATTERN OF EMPIRICAL FIELD WATER DEMAND FOR NEW LAND DEVELOPMENT IN THE LAMPUNG PROVINCE



To provide supporting evidence for the above mentioned tendency, the following outcomes have been recorded from the experience of the irrigation development in the Lampung Province. Whelburg (1935), in his field notes, *(Notes of Way Sekampung Irrigation Schemes*[▷33]*)* ".....

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irrigation water requirement in Lampung Province developed by analyzing the information from a number different sources. No information about the exact configuration of irrigation water requirements of this kind --such as that based on actual experiment-- were found either in the study areas or in the literature.

33 ▷ *Wehlburg, Ir, 1935. "Notes of the Way Sekampung Irrigation Scheme", unpublished report, translated from*

estimated that the water requirement for the first year of land reclamation of lowland paddy fields to be around three times the water requirement after the land has become stable". In the Way Tebu irrigation area, and in the Gedung Tataan Colonization settlement, the water requirement figures, recorded by Whelburg (1935), were around 3.00 l/s/bahu or about 4.23 l/s/ha, at the initial stages of land reclamation. They then gradually decreased to about 0.90 l/s/bahu or about 1.3 l/s/ha over a period of about 10 years. For the second and third year of the irrigation application, the requirements were about 2.50 and 2.10 l/s/bahu or about 3.53 and 2.96 l/s/ha respectively, while the average water requirement at the normal condition was at about 1.00 l/s/bahu or about 1.41 l/s/ha.

In the Way Sekampung experience, the Central Lampung Public Works Services[▷34] noted that the water requirement at the initial stage of land reclamation was at about 5.00 l/s/bahu or about 7.06 l/s/ha. It took several years to become completely stable at a rate of about 1.41 l/s/ha.

(2) The water requirement analysis in this study only deals with newly established independent irrigation schemes with a

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Dutch to Indonesian by Soenarjo Soekadis, BIE, 1969.

34 ▷ *Stated by Sabikoen, R. (Former chief of the Central Lampung Public Work Services) in his unpublished report; "Historical Note of Irrigation in Lampung Province", 1966.*

single command area of more than 700 hectares. It was observed by the author that projects with smaller command areas experience different operating conditions so that the problems signaled here do not develop to the same degree. It was also assumed that the projects simulated by the model would not have a storage reservoir *(See Table 6-1 which presents the historical evidence of irrigation development of some selected schemes in Lampung Province and Table 6-2 for the historical conditions of some selected irrigation schemes in the South Sulawesi Province).*

(3) The cultivable irrigation command area is assumed to have been virgin land that has not been subject to low-land paddy cultivation before.

(4) The average peak water requirement under stable (fully developed) conditions is estimated to be between 1 to 1.41 l/s/ha.[▹35] (More specific details on the stable demand were obtained from a field survey in each study area.)

(5) It was not possible to conduct a field experiment from which the actual irrigation requirement for newly broken land could be determined since that would take at least several years. The present study is therefore based on secondary information from local irrigation authorities

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35 ▹ *Sabikoen, 1966, stated in his report that the average water requirement figure, at the "normal" stage, in Lampung Province was commonly about 1.00 l/s/*bahu*, or about 1.41 l/s/ha. (One "bahu" is equivalent to 0.71 ha).*

TABLE 6-1 LIST OF SELECTED IRRIGATION AREAS IN THE LAMPUNG PROVINCE, SOUTHERN SUMATRA, BASE ON THEIR TOTAL POTENTIAL AREAS AND ACTUAL DEVELOPMENT

No.	IRRIGATION SCHEME	TOTAL IRRIGABLE AREA (HA)	YEAR OF COMPLETION OF STRUCTURAL WORKS	TOTAL PRESENT SAWAH (HA)	ESTIMATED WATER REQUIREMENT (L/S/HA)			REMARK
					DESIGN FIGURE	INITIAL STAGE	NORMAL STAGE	
001	WAY PADANG RATU I. [^]	1030	1929	750	1.45	5.75	1.5	
002	WAY TEBU III.	1750	1926	1674	1.25	6.75	1.3	
003	WAY TEBU IV.	2660	1928	1879	1.35	5.5	1.35	* IRRIGATION SCHEMES SMALLER THAN 700 HA ARE NOT TAKEN INTO CONSIDERATION BECAUSE MOST OF SUCH SCHEMES DID NOT HAVE PROBLEM ON SLOW LAND RECLAMATION.
004	WAY MERABUNG [++]	874	1955	739	?	?	?	
005	WAY RILAU [++]	758	1976	556	?	?	?	
006	WAY NGISON [++]	1586	1977	1015	?	?	?	
007	WAY SEMANGKA [^]	1550	1969	1154	1.3	5.2	1.41	
008	WAY LALAAN	1225	1926	433	?	?	?	? = NO DATA AVAILABLE
009	WAY RATAY NEGARA RATU [++]	1100	1969	815	?	?	?	
010	BATANGHARI UTARA	7104	1954	4661	?	?	?	[^] THE IRRIGATION AREA WAS PREVIOUSLY CONSISTED OF SWAMP
011	RAMAN UTARA	6304	1959	4193	?	?	?	
012	SEKAMPUNG	19262	1938	16290	?	?	?	
013	PUNGGUR UTARA	30843	1970	18448	?	?	?	[++] THE IRRIGATION AREA WAS PREVIOUSLY CONSISTED OF RAINFED
014	WAY JEPARA (*)	6651	1975	4975	?	?	?	
015	WAY CURUP HULU [^]	2220	1978	1571	?	?	?	(*) THE IRRIGATION SCHEME PROVIDED WITH SMALL WATER RESERVOIR
016	WAY TIPO BALAK [++]	1106	1974	1000	?	?	?	
017	WAY SEPUTIH	20201	1971	14531	1.35	6.1	1.51	
018	WAY PENGUBUAN	5000	1978	3093	1.3	4.5	1.5	
019	WAY GETAH SRI MENANTI	741	1976	164	?	?	?	
020	WAY CUKUH BATU	804	1978	108	?	?	?	
021	WAY KULUR	649	1977	178	?	?	?	
022	WAY UMPU	7500	1974	4235	?	?	?	
023	WAY RAREM (*)	22702	1985	13462	1.3	5.5	1.45	
024	WAY TULUNGMAS	3081	1977	547	1.25	5.5	1.45	
025	WAY KURIPAN	1200	1985	200	?	?	?	
026	WAY KETIBUNG	1550	1988	572	?	?	?	
027	WAY NGARIP I. [++]	1364	1988	800	?	?	?	
	TOTAL	150815		98049				AVERAGE LAND DEVELOPMENT 58.65%

SOURCE: LAMPUNG PROVINCIAL IRRIGATION SERVICES, 1992

TABLE 6-2 LIST OF SELECTED IRRIGATION AREAS IN THE SOUTH SULAWESI PROVINCE, BASE ON THEIR TOTAL POTENTIAL AREAS AND ACTUAL DEVELOPMENT

No.	IRRIGATION SCHEME	TOTAL IRRIGABLE AREA (HA)	YEAR OF COMPLETION OF STRUCTURAL WORKS	TOTAL PRESENT SAWAH (HA)	ESTIMATED WATER REQUIREMENT (L/S/HA)			REMARK
					DESIGN FIGURE	INITIAL STAGE	NORMAL STAGE	
001	SADANG	37962	1930	33211	1.5	?	?	
002	KALOSI	1004	1981	936	1.16	?	?	
003	BULUCENRANA	5999	1980	5099	1.16	?	?	
004	BULUTIMORANG	5337	1937	5037	1.5	?	?	
005	BELOKKA [++]	931	1977	931	1.5	?	?	
006	ALEKKARAJAE	1253	1980	1113	1.5	?	?	* IRRIGATION SCHEMES SMALLER TTHAN 700 HA ARE NOT TAKEN INTO CONSIDERATION BECAUSE MOST OF SUCH SCHEMES DID NOT HAVE PROBLEM ON SLOW LAND RECLAMATION
007	MALOSO (^)	6877	?	4073	1.5	?	?	
008	LAKEJO	1600	1987	1365	1.5	?	?	
009	RAPPANG/CUREDE	874	1983	333	1.5	?	?	
010	KUNYI	920	1979	826	1.5	?	?	
011	MAMBU BESAR/KECIL	7500	?	0	1.5	?	?	
012	TANDUNG	1000	?	0	1.5	?	?	
013	PALAKKA [++]	4610	1981	4095	1.5	?	?	
014	PATTIRO	4970	1979	3940	1.5	?	?	
015	UNYI	1300	?	1254	1.5	?	?	
016	BENGO	797	?	797	1.5	?	?	? = NO DATA AVAILABLE
017	JALING	1700	1983	1371	1.5	?	?	
018	LANCA	914	1976	676	1.5	?	?	
019	SANREGO [++]	9453	ON GOING	4000	1.2	?	?	[^] THE IRRIGATION AREA WAS PREVIOUSLY CONSISTED OF SWAMP
020	PONRE-PONRE	729	?	25	1.5	?	?	
021	SALOBUNNE	1386	?	1080	1.5	?	?	
022	LAJAROKO	824	?	824	1.5	?	?	
025	LEWORENGKIRI/KANAN	2258	1975	1116	1.5	?	?	[++] THE IRRIGATION AREA WAS PREVIOUSLY CONSISTED OF RAINFED
026	TINCO	2616	?	1250	1.5	?	?	
027	LALANGE	1200	?	900	1.5	?	?	
028	AKAMPENG	1100	1984	800	1.5	?	?	
029	BONGKIBONGKI	1796	?	587	1.5	?	?	
030	BAYANG-BAYANG	5030	?	3006	1.5	?	?	
031	BONTOMANAI	4846	?	2761	1.5	?	?	
032	DA'MGASA	870	?	0	1.5	?	?	
033	GALUNGLOHE	961	1980	404	1.5	?	?	
034	SANGKALA	940	1986	618	1.5	?	?	
035	BALANGTIKEKE	704	1983	656	1.5	?	?	
036	BONTONYELENG	1096	ON GOING	796	1.5	?	?	
037	APARANG I & III	1779	1981	1010	1.5	?	?	
038	BALAKIA I & II	851	1975	751	1.5	?	?	
039	APARANG HULU	941	1987	741	1.5	?	?	
040	KELARA [++]	7004	1983	4008	?	?	?	
041	MOTI	764	?	664	1.5	?	?	
042	BIANGLOE V/VI	700	1979	600	1.5	?	?	
043	BIANGKEKE V	479	1987	223	1.5	?	?	
044	KALAMASSANG I	727	1980	231	1.5	?	?	
045	POKOBULO KIRI	425	?	325	1.5	?	?	
046	JENEBERANG (^)	17488	1982	11929	1.5	?	?	
047	BILIBILI	2415	1982	1790	1.5	?	?	
048	SENRE	710	1980	406	1.5	?	?	
049	JENEMARRUNG	2108	?	406	?	?	?	
050	PAMUKULU	4398	1989	3610	1.5	?	?	
051	TABOTABO	8778	1983	7157	1.5	?	?	
052	PADAELO	1229	?	958	1.5	?	?	
053	LEANG LORONG	1229	1987	929	1.5	?	?	
054	BATUBESSI	929	?	729	1.5	?	?	
055	LANRAE	810	?	710	1.5	?	?	
056	PADANG SAPPA	6457	1987	1700	1.5	?	?	
057	BAJO	1637	?	1237	1.5	?	?	
058	MAMARA	861	ON GOING	270	1.5	?	?	
059	PADANG ALIPAN	1200	1975	800	1.5	?	?	
060	MAKAWA	1000	1977	880	1.5	?	?	
061	LAMASI KANAN	5039	1976	1487	1.5	3.00	1.25	
062	LAMASI KIRI	4400	1988	3886	1.31	3.00	1.25	
063	KALAENA	12176	ON GOING	6928	1.41	3.00	1.25	
064	SADANG UTARA [++]	5426	1980	4897	1.25	?	?	
065	SADANG SELATAN [++]	14245	1976	12225	1.22	?	?	
	TOTAL	227762		155367				AVERAGE LAND RECLAMATION 68.21%

SOURCE: SOUTH SULAWESI PROVINCIAL IRRIGATION, 1992 which was entered as a variable in the model. By varying the magnitude of the field water requirement in the model the sensitivity of the development to the magnitude of this parameter can be estimated for given conditions. This may also determine to what extent further information about this variable should be collected in the form of actual experiments.

(6) Although the peak water requirement for a crop will occur during the dry season from March to October, the present analysis will only take into account the system water requirements in the main growing season from October to March. This assumption is justified by the fact that the average irrigation intensity is only about 130% annually. Only a few irrigation schemes are equipped with storage reservoirs that allow additional water distribution during the dry season.[▷36] The present analysis is further simplified by not taking into account varying soil moisture conditions and the influence of effective rainfall as parameters that affect the demand. However, the model does include those aspects implicitly in the cumulative water requirement which is reflected in the amount of water that is applied to farm

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36 ▷ *For the case of Way Rarem, which was taken as the study area to represent conditions of the western part of Indonesia, a small reservoir has been provided to stabilize the water fluctuation during the main cropping season. The reservoir capacity was not designed for seasonal control to provide adequate water storage for regulating the water distribution supply during the dry season.*

land by the irrigation authority.

(7) The land development practice for ponded lowland paddy fields is assumed to be the "full inundation" approach with continuous flow. Only a paddy-to-paddy cropping pattern is considered in the analysis, with an average cropping intensity of about 130% annually. *See Chapter-V regarding this cropping intensity.*

(8) Since the land holdings in the irrigation schemes are on average less than 1.00 ha, it is assumed that manual labor and cattle power are used in the new land development.

6.2.2 CURRENT POLICY AND IMPLEMENTATION OF IRRIGATION DESIGN

The hydraulic design capacity of the irrigation conveyance systems in Indonesia is based on the water demand for stable conditions. This increased water demand in the first years is recognized in the "Irrigation Design Standard" *(DGWRD, 1986: KP-03)* which is used as a guide. It provides the following instructions.

> "........ In the newly developed areas where no *sawah* rice cultivation was practiced before implementation (first 3-4 years), field water requirements will be much higher than the remaining lifetime of the scheme. These water requirements can be three to four times higher than designed for the stabilized condition. In such cases the design capacities of the canals should be based on the ultimate water requirements and the start-up of the scheme should be carried out in stages. The irrigated area will thus be based on the capacity of the canal system and will only be expanded after field water requirements have reduced ......"
> *(DGWRD, "Irrigation Design Standard", 1986. Volume KP-03 ,English Edition, p.8.)*

A. Consequences of the Current Design Policy

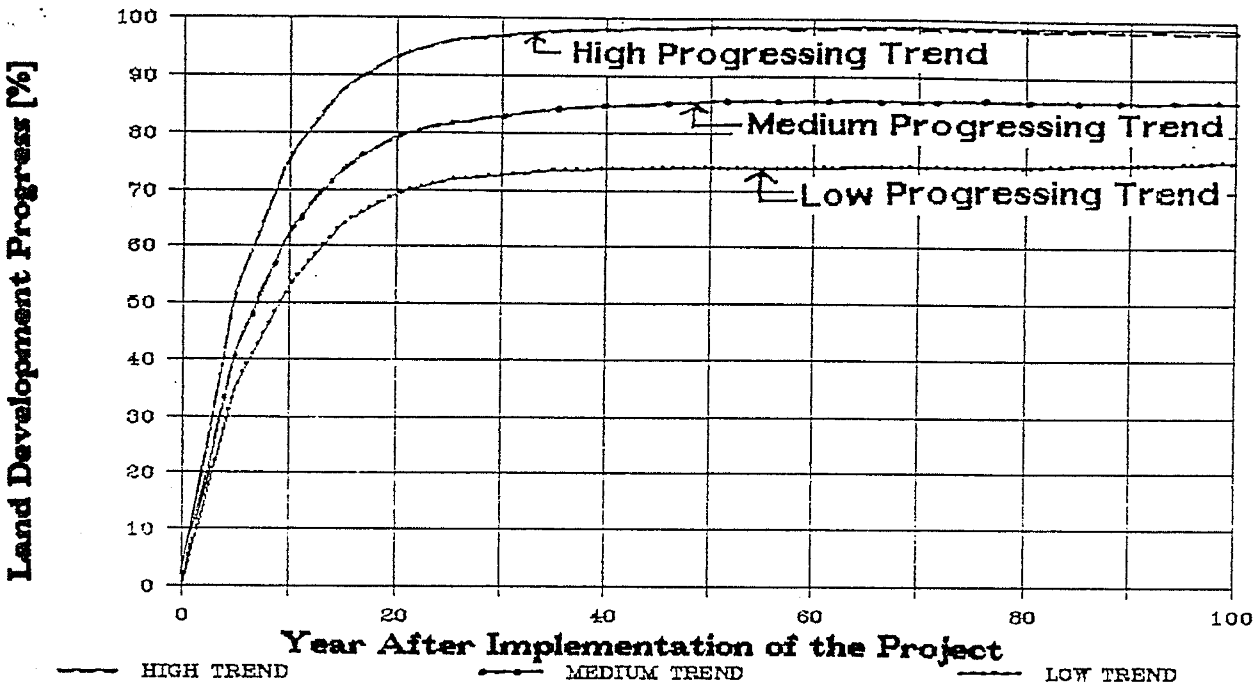
There is good reason for the current design policy of gradually expanding the irrigated area rather than building larger canals. Providing the exceptionally large amount of irrigation water, corresponding to the field demand characteristics in the initial years would require very large canals indeed.

The velocities in the canals cannot vary much if the canal cross-section is to remain stable with a view of erosion and sediment deposition. Thus a three to five fold increase in capacity would correspond to roughly the same increase in the required cross-sectional area of the canal. This would not only be very expensive, it would also lead to canals that are much too large to function properly when the flow is reduced to normal requirements.

An unfortunate consequence of the current policy is that the rate of development of land in new irrigation areas depends on the fixed amount of irrigation water that can be provided by facilities that are designed for long term production rather than immediate needs. This greatly retards the progress of land development as is demonstrated by *Figure 6-2*.

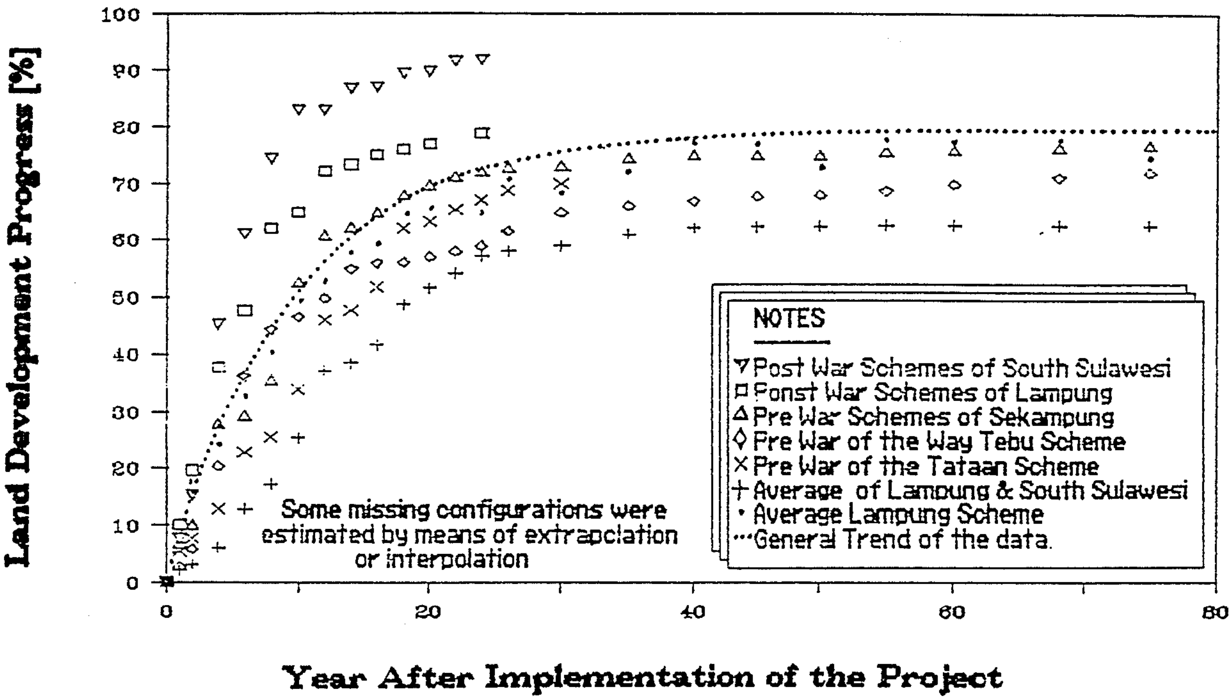
It is evident from *Figure 6-2* that the engineering constraints on the problem of coping with the variable demand for irrigation water plays an important role in preventing a scheme from achieving its potential, as

Figure 6-2 GENERAL TRENDS OF LAND DEVELOPMENT FOR NEW IRRIGATION AREAS



envisaged in the project planning, within a reasonable length of time. There are other, non technical, aspects which also affect the progress of project utilization. When these are also taken into account, the slow rate of land development will be even more pronounced. Evidence drawn from selected projects in the Lampung and South Sulawesi irrigation areas clearly demonstrates this as is shown in *Figure 6-3*.

Figure 6-3 GENERAL TRENDS OF IRRIGATION PROGRESS BASED ON SELECTED SCHEMES IN LAMPUNG AND SOUTH SULAWESI PROVINCES



In the following section some alternatives that retain the concept of the step-by-step approach but would increase the capacity to what is required in each yearare presented.

B. Technical Rotation or Step-by-Step Development

There appears to be merit in the idea of starting up a new irrigation scheme by means of technical rotation stages, or by a step-by-step development, in order to minimize the unwanted consequences of excessive field demand. However, the required conveyance capacity with such an approach is still so high that the determination of the "optimum" canal dimensions remain problematic.

It is important to note that the more the area is divided into sub-units, to be developed in stages, the lower the magnitude of the required conveyance capacity will be, but the longer the time which is required to develop the entire area. This tendency can be explained with an example:

Assume that the irrigation area is divided into five irrigation sub-units; A_1, A_2, A_3, A_4 and A_5 to be developed sequencially. The design capacity of the canals can now be expressed as:

$$Q_{(d)} = q_{(n)} * A \qquad (6\text{-}1)$$

Where $Q_{(d)}$ = Design Capacity of the Canal, [m^3/s] or [CMS]

$q_{(n)}$ = Unit Demand, [$m^3/s/ha$]

A = Irrigation Command Area, [ha]

Hence, for five 5 irrigation sub-units;

$$\begin{aligned} Q_{(d)} &= Q_{(d)_1} + Q_{(d)_2} + Q_{(d)_3} + Q_{(d)_4} + Q_{(d)_5} \\ &= q_{(n)} * (A_1 + A_2 + A_3 + A_4 + A_5) \ldots\ldots (m^3/s) \end{aligned}$$

The peak irrigation distribution capacity required for a delivery canal (Q_{m_i}) for a particular year (i) can then be calculated;

$$Q_{m_1} = q_{m_{(1,1)}} * A_1$$

$$Q_{m_2} = \{q_{m(1,2)} * A_1\} + \{q_{m_{(2,1)}} * A_2\}$$

$$Q_{m_3} = \{q_{m_{(1,3)}} * A_1\} + \{q_{m_{(2,2)}} * A_2\} + \{q_{m_{(3,1)}} * A_3\}$$

$$Q_{m_4} = \{q_{m_{(1,4)}} * A_1\} + \{q_{m_{(2,3)}} * A_2\} + \{q_{m_{(3,2)}} * A_3\} + + \{q_{m_{(4,1)}} * A_4\}$$

$$Q_{m_5} = \{q_{(d)} * A_1\} + \{q_{m_{(2,4)}} * A_2\} + \{q_{m_{(3,3)}} * A_3\} + + \{q_{m_{(4,2)}} * A_4\} + \{q_{m_{(5,1)}} * A_5\} \ldots\ldots\ldots\ldots\ldots$$

....

....

$$Q_{m_8} = \{q_{(d)}\} * \{A_1 + A_2 + A_3 + A_4\} + \{q_{m_{(5,4)}} * A_5\}$$

$$Q_{m_9} = \{q_{(d)}\} * \{A_1 + A_2 + A_3 + A_4 + A_5\} = Q_{(d)}, \ldots.(m^3/s)$$

or in a summarized form as follows:

$$Q_{m_i} = \sum_{j=1}^{5} [\ q_{m_{(i,i-j+1)}} * A_i\ ] \ldots\ldots\ldots.(6\text{-}2)$$

Where $q_{m_{(i,j)}}$ = Maximum Unit Discharge of water delivery for a particular year (i) with a particular irrigation sub unit (j), $(M^3/s/ha)$;

Q_{m_i} = Peak irrigation distribution demand in year i, (m^3/s)

By using the field water demand derived from the above equation, the maximum system water demand in each year of the development process, until the water requirement is stabilized, can be determined. Taking the following empirical values in the calculation:

$$q_{m[(1,2,3,4,5),1]} = 5.00 \text{ l/s/ha};$$
$$q_{m[(1,2,3,4,5),2]} = 4.00 \text{ l/s/ha};$$
$$q_{m[(1,2,3,4,5),3]} = 3.00 \text{ l/s/ha};$$
$$q_{m[(1,2,3,4,5),4]} = 2.00 \text{ l/s/ha};$$
$$q_{m[(1,2,3,4,5),5]} = 1.41 \text{ l/s/ha};$$

The annual maximum flows that must be accommodated by the canal as on this basis are:

$$Q_{m_1} = 1.000 * 10^{-3} \text{ A [cms]};$$
$$Q_{m_2} = 1.800 * 10^{-3} \text{ A [cms]};$$
$$Q_{m_3} = 2.400 * 10^{-3} \text{ A [cms]};$$
$$Q_{m_4} = 2.800 * 10^{-3} \text{ A [cms]};$$
$$Q_{m_5} = 3.082 * 10^{-3} \text{ A [cms]}; \text{ -------> (Peak maximum)}$$
$$Q_{m_6} = 2.364 * 10^{-3} \text{ A [cms]};$$
$$Q_{m_7} = 1.846 * 10^{-3} \text{ A [cms]};$$
$$Q_{m_8} = 1.582 * 10^{-3} \text{ A [cms]}; \text{ and}$$

$$Q_{m_9} = 1.410 * 10^{-3} A \text{ [cms]; -------> } = Q_{(design)}$$

It is evident from the above example, that the technical rotation or the step-by-step approach to implementation of irrigation projects and water distribution capacity for these projects will give an annual peak canal discharge significantly lower than that required to bring all parts of the project simultaneously to full development. However, it is also apparent that the discharge capacity is still too large to convey through a canal with dimensions based on stable water requirements. *(See Chapter-5, Figure 5-3, for the contrast between simultaneous and step-by-step concepts of irrigation water allocation).*

A crucial issue in the determination of the optimal design strategy is the trade off between the magnitude of canal discharge, the number of irrigation units and the time allocated for the completion of the development (as a target imposed by irrigation development strategy). The level of these three parameters is very much influenced not only by the water consumption rates (q_{m_i}), but also by social, managerial, and organizational factors that are related to the efficiency of irrigation operation and the ability of the farmers to undertake the development activities. The current engineering analysis is intended to assess the technical and non-technical aspects that affect the pace of land development achievement as illustrated by the above example.

6.2.3 PARAMETERS EMPLOYED IN THE SIMULATION MODEL

The required information about the model parameters was obtained from the field surveys in the Way Rarem and Luwu Irrigation Projects. However, most of the data concerning the actual field water requirements, irrigation efficiency, and water distribution records are based only on the empirical estimation by the irrigation authorities at the site. At this point in time, the academic and experimental research has not produced values for water requirements that can be used in the field. Hence the model was based on average values from field estimation together with some limited field tests conducted by the author in order to examine data that seemed anomalous.

The irrigation efficiency at the main systems both in the Luwu and in the Way Rarem Irrigation Schemes is estimated to be between 0.65 to 0.80[▷37], depending upon the specific site characteristics. Irrigation efficiency at the tertiary level, appears to be, perhaps not unexpectedly,

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37 ▷ *A conclusion of the Study of IPB (Bogor Institute of Agriculture) in the Way Seputih Irrigation Scheme, Central Lampung, was that the average irrigation efficiency at the main system in the Province was about 71%, (IPB, 1972). The technical Note IX of the Luwu Project (General Aspects of O&M):p.20 also mentioned that the average irrigation efficiency for wet "sawah" paddy is 0.69 (rounded to 0.70).*

more important than the irrigation efficiency of the main distribution system. The tertiary efficiency, however, is not taken separately as a parameter in the model.

The tertiary efficiency is very much affected by the quality of the water measurement devices. A calibration was undertaken by the author with the result that the measurement devices at the tertiary turnouts were generally found to be ±25 to 50% inaccurate with some tertiary turnouts being in error by more than 50%. This condition results in diversions that are clearly different from the allocated values. Consideration of this issue is beyond the scope of this thesis. However, it should be recognized that it affects the implementation of land reclamation at the farm level which is related to the objectives of the current study.

With respect to the water requirement for new land, the average figures for the Luwu Project tend to be significantly lower than the average figures for the Way Rarem Project. These variations are attributed to the fact that the Luwu Scheme is located in a lowland plain with greater rainfall intensity and durations, different soil characteristics, depth to water table and other physical characteristics of the land prior to irrigation. These characteristics affect the amount of the stored off-season soil water, the seepage loss, deep percolation, saturation requirement for land preparation and other causes of water consumption or losses, all of which eventually add up to the gross (field) water requirement.

The average water requirement of the Way Rarem Scheme, although higher than the Luwu Scheme, is lower than the average requirement of other irrigation schemes in the Lampung Province. This is attributed to the fact that the Way Rarem scheme is equipped with a storage reservoir which, albeit small, provides some supplementary water.

The water requirement parameters and the number of irrigation areas that are used in the simulation model are as follows:

A. The Way Rarem Scheme

The water requirement patterns of the Way Rarem Scheme are characterized by the occurrence of high water consumption rates within the first three consecutive years with the demand becoming "normal" in the fourth year of irrigation. According to the engineering report on the Operation and Maintenance of the Way Rarem Irrigation Project, three areas with distinct sets of demand figures exist: (1) areas with a high initial demand, (2) areas with a medium initial demand, and (3) areas with a relatively low initial demand. The figures for each set is as follows:

o High Initial Demand:

$$q_{(year\ 1)} = 4.37\ l/s/ha;$$

$$q_{(year\ 2)} = 3.43\ l/s/ha;$$

$$q_{(year\ 3)} = 2.50 \text{ l/s/ha; and}$$

$$q_{(year\ 4)} = 1.56 \text{ l/s/ha,}$$

- Medium Initial Demand:

$$q_{(year\ 1)} = 4.04 \text{ l/s/ha;}$$

$$q_{(year\ 2)} = 3.03 \text{ l/s/ha;}$$

$$q_{(year\ 3)} = 2.01 \text{ l/s/ha; and}$$

$$q_{9year\ 4)} = 1.00 \text{ l/s/ha;}$$

- Low Initial Demand:

$$q_{(year\ 1)} = 2.62 \text{ l/s/ha;}$$

$$q_{(year\ 2)} = 2.49 \text{ l/s/ha;}$$

$$q_{(year\ 3)} = 1.47 \text{ l/s/ha;}$$

$$q_{(year\ 4)} = 1.00 \text{ l/s/ha;}$$

B. The Luwu Scheme

For the Luwu Scheme, the water requirement patterns are represented by the Lamasi Kanan and the Kalaeana Schemes. Both schemes have approximately the same initial water requirement characteristics. The higher initial water requirements occur within the first two years of the implementation process. The water consumption rate in this case becomes stable in the third year. The water requirement pattern is as follows:

$$q_{(year1)} = 3.00 \text{ l/s/ha;}$$

$q_{(year\ 2)} = 2.00$ l/s/ha; and

$q_{(year\ 3)} = 1.25$ l/s/ha.

C. Irrigation Operation Units

The operation of the Way Rarem Irrigation Scheme with a total command area of 22,233 ha and an intake capacity at 22.2 m^3/s is implemented through four irrigation sub-units: (1) Sidomukti with a command area of 4,942 ha; (2) Tata Karya with a command area of 5,738 ha; (3) Margo Mulyo with a command area of 5,663 ha; and (4) Pulung Kencana with a command area of 5,980 ha.

The Lamasi Scheme in Luwu with a command area of 4,473 ha and with an intake capacity of 7.5 m^3/s is operated through six sub-units. However, as the size of some units is disproportionally small compared to the others, the scheme is regrouped into three units: (1) Pompengan I and Pompengan II with a total command area of 1,905 ha; (2) Pompengan III and Pompengan IV with a total command area of 1,998 ha; and (3) Pompengan V and Pompengan VI with a total command area of 570 ha.

For the same reason the Kalaena Scheme in Luwu, with a command area of 12,392 ha and with an intake capacity of 13.0 m^3/s was also regrouped into the following sub areas: (1) Area I with a total command area of 3,353 ha, (2) Area II with a total command area of 3,369 ha, and (3) Area III with a total command area of 5,670 ha.

6.2.4 FARMER'S CAPACITY TO UNDERTAKE LAND DEVELOPMENT

It was mentioned in the previous chapter, that one of the boundary conditions of the current study is the land ownership pattern which is characterized by small land holdings averaging less than 1.00 ha. It was also mentioned that land development had to rely on manual labor and "cattle" power.

High initial water demand is not the only factor that limits the rate of land development. The reliance on manual labor to be provided by individual farmers also plays a significant role. Even if the land has easy access to required irrigation water, the ability and willingness of farmers to perform the development work is still a dominant factor in determining the failure or success of the project. To incorporate quantitatively the farmer's capacity to undertake new land development an empirical coefficient beta [β] varying between 0 and 1 was introduced to the model.

Another important factor for the development is the water distribution efficiency. It is expressed by means of a coefficient denoted by alpha [α] which also varies between 0 and 1. The idea, as outlined in Chapter-V *(Equation 5-3* through *Equation 5-5,)* was proposed on the basis of the notion that the capacity of both the farmer, as the subject, and the irrigation scheme, as the object, will never achieve 100% if they are continuously constrained by a number of undesirable environmental circumstances.

The magnitude of distribution efficiency [α] is determined by the care given to operation and maintenance, as well as the soundness of the engineering design and the quality and performance of the structures. The greater the magnitude of irrigation efficiency [α] the more successful the performance will be, and correspondingly the less likely that part of the project will be abandoned.

Similarly, the more capable the farmer is in undertaking land development, the greater the rate of land development achieved. However, the capability of farmers to undertake acceleration of land utilization is determined by a number of factors, such as skill, motivation, financial availability, experience, traditional practices, and agricultural equipment which are hard to articulate in precise terms. The impacts these factors have in determining the farmer's capacity are put together at an empirical coefficient [β], which is incorporated in the model the value of β is determined trial and error using historical data.

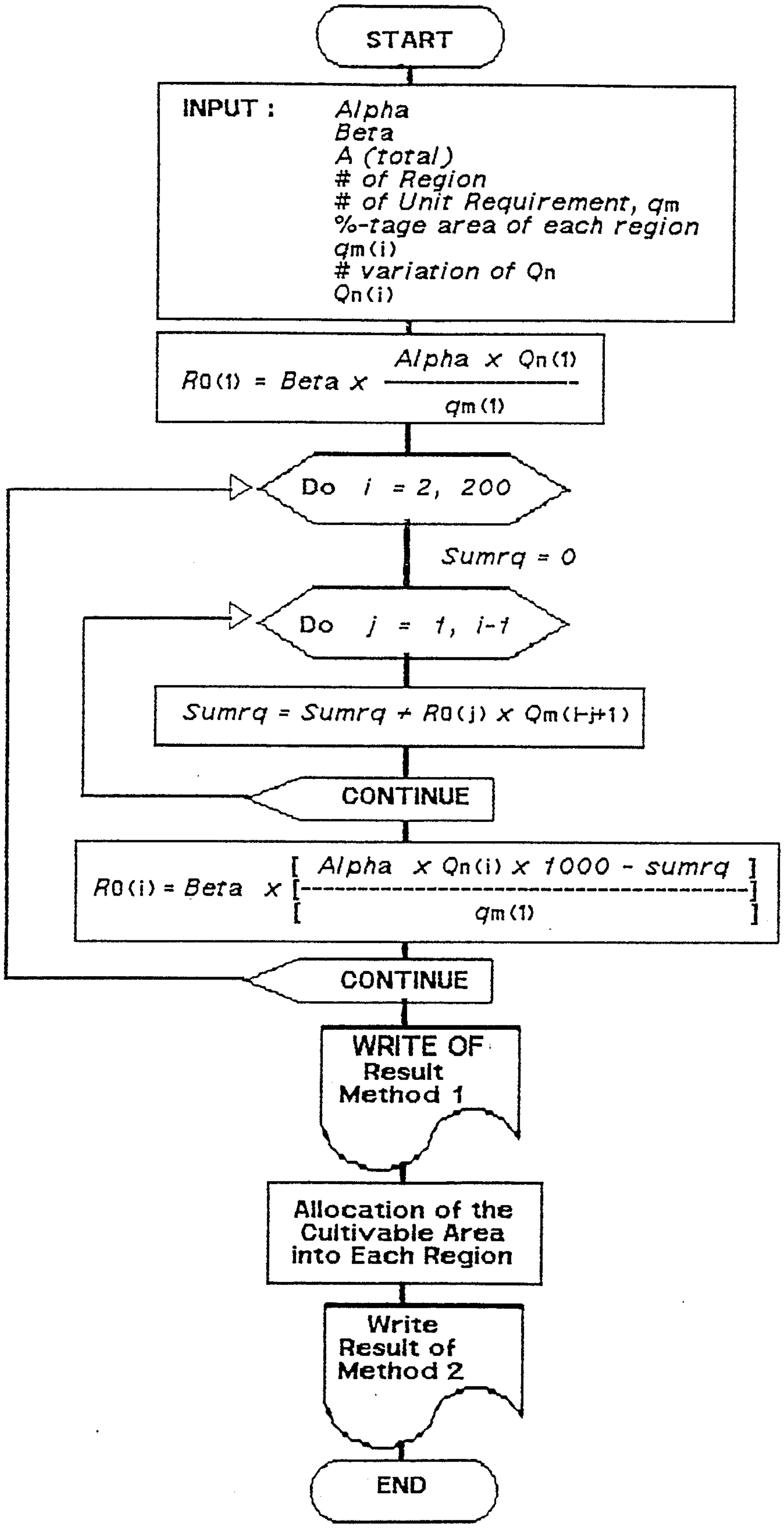
6.2.5 CONCEPT OF THE SIMULATION MODEL

The model in the present study is designed to assess the capacity of an irrigation scheme to achieve its objectives by imputing the existing combination of variables. By changing the physical parameters and mode of operation the simulation model can also be used to "optimize" the achievement of an irrigation project in terms of time required for full development. This can be done for the purpose of new development projects or to assess and possibly modify existing ones.

The model itself consists of a computer program that is derived from *Equations 5-3* through *Equation 5-5* in *Chapter V*. The computer program calculates the rate of land reclamation development of an irrigation scheme over a period of 100 consecutive years. *See the general flowchart of analysis procedure presented in Figure 6-4 for a description of how the model operates*. From the flowchart, it can be seen that the program is initiated by inputting of the nine parameters: (1) alpha [α] or irrigation efficiency, (2) beta [β] or empirical coefficient for farmers' readiness, (3) total irrigable area in the command area [A], (4) number of irrigation sub units, (5) number of stages of water requirement units, (6) percentage of area covered by irrigation sub-units, (7) actual water requirement units in each incremental stage [$q_{m(i)}$], (8) number of variations of intake capacities (design capacity) within the first few years of irrigation services, and (9) design intake capacity in each stage [$Q_{n(i)}$].

Two kinds of output are obtained from the model. The first output is the land development achievement in the simultaneous irrigation approach, while the second is the

Figure 6-4 GENERAL FLOWCHART OF THE MODEL TO DETERMINE ACTUAL UTILIZATION OF A PROJECT AREA WITH TIME



land development achievement under the step-by-step (technical rotation) approach. A more complete description of the model is given in the flowchart of calculation procedures that presented in *Appendix 6-1, 6-2,* and *6-3*, and the computer program as listed in *Appendix 6-4*.

6.3 RESULT OF THE ANALYSIS FOR CONVENTIONAL METHOD

6.3.1 THE WAY RAREM IRRIGATION SCHEME

In investigating the Way Rarem Project, three categories of water requirement configuration were used: (1) a high initial requirement, (2) a medium requirement, and (3) a low requirement. The α and β parameters were considered through application of a range of possible values for them from the highest irrigation efficiency (unlikely to occur) to the lowest obvious conditions. The sensitivity analysis revealed that the value of α (irrigation efficiency) is much more significant than the value of β (the ability of the farmer to undertake land development) in terms of the effect on the achievement. This implies that it is very important to maintain the highest possible level of irrigation efficiency if the objectives of the irrigation project are to be achieved.

The result of the analysis for the low level of water requirement in the Way Rarem scheme indicates that the average land development progress will be about 85% (at α =

0.87 and β = 0.72)[▷38] within 25 years of irrigation implementation. At the same level of water requirement, the land development progress for high and moderately low irrigation efficiency will is 99% (at $\alpha = 1.00$; $\beta = 1.00$); and 75% (at $\alpha = 0.75$; $\beta = 0.85$) within 25 years of implementation *(Figure 6-5 gives details of the results for a range of values of α and β)*. However, with this level of water requirement, it is possible that the development will reach only 55% in 25 years if the irrigation efficiency (α) is only around 0.50, which is not uncommon for poorly maintained irrigation schemes.

At the medium level of water requirement, the average land reclamation progress of the Way Rarem Scheme was 82% (at $\alpha = 0.87$; $\beta = 0.72$) in the 25 years time span. The high and low trends of land development at the same level of water requirement result in 95% (at $\alpha = 1.00$; β =1.00), and 72% (at $\alpha = 0.75$; $\beta = 0.85$) land development progress respectively *(as shown in Figure 6-6)*.

At a high level of water requirement, the average land reclamation progress results in development of only 54%

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38 ▷ *This combination of values was determined on the basis that it represents the most likely trend of the Way Rarem Scheme at its full development condition. This is comparable to the average value of Alpha (α) for irrigation in Lampung Province at 71% (IPB, 1972), and for the Luwu scheme at ±70% (Technical Note IX). However, if the scheme is not properly maintained, the value of Alpha (α) would decrease significantly and the value of Beta (β) would then also decrease follow.*

Figure 6-5 LAND DEVELOPMENT TRENDS OF "WAY RAREM" FOR VARIOUS VALUES OF ALPHA AND BETA, AND WITH LOW [q]

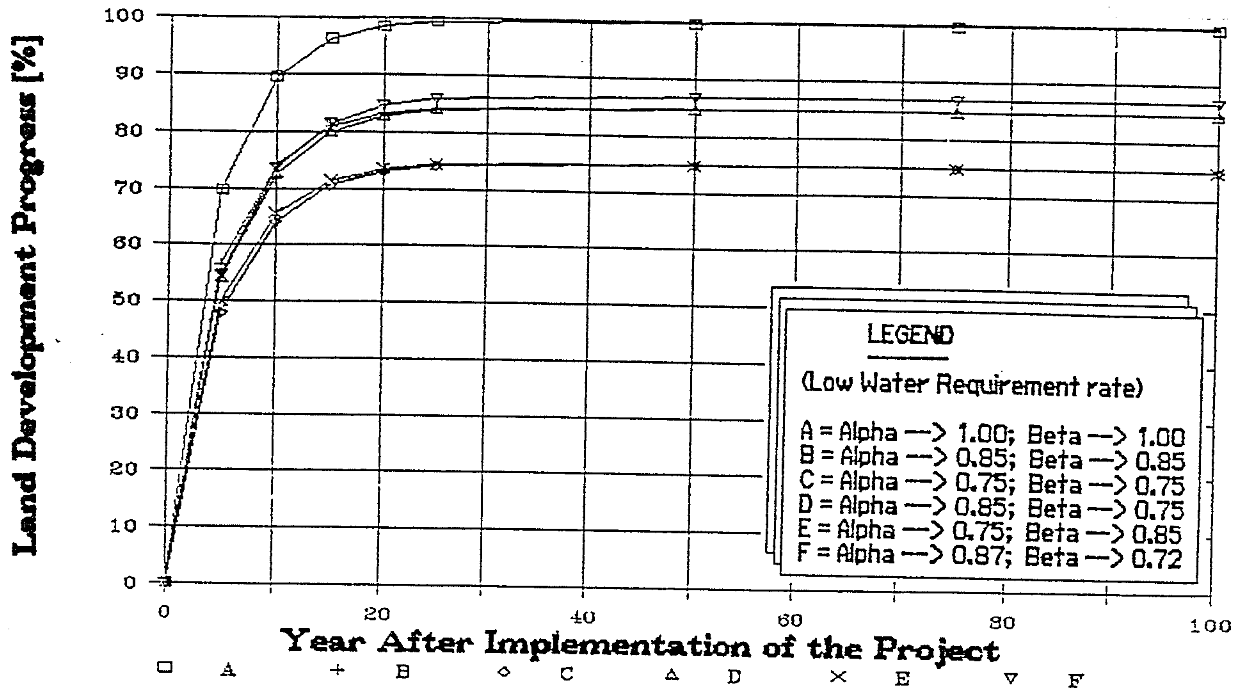
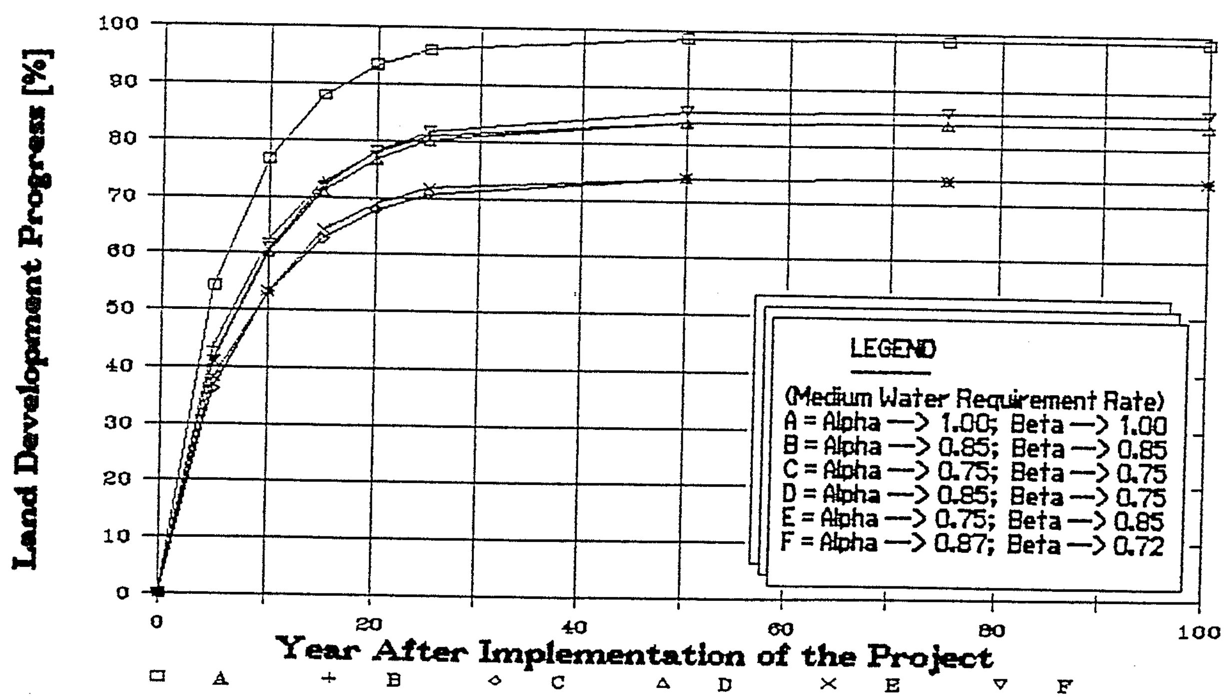


Figure 6-6 LAND DEVELOPMENT TRENDS OF "WAY RAREM" FOR VARIOUS VALUES OF ALPHA AND BETA, AND WITH MEDIUM [q]



(at $\alpha = 0.87$; $\beta = 0.72$) after 25 years of irrigation implementation. In this category, the higher level of 64% progress will only be achieved when $\alpha = 1.00$ and $\beta = 1$, while only 48% progress will be obtained after 25 years with values of $\alpha = 0.75$ and $\beta = 0.75$ *(Figure 6-7 shows the values of land reclamation progress for this case of high water requirement)*.

From the analyses of all of the three water requirement categories, it can be seen that the land development progress tends to become stagnant at any point beyond 25 years. As shown in *Figure 6-8*, whatever the progress of land development up to the 25th year, it will remain so (or otherwise only increase very slowly) for the remaining life of the scheme. A more detailed description of the results are presented in *Appendix 6-5* (Analysis of Results of Land Development Trend in the Way Rarem Scheme for a number of combinations of α and β).

6.3.2 The Luwu Irrigation Schemes

The model for the Luwu Irrigation project is represented by the Lamasi Scheme in the southern part, while the Kalaena Scheme represents the northern part of the Luwu plain. Using these representative samples, the results from the Luwu scheme are quite similar to those of the Way Rarem Scheme. The only difference between the two sets of results lies in the magnitude of land development progress for each

Figure 6-7 LAND DEVELOPMENT TRENDS OF "WAY RAREM" FOR VARIOUS VALUES OF ALPHA AND BETA, AND WITH HIGH [q]

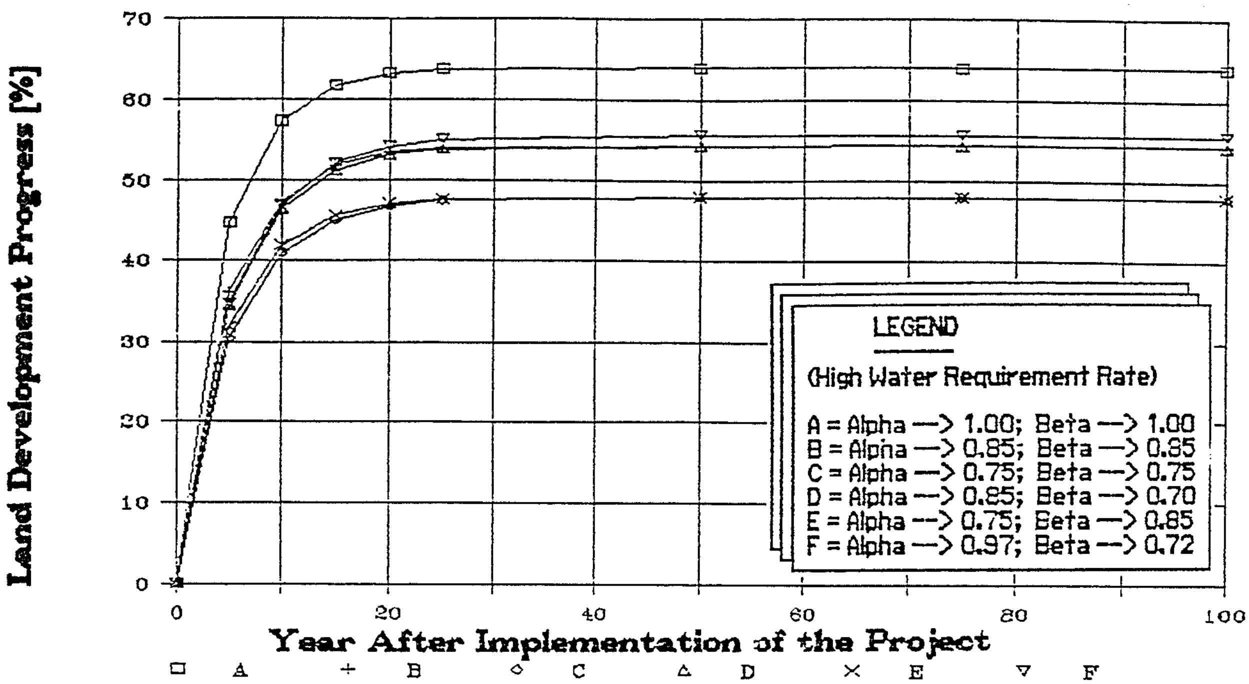
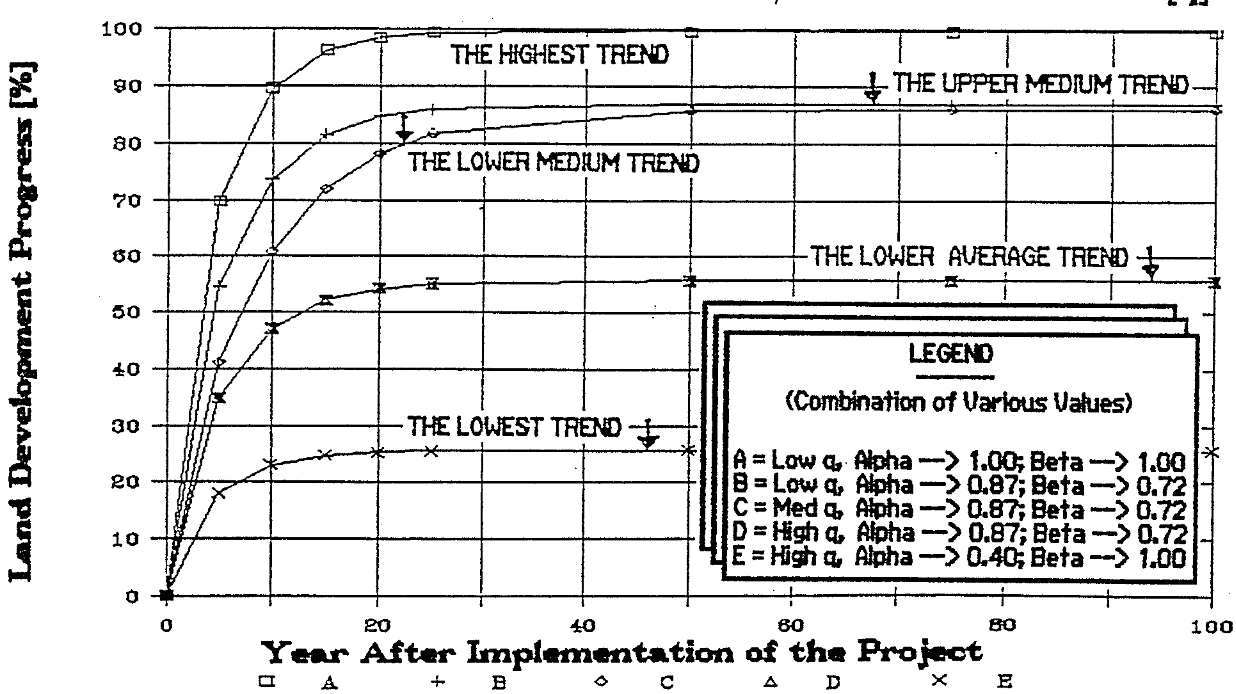


Figure 6-8 LAND DEVELOPMENT TRENDS OF "WAY RAREM" FOR VARIOUS VALUES OF ALPHA AND BETA, AND WITH VARIOUS [q]



given condition. The overall general trends demonstrated by the Luwu model suggest that the development progress of the Way Rarem Scheme tends to be slower.

The results of the analysis for the Lamasi Scheme indicate that the full land development at current "average" physical characteristics will be achieved at 100% (at α = 0.87 and β = 0.72) within around 20 years of irrigation implementation. For the high trend of land utilization and high irrigation efficiency, the 100% land reclamation progress will occur within 5 years (at α = 1.00 and β = 1.00), while at the low trend of land utilization and irrigation efficiency, the progress will be about 67% of land development (with α = 0.50 and β = 0.60) within 25 years. *These results are summarized in Figure 6-9.*

From the results of the Kalaena Scheme, it is apparent that the general development tendency is slower, unlike the Lamasi Scheme, reflecting the less developed nature of the region. The average progress of land development of the Kalaena Scheme is about 73% (at α = 0.87 and β = 0.72) within 25 years The high trend of land development results in 84% development (at α = 1.00 and β = 1.00), while the lower trend results in 63% development (at α = 0.75 and β = 0.85) within 25 years of implementation of the irrigation and for any point beyond. *These results are shown in Figure 6-10 with a more detailed summary of the Luwu case presented in Appendix 6-6.*

Figure 6-9 LAND DEVELOPMENT TRENDS OF "LAMASI" FOR VARIOUS VALUES OF ALPHA AND BETA, AND WITH CONSTANT [q]

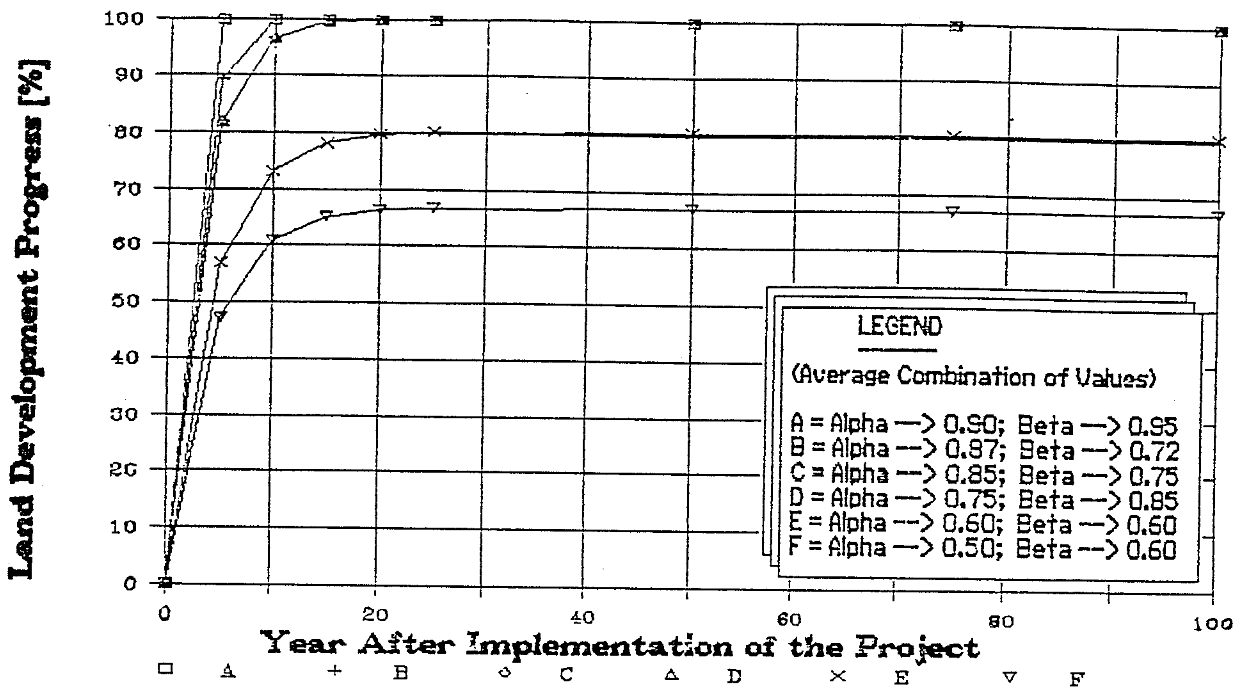
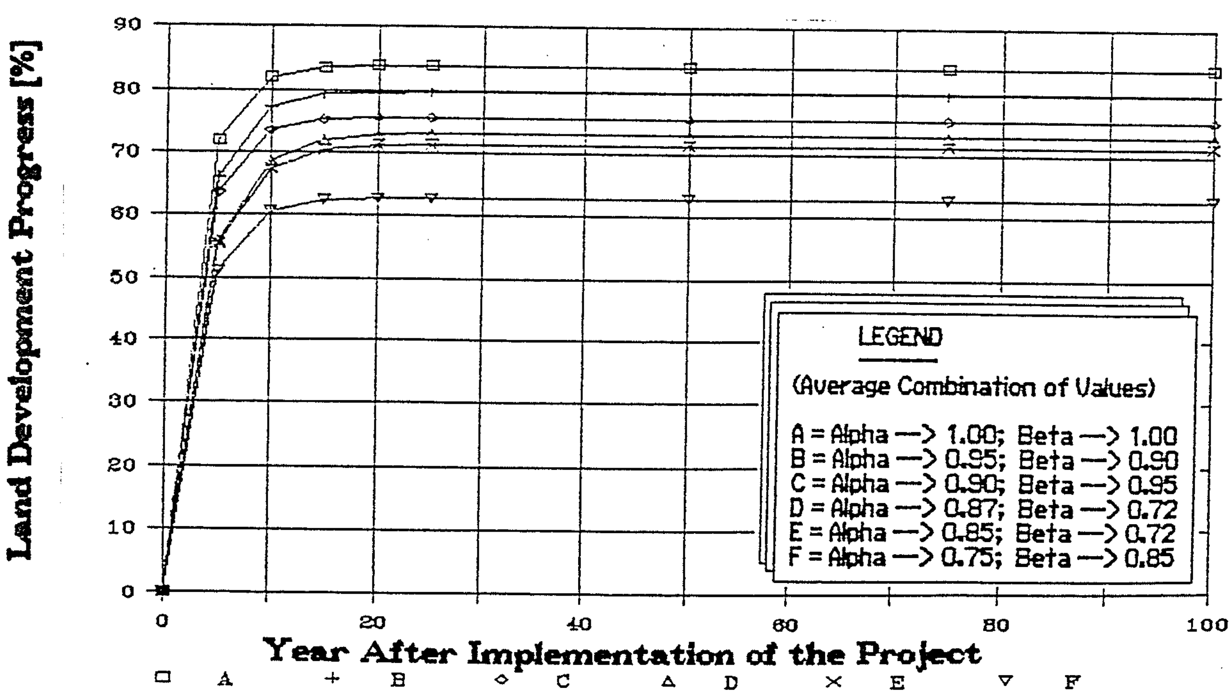


Figure 6-10 LAND DEVELOPMENT TRENDS OF "KALAENA" FOR VARIOUS VALUES OF ALPHA AND BETA, AND WITH VARIOUS [q]



These outcomes indicate that the Kalaena Scheme needs more time to develop relative to the Lamasi Scheme. However, the achievement of the Kalaena scheme is still fairly high in comparison with the development characteristics of the Way Rarem Scheme, though the development patterns are almost similar with each other. Both schemes have significantly high rates of achievement at the beginning of the project implementation and gradually become very slow or even stagnant before full development is achieved.

6.4 USE OF THE MODEL FOR THE ANALYSIS OF STEP-BY STEP AND SIMULTANEOUS IRRIGATION CONCEPTS

6.4.1 MODEL PROCEDURES

In the previous section the model was utilized to simulate the development that would result from adhering the policy recommended by the irrigation design standard of the Department of Public Works. It will be recalled that this standard prescribes that the distribution be designed for stable conditions and that the start-up of the scheme should be carried out in stages (step-by-step or technical rotation principle) by utilizing existing capacity of the canal system to its maximum level at any time. Two alternative implementation systems were investigated and are described in this section. In the first alternative the development of the irrigation system is conducted with the simultaneous development concept, but the design capacity of the canal is increased to meet the total water demand that will be required under these conditions. In the second alternative the implementation is carried out through a technical rotation (step-by-step) system, but here also the design capacity of the distribution system is made sufficient to meet the water demand in any stage of the development.

For the first alternative the determination is straight forward as it only involves multiplying the initial water requirement per ha with the acreage of agricultural land that is going to be developed. The determination of the water requirement for the second alternative is based on *Equation 6-1* and *Equation 6-2*. With a given number of sub units involved in the technical rotation and with the given annual water requirement demand of the new land, one can calculate the required capacity of the canal system for each year from the initial stage of irrigation implementation up to the point of stabilization. The system must then be designed for the maximum capacity that is required.

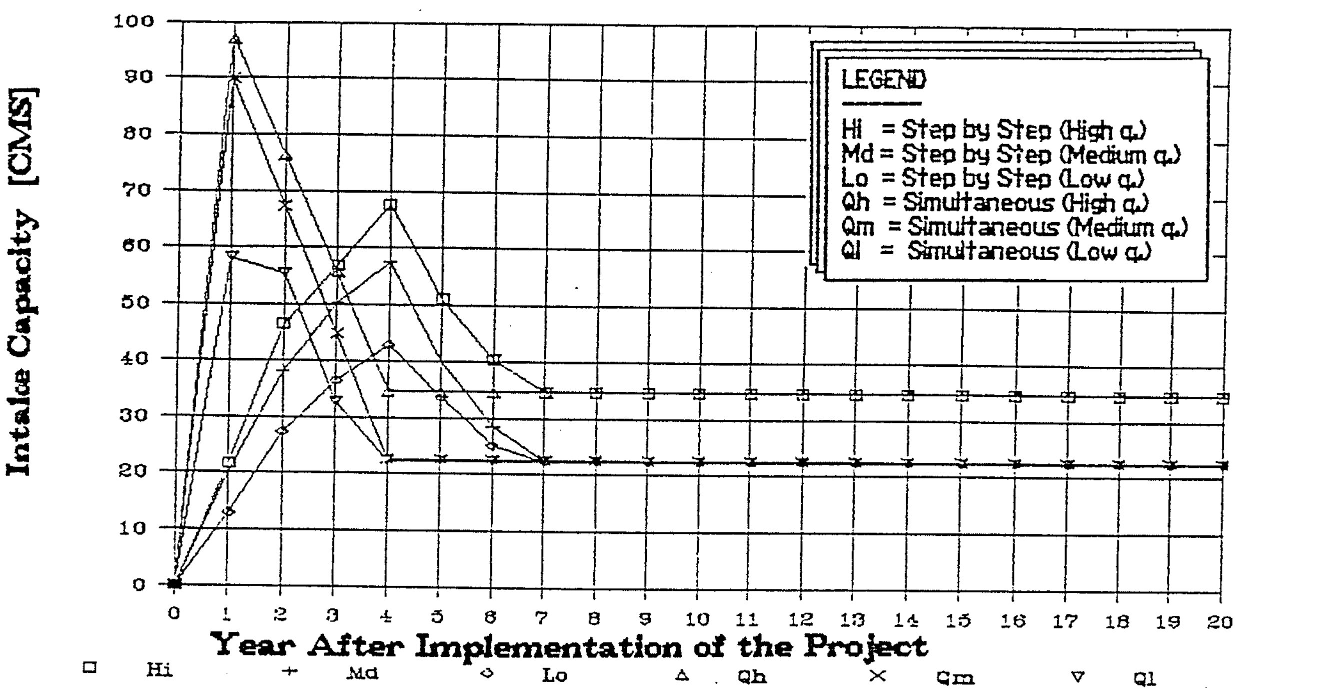
The canal capacities resulting from the above calculations are then incorporated in the model with the other parameters that were previously employed in the computer program to calculate the rate of land development for each alternative. The latter calculation procedure is exactly the same as the one described in the previous section, only the parameters used in the model are different.

6.4.2 RESULT OF ANALYSIS

A. The Way Rarem Irrigation Scheme

As in the previous analysis, the water requirement of the two alternatives for the Way Rarem Project is based on three initial demand categories: low, medium and high initial demand. *(Way Rarem Project, O&M Report, 1984)*. These values determine the canal capacities of the Way Rarem for the two alternatives. *Figure 6-11* shows the results. From this figure it is apparent, not unexpectedly, that the

Figure 6-11 ALTERNATIVES OF WAY RAREM INTAKE CAPACITIES UNDER THE SIMULTANEOUS AND STEP-BY-STEP CONCEPTS



required intake capacity for simultaneous development is much greater than that for the step-by-step system. The peak intake capacity associated with the step-by step method also occurs several years later than for the simultaneous development.

Figure 6-11 clearly demonstrates that the application of the simultaneous development concept is not impossible, but that the required capacity of the canal systems for the first few years is quite unrealistic. The maximum capacity of the main intake for the simultaneous water distribution system is about 97 m^3/s or about 435% of the stable design capacity for the high initial demand, 404% of the stable design capacity for the medium initial demand, and about 252% of the stable design capacity for the low demand. In addition, even if the infrastructure and the water were adequate to meet the peak demand, the small-farmers do not have the capacity to undertake simultaneous land development. Therefore, the implementation of a simultaneous irrigation development concept is not advisable.

Analysis of the technical rotation (step-by-step) development method also shows the need for a greater intake capacity for the first few years of irrigation. However, the maximum required canal capacity is not as extreme as for the simultaneous case. The implementation time, however, is longer (7 years), compared to 4 years for simultaneous development. The peak capacity for a high initial demand is 304% of the stable design capacity, 260% for a medium initial demand, and about 193% for the low demand *as shown in Figure 6-11)*. More figures about intake capacities of the Way Rarem projects from the resulting analysis are presented in *Table 6-3*.

These figures demonstrate that the canal system capacity and dimension would need to be increased by a factor of two to three for the first three years if the system is expected to serve the command area simultaneously. It may also be desirable, for hydraulic or other consideration, to rescale the channel to meet only normal conditions after three years. However, such a step would have a huge financial consequences and would go far beyond the normal requirements of constructing an irrigation scheme on a conventional basis.

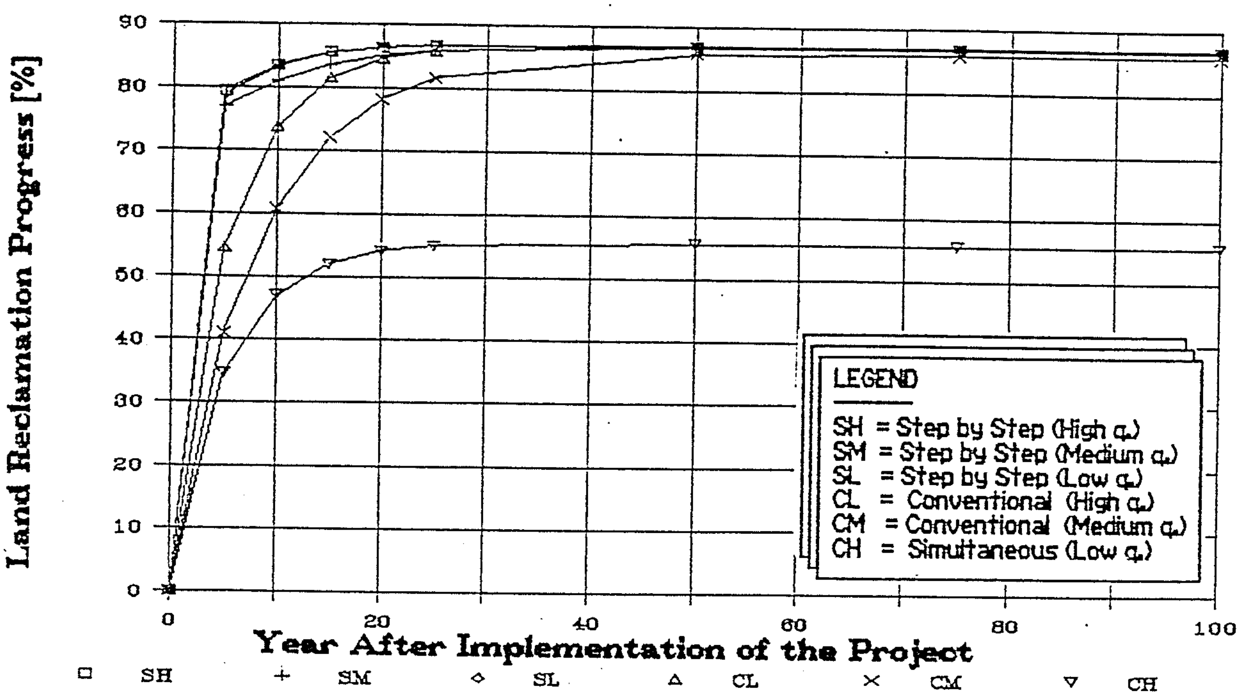
The difference in long term development achievement between the step-by-step method and the conventional approach is obvious when their development diagrams are compared in *Figure 6-12*. This figure shows that the step-by-step concept results in a more rapid development in the first 10 years as compared to the conventional approach. However, after 25 years the difference disappears.

It is necessary to conduct a judicious optimization study that will identify the best compromise between a more rapid development and a lower cost of the distribution

TABLE 6-3 ALTERNATIVES OF INTAKE CAPACITY OF THE WAY RAREM SCHEME ON STEP-BY-STEP DEVELOPMENR APPROACH

NO.	UNIT OF WATER REQUIREMENT OF THE NEW LAND	TRENDS OF CANAL INTAKE CAPACITY FOR STEP-BY-STEP LAND RECLAMATION								ACTUAL DESIGN CAPACITY [CMS]	REMARKS
		YEAR 1 [CMS]	YEAR 2 [CMS]	YEAR 3 [CMS]	YEAR 4 [CMS]	YEAR 5 [CMS]	YEAR 6 [CMS]	YEAR 7 [CMS]	YEAR 8, ON [CMS]		
I	HIGH TREND										TOTAL IRRIGABLE AREA = 22,233 HA
	q(1) = 4.37 l/s/ha										AREA 1 = 4,942 HA
	q(2) = 3.43 l/s/ha										AREA 2 = 5,738 HA
	q(3) = 2.50 l/s/ha										AREA 3 = 5,663 HA
	q(4) = 1.56 l/s/ha	21.598	46.523	56.786	67.659	51.018	40.218	34.681	34.683	22.200	AREA 4 = 5,890 HA
	Q = 34.683 M3/Sec.										PERCENT OF TOTAL
											AREA 1 = 22.23 %
											AREA 2 = 25.81 %
	Q(simultaneous).Hi.=	97.158	76.259	55.583	34.683	34.683	34.683	34.683	34.683		AREA 3 = 25.47 %
											AREA 4 = 26.49 %
II	MEDIUM TREND										TOTAL IRRIGABLE AREA = 22,233 HA
	q(1) = 4.04 l/s/ha										AREA 1 = 4,942 HA
	q(2) = 3.03 l/s/ha										AREA 2 = 5,738 HA
	q(3) = 2.02 l/s/ha										AREA 3 = 5,663 HA
	q(4) = 1.01 l/s/ha	19.960	38.158	50.247	57.534	40.070	28.400	22.455	22.455	22.200	AREA 4 = 5,890 HA
	Q = 22.455 M3/Sec.										PERCENT OF TOTAL
											AREA 1 = 22.23 %
											AREA 2 = 25.81 %
	Q(simultaneous).Med=	89.821	67.366	44.911	22.455	22.455	22.455	22.455	22.455		AREA 3 = 25.47 %
											AREA 4 = 26.49 %
III	LOW TREND										TOTAL IRRIGABLE AREA = 22,233 HA
	q(1) = 2.62 l/s/ha										AREA 1 = 4,942 HA
	q(2) = 2.49 l/s/ha										AREA 2 = 5,738 HA
	q(3) = 1.47 l/s/ha										AREA 3 = 5,663 HA
	q(4) = 1.00 l/s/ha	12.494	27.340	36.388	42.907	33.670	25.000	22.233	22.233	22.200	AREA 4 = 5,890 HA
	Q = 22.233 M3/Sec.										PERCENT OF TOTAL
											AREA 1 = 22.23 %
											AREA 2 = 25.81 %
	Q(simultaneous).Lo.=	58.250	55.360	32.683	22.233	22.233	22.233	22.233	22.233		AREA 3 = 25.47 %
											AREA 4 = 26.49 %

Figure 6-12 COMPARISON OF CONVENTIONAL, SIMULTANEOUS AND AND STEP-BY-STEP IRRIGATION CONCEPTS ON THE WAY RAREM



system. For the time being, however, as long as the basic problems are not resolved, the step-by-step development concept is advocated for new irrigation projects. Future irrigation projects especially those that are supporting resettlement programs, should carefully consider the minimum time span required to develop the irrigation project. The resettlement program should adjust to this time span in setting the time schedule for resettlement.

More studies are required to deal more effectively with the problem of high initial water demand and to find solutions to the problems for future irrigation projects.

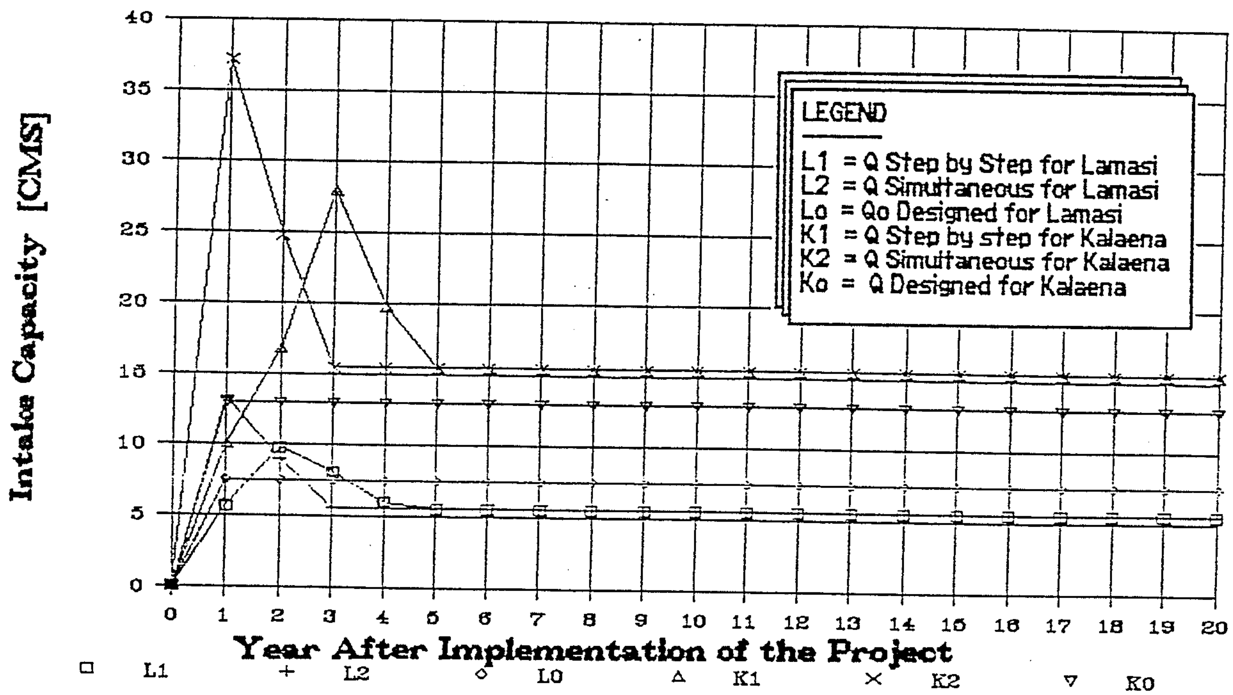
B. The Luwu Irrigation Schemes

It was mentioned before that the Luwu Project has two sub-divisions that differ in their initial water demand: the Lamasi sub-project and the Kalaena sub-project. The Lamasi sub-project requires a maximum distribution capacity of 130%, and 180% of the stable design capacity with the step-by-step and simultaneous methods respectively. A discharge of 1.3 times the design capacity can be accommodated by raising the canal dykes somewhat and by allowing a smaller free board than is normally required. While this violates standard engineering practice, it can be tolerated for the limited number of years for which the excess capacity is needed.

In the case of the Kalaena Scheme, maximum capacities are about 215% (in the third year), and 286% (in the first year) of the stable design capacity for the step-by-step and simultaneous method respectively. *Figure 6-13* shows the requirements for both sub-projects. *Table 6-4* presents the differences between the required capacities of the Lamasi and the Kalaena sub-projects of the Luwu Irrigation Project in more detail.

It can be seen that from *Figure 6-13* and *Table 6-4* that the land development levels are much lower than the corresponding average figures of the Way Rarem scheme, where the required flow capacity for either the simultaneous and

Figure 6-13 COMPARISON OF CONVENSIONAL, SIMULTANEOUS AND STEP-BY-STEP IRRIGATION CONCEPTS, LUWU



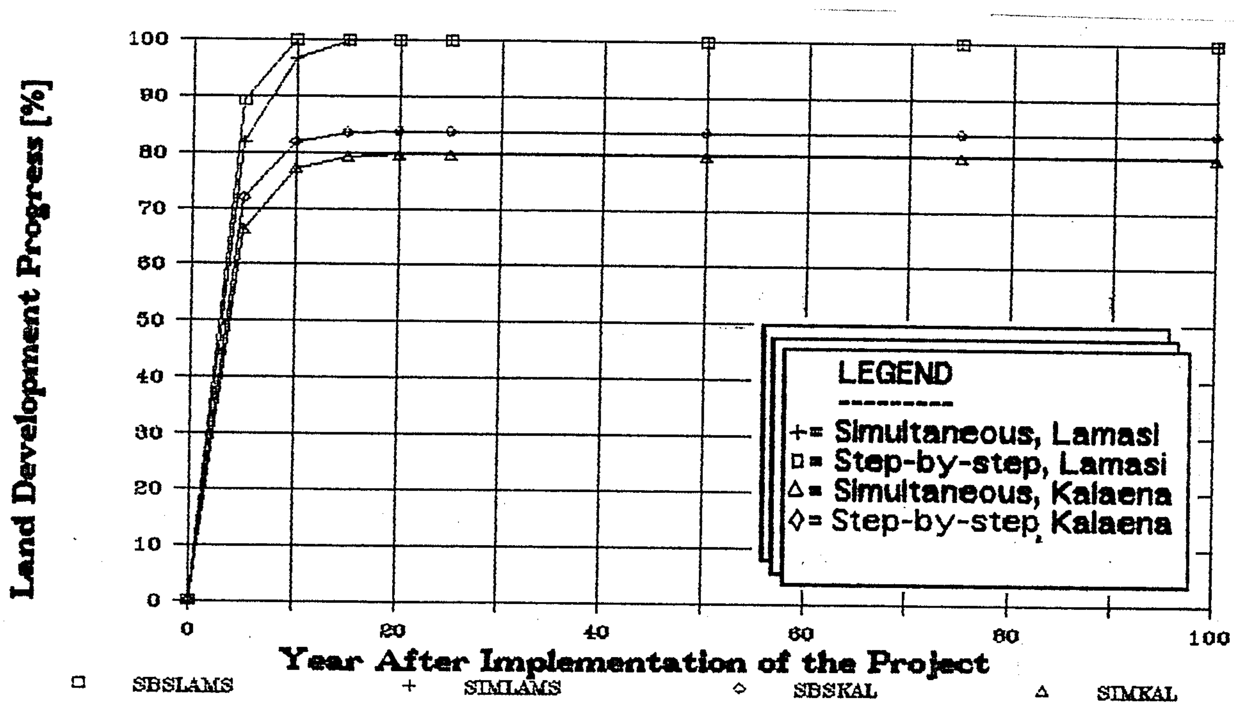
step-by-step development procedure is much too high to accommodate within the existing canal dimensions.

Similar to the case of Way Rarem, the difference in long term development achievement between the step-by-step method and the conventional approach is also obvious for the Luwu scheme when their development diagrams are compared as in *Figure 6-14*. This figure shows that the step-by-step concept also results in a more rapid development in the first 10 years as compared to the conventional approach. However, after 25 years the difference disappears or becomes relatively small.

TABLE 6-4 ALTERNATIVES OF INTAKE CAPACITY OF THE LAMASI AND KALAENA SCHEMES ON STEP-BY- STEP DEVELOPMENT APPROACH

NO.	UNIT OF WATER REQUIREMENT OF THE NEW LAND	TRENDS OF CANAL INTAKE CAPACITY FOR STEP-BY-STEP LAND RECLAMATION								ACTUAL DESIGN CAPACITY [CMS]	REMARK
		YEAR 1 [CMS]	YEAR 2 [CMS]	YEAR 3 [CMS]	YEAR 4 [CMS]	YEAR 5 [CMS]	YEAR 6 [CMS]	YEAR 7 [CMS]	YEAR 8, ON [CMS]		
I	LAMASI SCHEME										TOTAL IRRIGABLE AREA = 4,473 HA
	q(1) = 3.00 l/s/ha										AREA 1 = 1,905 HA
	q(2) = 2.00 l/s/ha										AREA 2 = 1,998 HA
	q(3) = 1.25 l/s/ha										AREA 3 = 570 HA
	Q = 7.500 M3/Sec.	5.715	9.804	8.087	6.019	5.591	5.591	5.591	5.591	7.500	PERCENT OF TOTAL
											AREA 1 = 42.59 %
											AREA 2 = 44.67 %
	Q(simultaneous) =	13.419	8.946	5.591	5.591	5.591	5.591	5.591	5.591		AREA 3 = 12.74 %
II	KALAENA SCHEME										TOTAL IRRIGABLE AREA = 12,392 HA
	q(1) = 3.00 l/s/ha										AREA 1 = 3,353 HA
	q(2) = 2.00 l/s/ha										AREA 2 = 3,369 HA
	q(3) = 1.25 l/s/ha										AREA 3 = 5,670 HA
	Q = 13.000 M3/Sec.	10.060	16.815	27.939	19.743	15.491	15.491	15.491	15.491	13.000	PERCENT OF TOTAL
											AREA 1 = 27.06 %
											AREA 2 = 27.19 %
	Q(simultaneous) =	37.176	24.784	15.490	15.490	15.490	15.490	15.490	15.490		AREA 3 = 45.75 %

Figure 6-14 COMPARISON OF SIMULTANEOUS AND STEP-BY-STEP IRRIGATION CONCEPTS ON THE LUWU PROJECT



The size of the irrigation command area is an important factor in dealing with the high water requirement. This can be seen from the fact that the Lamasi scheme has a lower ratio between peak capacity and long term capacity than the Kalaena schemes. The two differ primarily in area. The Kalaena scheme has a command area of 12,393 ha, while the Lamasi scheme only has 4,474 ha. All other aspects are similar or almost similar.

This scale effect was also noted in other irrigation developments studied by the author. Examination of past records of irrigation development shows that problem associated with the large initial water demand are only apparent in schemes with a command area of 700 ha or more. Apparently, with few exceptions, the larger the size of the command area of a single scheme, the more serious the problems of new land development. In part this may be explained by the fact that smaller canals are more often over-designed than large canals. In addition, there is relatively greater reserve capacities in the free board provided in the small channels than in the large channels.

Another factor, however, may be that there is a certain size of irrigation command area which is sufficiently large to serve the irrigation requirements but still small enough to be efficiently manageable. These factors should be taken into account in determining the size of a single irrigation scheme, especially, in relation to the question of what size of single irrigation command area would best meet the objectives of efficient management?" The answer to this question, which is beyond the scope of the present study, is a fertile area for future research.

6.5 GENERAL CONCLUSIONS

The simulation of a number of conditions by means of the model, leads to the following general conclusions:

(1) With the current design conditions and current practice of operation and maintenance in the newly developed irrigation schemes, it is likely that irrigation development

will achieve on average only 80% of the target within 25 years. A high rate of land development, would result in a slightly more larger achievement, about 85%, while with a low rate of land development, an achievement level of about 60% within 25 years is not unusual. It is likely that for these conditions most irrigation schemes will never achieve 100% of the targeted area, even within a time span of 100 years. This finding is corroborated by the current experience with newly developed agricultural land for low-land paddy fields in Indonesia.

(2) Land development normally levels off after about 25 years. No matter what level of development is achieved to this point, no further or only very minor progress will occur throughout the remaining life of the project.

(3) The irrigation efficiency is one of the most important parameters in determining the failure or success of an irrigation scheme as shown by a sensitivity test concerned with the rate of land development. Indeed, a minor improvement in the magnitude of the irrigation efficiency will bring about a substantial improvement in the rate of development. Therefore, it is vitally important to maintain a high level of irrigation efficiency if the scheme is to be successful in meeting its objectives.

(4) The farmer's ability to undertake land development, as expressed in the coefficient β is also considered a key factor. It does not, however, have the same impact on land

development as the magnitude of the irrigation efficiency. This implies that land development progress is primarily governed by water availability. However, it is also obvious that there will be no progress if farmers do not undertake the work required for the development. In other words, land development will proceed continuously as long as water is readily available. It will not achieve the target, even with high farmer participation, if the irrigation efficiency is low.

(5) Acceleration of the development process by implementing simultaneous irrigation, although technically possible, is highly unrealistic, not only because of constraints on the water supply, but also because of prohibitive cost of the distribution system.

(6) Practicing technical rotation or step-by-step development produces the same development as the simultaneous method. However, the required capacity of the distribution system is not so extreme as for the simultaneous method. The trade-off, however, is that the implementation time is considerably longer.

(7) Compared with the conventional approach, the step-by-step concept produces a greater development in the first 10 years of irrigation implementation; however, after 25 years the pattern of development becomes similar. Therefore there is a need for more study to determine optimum structural dimensions within the constraints imposed

by the available resources. This is a topic which is beyond the scope of this study.

(8) The current experience in irrigation development indicates that, with few exceptions, the larger the size of the single command area (beyond a threshold of 700ha), the more serious the development problems become. There seems to be a certain size of command area for which the scheme is sufficiently large to serve the irrigation requirements but still small enough to be efficiently manageable. The question is then: What size should be chosen for a single irrigation command area to attain efficient management so as to meet the irrigation targets as closely as possible. The answer of this question, which is beyond the scope of the present study, is also open for future research.

CHAPTER SEVEN

ANALYSIS FOR ESTIMATING THE VALUE OF IRRIGATION WATER FOR TRANSMIGRANT FARMERS

CHAPTER SEVEN

ANALYSIS FOR ESTIMATING THE VALUE OF IRRIGATION WATER FOR TRANSMIGRANT FARMERS

7.1 INTRODUCTION

This chapter discusses the economic relationship between the irrigation projects and the transmigrant farmer. This includes: the value of irrigation water for small land holders; a financial analysis for estimating irrigation water cost; the accepted methods and policies of charging for water; an analysis of the farmer's ability to pay the cost of irrigation water; and the prospects of actually charging the small holder transmigrant for water. The estimate was based on a financial analysis of the economic components of the engineering project. It is not a complete economic analysis and does not consider the opportunity cost of the resources used in the project investment.

The financial analysis assumes that the individual farmers are capable of contributing part of their earnings to recover the costs of providing irrigation water, at least to the point that operation and maintenance costs of the project are covered. In that way the irrigation project can become a self-sustaining operation.

Since a fairly extensive area is covered by this study, the analysis concentrates on the supply side (ie., cost) of the project. The figures used in the analysis were mainly obtained from a study of current irrigation practice in the study areas: (1) the Way Rarem scheme in Lampung Province, (2) the Kalaena scheme in the Luwu Irrigation Project, and (3) the Lamasi scheme also in the Luwu Irrigation Project, South Sulawesi Province.

The study provides a comparative analysis in an attempt to understand the consequences of charging small land-holder transmigrants for water services.

7.2 OUTLINE OF THE ANALYSIS METHOD

7.2.1 THE GENERAL ISSUE OF ECONOMIC VALUATION AND PROJECT INVESTMENT ANALYSIS

A. General Principle of Economic Analysis

General economic theory holds that society is concerned about efficient resource use -- extracting the greatest total product (income) from available resources. In the pursuit of this goal, theoretical economic analysis ignores all institutional constraints and visualizes an economy with no ownership rights to resources, no under-utilization of resources, no constraints on free trade of resources and product, no interests that are able to restrict output and increase price because of a natural monopoly, and no government interference except to ensure a competitive economy with freedom of choice and a complete internalizing of all external project costs and benefits. However, these conditions pertain to a fictitious economy which does not exist. In reality no actual project is ever evaluated assuming that all these conditions prevail.

A rigorous approach to an economic analysis of agricultural projects would be to start from where the economy currently is and to conceptualize what the conditions would be if the major restrictions to efficient resource use were removed. What would the effect on agriculture be if all taxes, subsidies, and price supports were removed? What would import prices be if all import controls were removed. If there are under utilized resources, what are the opportunity costs of employing additional units of those unused resources? Once these preliminary questions are answered one could begin to determine what the incremental net benefit of a project would be if all external costs and benefits were included in the analysis.

Conceptualization, however, is not enough. The results of the removal of the restrictions on the free market system must be estimated and interpreted in terms of quantitative changes in project input and output prices and quantitative changes in the incremental net benefit. To do this and to complete an economic analysis, one must analyze the project within a general equilibrium model so as to evaluate the ultimate full effects of removing institutional constraints such as price support and price subsidies.

A complete economic analysis, however, is far beyond the scope of this study and would have little practical value for the purpose of this study, which is to suggest policy changes that would lead to greater success in future transmigration schemes. The analysis is therefore limited to a Project Investment Analysis.

B. Project Investment Analysis for Agricultural Projects

Project investment analysis in agricultural development projects has advanced significantly during the last decades. The policy objectives are not limited to choosing the project that maximizes economic growth; but may also favor projects that can create income re-distribution and consumer benefits.

In principle, project investment analysis proceeds by imputing an opportunity cost and return to all resources that are used in a development project. Investment criteria such as benefit cost ratio, internal rate of return and net present worth, are then used to select the best alternative among the projects which meet the policy objectives of maximizing income growth, social well being, or returns to capital.

The *opportunity cost* of a resource use in a particular project is defined as "*the value it could command if it were used for the best available alternative (Baum and*

Tolbert, in Tweeten, 1989:240). Thus the basic principle is that the value of any product (expressed as the market price or as the willingness-to-pay by the consumer) should be equal to marginal cost (the opportunity cost of the forgone output from the use of the resource) of producing the last unit sold. This can be achieved in a competitive market.

Competitive markets, however, do not always exist. Many infrastructure projects, such as irrigation services are best handled as a public utility, which acts as a non-profit firm, because such projects operate as a natural monopoly. If left to the market, consumers could be forced to pay more than the marginal cost of providing the good or service through controlling output and increasing price.

An economic analysis of the irrigation projects associated with transmigration is also hampered by the fact that the benefits are varied and difficult to evaluate or to compare in financial terms. Furthermore since, the fact that the irrigation development is handled by the government makes it difficult to assign an opportunity cost to the resources used, e.g. the water, since there is no real alternative use.

Other problems with the economic analysis stem from the traditional mind set of the farmers who would not respond to changes in, say, price of water, by modifying their farming methods, unless forced out of the market.

What project contribution to measure and how, depends on the collective preference of the society which may set different values on such things as as stability, equality in income distribution, social stability, personal freedom and so on. The policy objectives of social stability or income redistribution thus require further criteria for project evaluation. Project benefits in these matters are difficult to evaluate because there is no market for them.

As far as tangible costs are concerned, the cost of administering water usage fees is often greater than the revenue collected. This is particularly true for the case of small land holders. Therefore, a proper project investment analysis is not easy to apply for irrigation that has non-tradeable inputs and outputs that are difficult to evaluate and compare in monetary terms.

One reason for the government to intervene in the agricultural sector is the belief that intervention can accelerate the rate of income growth. Investment policy, -- that is, the provision of public goods, such as infrastructural development -- is an example of public sector intervention to stimulate economic activity. This investment will not as a rule be made by the private sector, because they may be unable to capture the full benefit from the investment. It is also seldom possible to exclude those who do not pay for services created. Consumers, therefore, avoid declaring their willingness to pay for the goods or services, and a market does not form. For most of these public sector investments, according to *Monke, (1989)* the public sector has the potential to recover the cost of intervention through user fees or through taxation of commodities or the regional population that benefits from the investment *(Monke, 1989:4)*.

7.2.2 ENGINEERING ECONOMIC CONCEPT USED FOR ESTIMATING FINANCIAL VALUE OF IRRIGATION WATER

Investment analysis for irrigation projects can be conducted by using "financial analysis". In financial analysis market prices are used in measuring the project input and output. The project is viewed economically from the perspective of direct costs and direct benefits.

Financial analysis is that market prices restricts on limiting social values shows how a policy will effect the land-holder, in the sense that it influences the cash flow available for investment. Thus in financial analysis, the project is evaluated on the basis of cash flow. However, cash flow is not always limited to cash transactions. When measuring the contribution to a development project by small holder resources, problems arise because many transactions are not in cash, and not measured in cash but in increases or decreases in home consumption.

The individual land holders are providing the equity capital and are receiving an incremental net benefit. Project inputs are valued at market prices which may or may not the same as opportunity cost of the small holder. Labor cost is the number of work days times wage rate and represents either the cost to the small holder if he hires the labor or his own opportunity cost of spending this time in the project versus spending time in alternatives such as leisure or off-farm employment.

The present chapter contains an analysis for estimating the financial value of irrigation water by means of principles of engineering economics. The analysis is mainly based on the supply side of the project. It does not investigate the cost from the demand side of the project as required by the criteria of economic analysis. The approach essentially follows "private profitability"[39] methods where a form of cost recovery based on user fees is investigated. In order to provide alternative forms of recovery that could be followed by the government to levy the water users, a range between "free" water and fully cost-recovered water is investigated. The estimated figures are then compared with the present capacity of the farmer to pay based on the actual income earned from their agricultural land allocation.

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39 ▷ *According to Monke and Pearson, 1989, "the term* private *refers to observed revenues and costs reflecting actual market prices received or paid by the farmers, merchants, or processors in the agricultural system."*

7.3 COMMON PROBLEMS OF WATER CHARGING

The success of past irrigation-based transmigration programs varies greatly. Some schemes were successful; others were not developed in accordance with schedules originally envisaged. One of the underlying problems is the low water distribution efficiency of irrigation schemes *(Bogor Institute of Agriculture-IPB, 1972; see also technical note of Operation and Maintenance of the Luwu Irrigation Project:10)*.

Most newly constructed irrigation facilities are deteriorating very rapidly. The main systems which are operated and maintained by the government through the "Irrigation Agency" suffer from the lack of an adequate maintenance budget. On the other hand, the tertiary irrigation schemes which are to be operated and maintained by the farmers also suffer from poor maintenance resulting in poor distribution efficiency. The farmers tend to expect that the government bear the responsibility not only of constructing the irrigation infrastructures but also of subsequently operating and maintaining the scheme. If this expectation persists, the irrigation-based transmigration settlement will likely continue to be hampered by a dependency syndrome, and it will not achieve self-sustainable agricultural development within the foreseeable future.

Therefore, the Government of Indonesia is conducting experimental studies pertaining to the possibility of imposing an irrigation water charge to beneficiaries in order to be able to at least cover the operation and maintenance budget on a self-supporting basis. The general government budget can then be used to finance other development sectors. This position raises the following questions: to what extent is the farmer capable of paying any form of water charge or water service fees?; how much should he pay?; how should the water charge be applied?; and who will undertake the collection of the water service fees?

In an attempt to answer some of these questions, the author undertook a series of analyses for estimating the water value and compared the resulting analyses with the current level of farm income. Due to the complexity of the analyses and the wide range of data collected, the analyses in this chapter focused mainly on the average conditions obtained from field data collected in the study areas.

7.4 THE SALIENT FEATURES OF IRRIGATED AGRICULTURE IN THE STUDY AREA

The following sections describe the relevant study areas together with issues pertaining to the contextual circumstances of the project.

7.4.1 THE WAY RAREM SCHEME

The Way Rarem irrigation-based transmigration resettlement scheme is located in Lampung Province, which is situated in the southern-most end of Sumatra Island.

Based upon information collected from the field survey, the Project features may be summarized as follows: (1) out of the 22,000 ha of the irrigation command area, a total of 12,103 ha have been developed since 1984[40]; (2) the average land ownership of the farmer in the scheme is currently 1.27 ha per household with mainly paddy rice planted, having an annual cropping intensity of 122%; (3) the average paddy production at this time is 3.72 ton per ha of unhusked rice for the wet season crop and about 4.00 ton per ha for the dry season crop; (4) the average size of the household 6.91.

7.4.2 THE LUWU SCHEME

The Luwu project area is located in the North Luwu plain, which is part of the *Kabupaten Luwu* in the province of South Sulawesi. It covers a total command area of about 29,000ha --the Kalaena Right Bank (13,600 ha), Bone-Bone

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40 ▹ *The first irrigation implementation was conducted in 1984 with 802 ha of new land developed for paddy fields. Since then, the area has been gradually developed into a permanently irrigated paddy field. In January 1992, some 12,103 ha of paddy field were developed, which means about 55% progress was achieved within a period of eight years' irrigation implementation.*

(1,480 ha), Kanjiro (1,500 ha), Lamasi (8,600 ha), Makawa (2,600 ha) and Tomini (1,200 ha).

The Kalaena scheme in the northern part of the Luwu plain has been selected as the study area to represent the northern condition of the Luwu project, while the Lamasi scheme, located in the southern part of the Luwu plain, has been selected as a study area representing the southern conditions of the plain.

The present condition of both study areas in the Luwu scheme are summarized as follows:

A. The Lamasi Scheme

The Lamasi scheme which is located in the southern plain of the Luwu Project has a currently developed paddy field of 3,886 ha out of a total command area of 4,473 ha. On average, the farmers in the scheme own 1.27 ha per household. The irrigation area has mainly a mono-cropping pattern of paddy rice with an annual cropping intensity of 142%. The average paddy production at this time is 4.28 ton per ha of unhusked rice for the wet season crop and about 4.50 ton per ha for the dry season crop. The average size of the household family used to be higher (8.2 persons per household) than the current average of about 6 persons per household.

B. The Kalaena Scheme

The Kalaena scheme is located in the upper northern part of the Luwu plain, having a currently developed area of 6,375 ha out of a total command area of 12,392 ha. Farmers of the Kalaena scheme own an average of 1.18 ha per household. Farmers mainly cultivate paddy rice with an annual cropping intensity of about 190%.

The average paddy production in the Kalaena scheme is 3.15 ton/ha of unhusked rice for the wet season crop and about 4.15 ton/ha for the dry season. This production is lower than the average figure of the schemes in the Luwu plain owing to the fact that the area has not reached stable productivity. The average size of the transmigrant farmer's family in the Kalaena scheme is at 5.79 capita per household, which is lower than in other schemes.

7.4.3 IRRIGATION CLASSIFICATION FOR THE ANALYSIS

In Indonesia in general,and in the study areas in particular, three irrigation classifications that are commonly recognized: (1) technical irrigation, (2) semi-technical irrigation, and (3) simple irrigation. In technical irrigation the water supply and distribution is fully controlled by the government through permanent structures that are operated and maintained by the Irrigation Agency of the Ministry of Public Works. The water can be fully "measured" and "regulated". Semi-technical irrigation may have permanent or semi-permanent structures. In this irrigation category the water can only be regulated, but not properly measured, or it can be measured but cannot be fully regulated. Simple irrigation refers to small scale irrigation systems with simple structures and simple operating procedures which are mostly operated and maintained by the farmers themselves. In this category, irrigation water can neither be fully regulated, nor properly measured *(Directorate of Irrigation I, DGWRD, 1988)*.

The size of irrigation systems varies from place to place within the country, but a large project usually covers an area of more than 20,000 ha, while a medium sized project may cover an area between 5,000 to 20,000 ha. Irrigation systems that have an area between 1,000 ha and 5,000 ha are usually categorized as small-medium, and those less than 1000 ha are categorized as small irrigation projects. This categorization is used in the present chapter in the development of models that use related economic engineering analysis to estimate the economic value of irrigation water.

7.5 METHOD OF ESTIMATING IRRIGATION WATER VALUE

7.5.1 GENERAL

The following cost recovery analysis presents a "general indicator" or "yard stick" for assessing how much the farmers should be charged per unit volume of irrigation water (irrigation water value) considering the amount of capital invested in the project. In this analysis, a number of conditions were considered, such as (1) the water distribution mode involving continuous, rotational or intermittent flow; (2) the construction methods used as to stay relate to the capital costs; (3) the lay-out of the irrigation system in order to determine the efficiency of the water conveyance; (4) crop varieties used in order to determine the water requirements, the agricultural inputs and production; (5) the total amount of capital invested including all investments during the pre-construction stage; (6) the schedule of construction implementation and capital investment; (7) basic parameters of economic valuation such as time horizon or economic life of the project, inflation rates and discount rates, etc.; and (8) operation and maintenance requirements of the scheme and other related circumstances such as irrigation distribution efficiency, cropping season, agricultural technology, crop production and crop price.

Necessary assumptions in the analysis were based on the generalized experience of the irrigation development in the general area of the Way Rarem scheme within the Lampung Province, and the Luwu scheme within the Southern Sulawesi Province.

The analysis is depicted schematically in the chart in *Figure 5-6* of Chapter-V. This chart shows that the unit cost analysis is developed from three main components: (1) the magnitude of irrigation water consumption, (2) the operation and maintenance costs, and (3) the total capital costs. To arrive at a figure for the irrigation water value (to be charged to the farmers) two alternatives main assumptions are made. First, it is assumed that the water value is based on full or partial recovery of all costs, capital as well as operation and maintenance costs of the project. Sub-alternatives in this main division are recovery of 20%, 40%, 60%, 80% and 100% of the full cost. Secondly, the water value is based on the recovery of only the operation and maintenance costs of the project. This alternative was specially considered in the analysis for three reasons. First, The World Bank suggests that for Bank assisted projects the farmer should pay at least an irrigation service fee that covers the operation and maintenance cost of the project *(Duane, P., 1975: World Bank Working Paper No. 218)*. Second, this level of service fee is standard practice in many irrigation projects all over the world, including North America, where governments frequently provide the entire initial capital cost of the projects. Thirdly, the alternative provides the minimum fee that makes the projects economically self maintaining thus preventing them from becoming a permanent drain on the government budgets.

7.5.2 PRINCIPLE OF THE ANALYSIS

Assuming that irrigation water (in terms of capital and management costs) is actually sold to the consumer, and bearing in mind that the unit price is valid until the expiration of the project's economic time horizon, and assuming that at minimum the Net Present Value (NPV) of water supply will be equal to 0 (zero). The financial value of irrigation water (for the recovery capital and O&M costs) is calculated by using the following equation:

$$X = \frac{\left[PV_{(i,r)} \text{ Capital Cost} + PV_{(i,r)} \text{ O \& M Cost} \right]}{\left[PV_{(i,r)} \text{ Water Volume Index} \right]}$$

Where: X = Estimated value of irrigation water, [Rp/m^3/year]

$PV_{(i,r)}$ = Present Value at a given (i) and (r), Rp.

(i) = Project life or time horizon, (year)

(r) = Discount rate, [%]

The recovery of O&M cost is calculated separately using the following equation:

$$X_{(O\&M)} = \frac{PV_{(i,r)} \text{ O \& M Cost}}{PV_{(i,r)} \text{ Water Volume Index}}$$

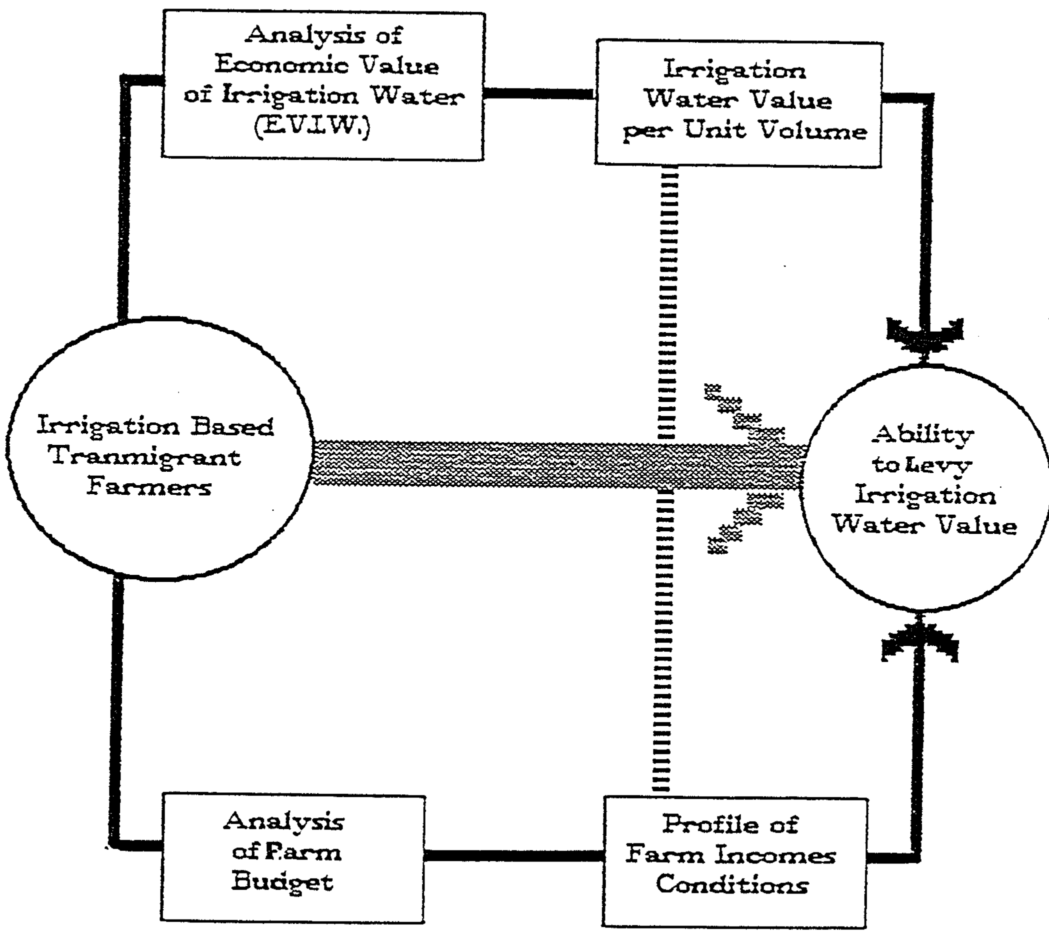
The terms = as defined previously

In later part of this chapter, Section 7-7, estimated values of irrigation water obtained from the above analysis are incorporated in the transmigrant farmers' current income profiles obtained from the field survey for the purpose of examining their capacity to contribute to the recovery of project costs. The comparison is schematically presented in *Figure 7-1.*

7.5.3 DATA AND PARAMETERS USED IN THE ANALYSIS

An analysis of the ability of farmers to contribute to cost recovery of an irrigation project depends on several important parameters that must be incorporated into the analysis. These are: cropping pattern, cropping intensity, water distribution efficiency, water consumption, level of technology employed for operation and maintenance, operation and maintenance costs, construction method, type of structures, construction period, time horizon used for economic analysis, discount rates and total construction costs.

Figure 7- 1 COST RECOVERY ANALYSIS



7.5.4 THE METHOD OF ANALYSIS

From a given irrigation scheme configuration, the required quantity of water is determined using fixed irrigation design criteria. This quantity is used to estimate the amount of water consumed by a particular irrigated piece of land for the purpose of estimating the value of the water.

The total construction cost (capital cost) associated with the land was calculated from available figures obtained from construction records of the project in the study area, and some comparisons with irrigation projects in the vicinity.

The operation and maintenance costs of the scheme were calculated from the same data base assuming that these should cover a level of operation and maintenance that will be adequate in sustaining an optimum level of irrigation distribution efficiency.

To distinguish between irrigation water value based on all costs, including capital costs, and the value based on recovery of O&M costs only, the analysis of each is done separately. Annual O&M costs are converted to their present value (PV) using a discount rate (r) and time horizon (i) that is considered to be appropriate for each particular irrigation scheme.

For calculating the sub-alternatives of cost recovery strategies, the cost figures are taken at the levels of 20%, 40%, 60% and 80% of full recovery costs respectively.

This analysis approach is shown in principle in *Figure 5-4*. Since each individual irrigation operation will have its own characteristics, the irrigation water value will vary in a region. Conclusions with regard to a region are therefore to a degree only generalizations.

7.5.5 ASSUMPTIONS USED IN THE ANALYSIS

Limitations imposed by data collection and scope of the analysis made it necessary to supplement the available data and information with some some assumptions.

The principal assumptions are as follows:

- Cost recovery pertains to all invested capital, including the costs of feasibility studies, site investigations, surveys, design, construction, operation and maintenance of the primary and secondary irrigation works.
- The costs of constructing and maintaining tertiary irrigation schemes and land development are not included in this analysis because these works should be performed by the beneficiaries themselves through a mutual-aid or "self-help" system.[▷41]

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41 ▷ *The construction and maintenance of rural facilities, such as tertiary irrigation schemes, farm ditches, farm roads, land reclamation and so on, are traditionally conducted by a mutual-aid (self-help) system, known as* "gotong-royong". *However, some recent attempts have been*

o The analysis is limited to irrigation schemes with a cultivable command area (CCA) larger than 700 ha because smaller figure is usually composed of small scattered schemes with different operating characteristics.

o The project life (time horizon) is taken to be 30 years.

o The construction time of the project is assumed to be 3 to 6 years, with full crop development reached in 6 to 10 years --depending upon the the nature and the category of the project.

o Only the low-land paddy crop is considered in the analysis with an average cropping intensity of 145% per year (the Lamasi Scheme was taken at 145% per year, the Kalaena Scheme at 190% per year, and the Rarem scheme at 120% per year).

o The average water consumption for low-land paddy is taken to be 12,000 m3/ha/crop for wet season paddy and 21,000 m3/ha/crop for dry season paddy.[▷42]

o The average irrigation water distribution efficiency in the study area is about 71% (Bogor Institute of Agriculture, IPB, 1972). However, a higher figure (80%)[▷43] was used in the

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made to provide assistance for constructing part of the tertiary schemes as a prime mover for stimulating the subsequent construction by the farmers themselves.

42 ▷ *The water requirement for low-land paddy varies from place to place in the study area, however, a study concludes an average figure of 11,893 m3/ha/crop for wet season paddy and 21,082m3/ha/crop for dry season (Bogor Institute of Agriculture, 1972). The figures in this analysis have been rounded.*

analysis since it was expected that the schemes will have a better water distribution efficiency operation as maintenance conditions improve.

- The discount rate was varied from 5 to 30% with 5% intervals.▷44

7.6 RESULTS OF ANALYSIS AND DISCUSSIONS

7.6.1 WATER VALUE BASED ON FULL COST RECOVERY

The results of the analysis for fully cost recovery are summarized and presented in *Table 7-1. "Summary of estimated value of irrigation water based on full cost recovery."* This table lists the estimated value of irrigation water in [Rp/m^3] of ten different irrigation models with six different discount rates. The results of the analysis are presented graphically in *Figure 7-2a. "Chart for estimating irrigation water value -- based on the recovery of capital and operation & maintenance costs."*

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45 ▷ *The figure of irrigation efficiency at 80% is considered to be slightly higher than the underlying condition, however, it is expected that within a short time, the figure will be achieved.*

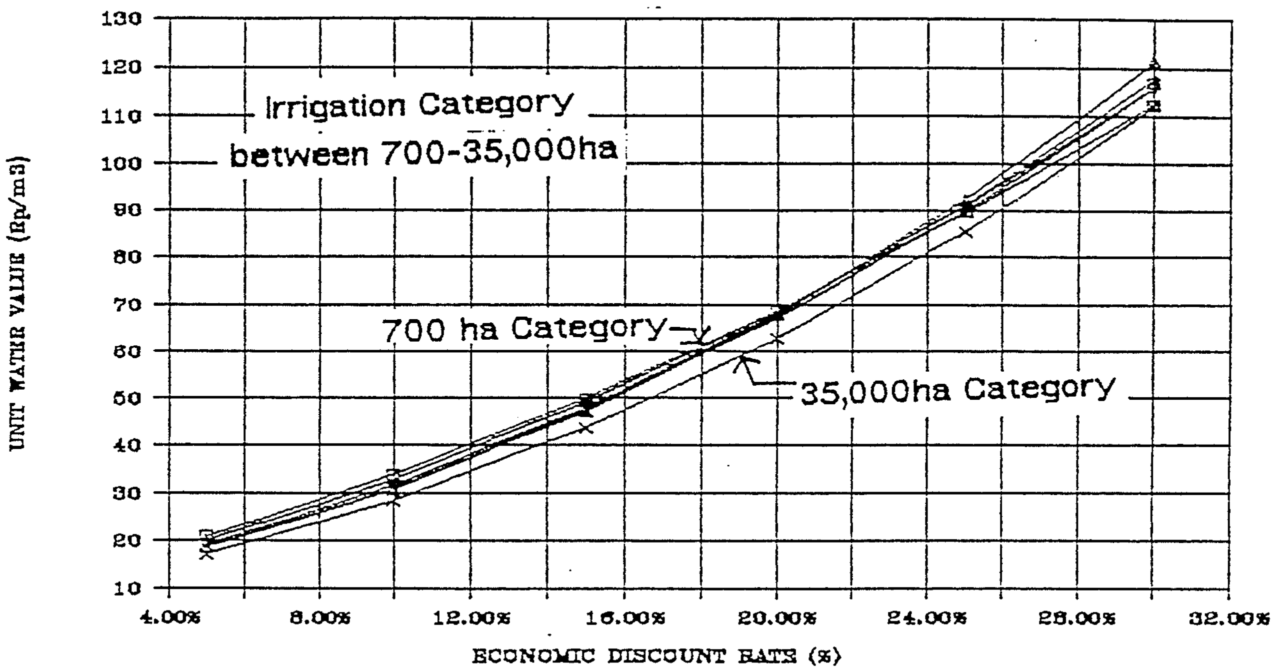
44 ▷ *According to some figures given from the existing feasibility studies, discount rates in the study areas vary between 12 and 17%. For comparison, the Way Rarem irrigation project was evaluated as feasible at an IRR of 11.45%, while the West Rumbia project was evaluated at an IRR of 17.6% (PRC Engineering Consultant, pp.Viii 32-36).*

Table 7-1

TABLE 7-1 SUMMARY OF THE ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME-MODELS BASED ON THE RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS

No.	Total Area (ha)	Total CONTRUCTION Costs (Rp10^6)	Economic Value of Water [Rp/m3]						
			Discount Rate [%]						TOTAL
			5%	10%	15%	20%	25%	30%	AVERAGE
1	700	2,800x10^6	20.934	33.950	50.093	68.788	89.666	112.535	62.661
2	1,000	4,000x10^6	20.935	33.952	50.095	68.791	89.670	112.540	62.664
3	5,000	18,750x10^6	19.583	31.758	46.918	64.443	84.016	105.545	58.711
4	7,500	28,125x10^6	20.633	34.176	51.738	73.027	97.870	126.226	67.278
5	1,0000	35,000x10^6	19.212	31.850	48.235	68.108	91.292	117.756	62.742
6	15,000	52,500x10^6	19.212	31.850	48.235	68.108	91.292	117.756	62.742
7	20,000	65,000x10^6	18.421	30.807	47.279	67.810	92.445	121.335	63.016
8	25,000	81,250x10^6	18.421	30.807	47.279	67.810	92.445	121.335	63.016
9	30,000	90,000x10^6	17.089	28.525	43.743	62.689	85.432	112.104	58.264
10	35,000	105,000x10^6	17.089	28.525	43.743	62.689	85.432	112.104	58.264
	AVARAGE		19.153	31.620	47.736	67.226	89.956	115.924	61.936

FIGURE 7-2A ESTIMATED VALUE OF IRRIGATION WATER BASED ON THE RECOVERY OF CAPITAL AND O&M COSTS [RP/M3]



From this chart, one can obtain the estimated value of irrigation water for a particular size of irrigation area in terms of hectares with a given value of discount rate. For example, an irrigation scheme with a cultivable command area between 700 and 35,000 ha -- the average range in the study area -- at a given discount rate of 15% will have an estimated value of irrigation water of about Rp50/m^3 *(Figure 7-2a)*. This means that for a farm holding of say 1.0 ha of lowland paddy -- at a cropping intensity of 130% -- the government, in order to recover the capital and O&M costs, must levy an irrigation water fee of around

Rp1,143,750/ha/year or about US$565/ha/year.[▷46] For the intermediate values, the figures can be estimated by interpolation. It should be noted that this only presents average conditions. Individual analysis is required for more exact values. *Figure 7-2b* and *Figure 7-2c* present the estimated value of irrigation water for wet and dry season paddy on the basis of full cost recovery in Rp/ha/crop and in US$/ha/crop respectively.

7.6.2 WATER VALUE BASED ON RECOVERY OF O&M COST ONLY

Estimated value of irrigation water based on the recovery of operation and maintenance costs only is summarized and presented in *Table 7-2., "Summary of estimated value of irrigation water based on the recovery of O&M Cost".* Similar to *Table 7-1*, this table also presents the estimated value of irrigation water in [Rp./m^3] for ten different irrigation schemes and six discount rates. The results are presented in different charts to provide a clearer picture of the analysis. See *Figure 7-3a* for the general figure of the recovery of O&M costs for different categories of irrigation scheme; *Figure 7-3b* for the configuration in terms of water value in Rp/ha/crop; and

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46 ▷ *The water value for rainy season crop is 15,000m^3 x Rp50 = Rp750,000.-; and for 30% of the dry season crop is 30% x 26,250 m^3 x Rp50 = Rp565,000; totaling at Rp1,143,750 or about US$565.00 /ha/year. (The water distribution value is calculated at 80% irrigation application efficiency)*

FIGURE 7-2B ESTIMATED VALUE OF IRRIGATION WATER BASED ON THE RECOVERY OF CAPITAL AND O&M COSTS [RP/HA/CROP]

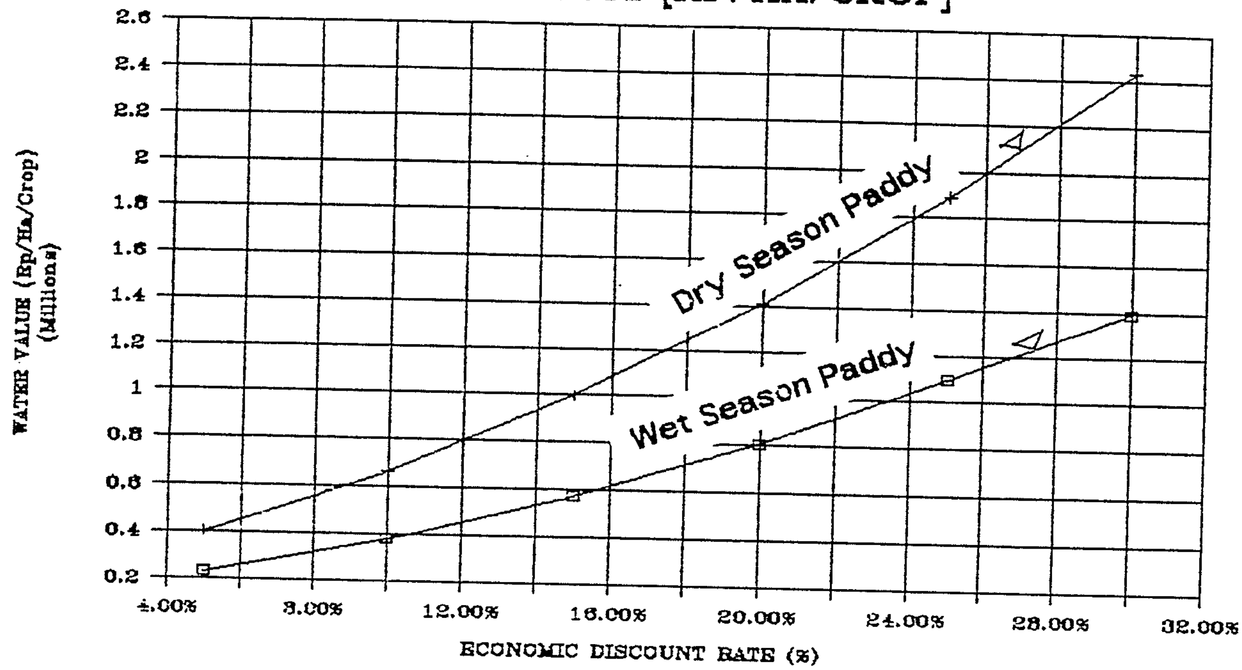

FIGURE 7-2C ESTIMATED VALUE OF IRRIGATION WATER BASED ON THE RECOVERY OF CAPITAL AND O&M COSTS [US$/HA/CROP]

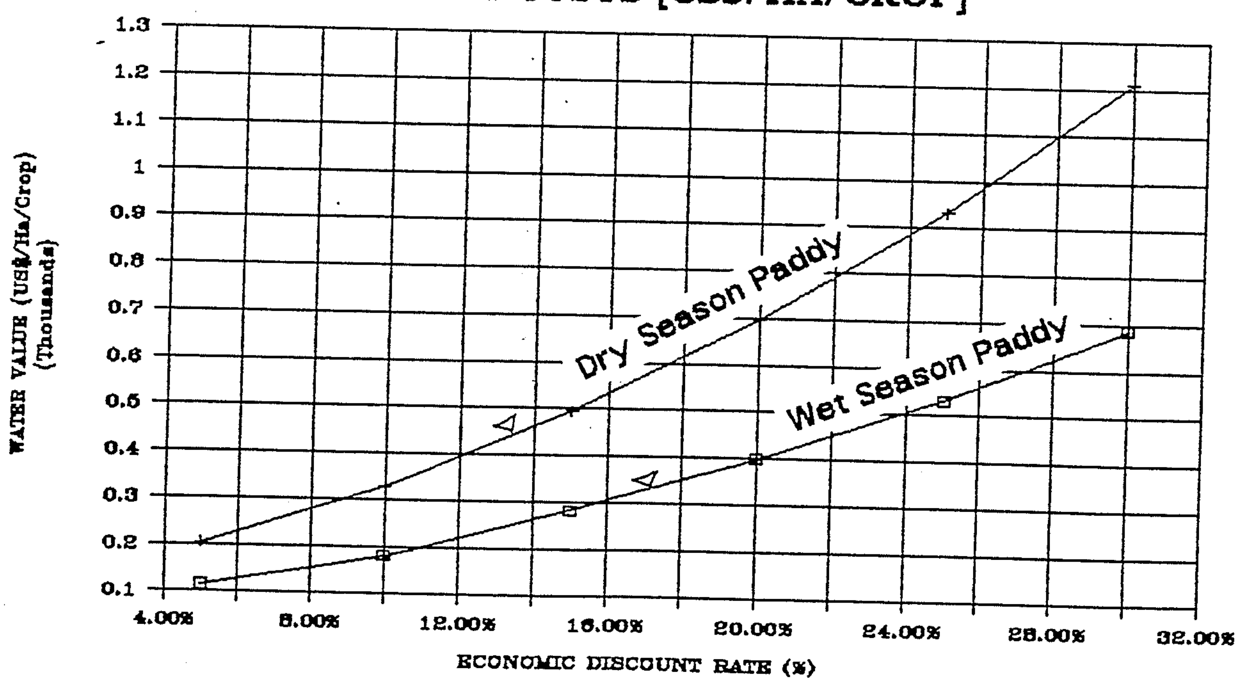

TABLE 7-2 SUMMARY OF THE ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME-MODELS BASED ON THE RECOVERY OF OPERATION AND MAINTENANCE COSTS

No.	Total Area (ha)	Total O & M Costs (Rp10^6)	Economic Value of Water [Rp/m3]						
			Discount Rate [%]						AVERAGE
			5%	10%	15%	20%	25%	30%	
1	700	21 x 10^6	2.061	2.138	2.225	2.317	2.421	2.508	2.278
2	1000	30 x 10^6	2.061	2.138	2.225	2.317	2.421	2.508	2.278
3	5000	137.50 x 10^6	1.889	1.960	2.040	2.124	2.211	2.299	2.087
4	7500	206.25 x 10^6	1.892	1.962	2.041	2.125	2.211	2.299	2.088
5	10000	250 x 10^6	1.720	1.783	1.855	1.932	2.010	2.090	1.898
6	15000	375 x 10^6	1.720	1.783	1.855	1.932	2.010	2.090	1.898
7	20000	311.10 x 10^6	1.550	1.607	1.671	1.739	1.810	1.881	1.710
8	25000	526.50 x 10^6	1.550	1.607	1.671	1.739	1.810	1.881	1.710
9	30000	660 x 10^6	1.516	1.571	1.634	1.700	1.769	1.839	1.672
10	35000	770 x 10^6	1.516	1.571	1.634	1.700	1.769	1.939	1.688
		AVERAGE	1.748	1.812	1.885	1.963	2.044	2.133	1.931

FIGURE 7-3A ESTIMATED VALUE OF IRRIGATION WATER BASED ON THE RECOVERY OF CAPITAL AND O&M COSTS [RP/M3]

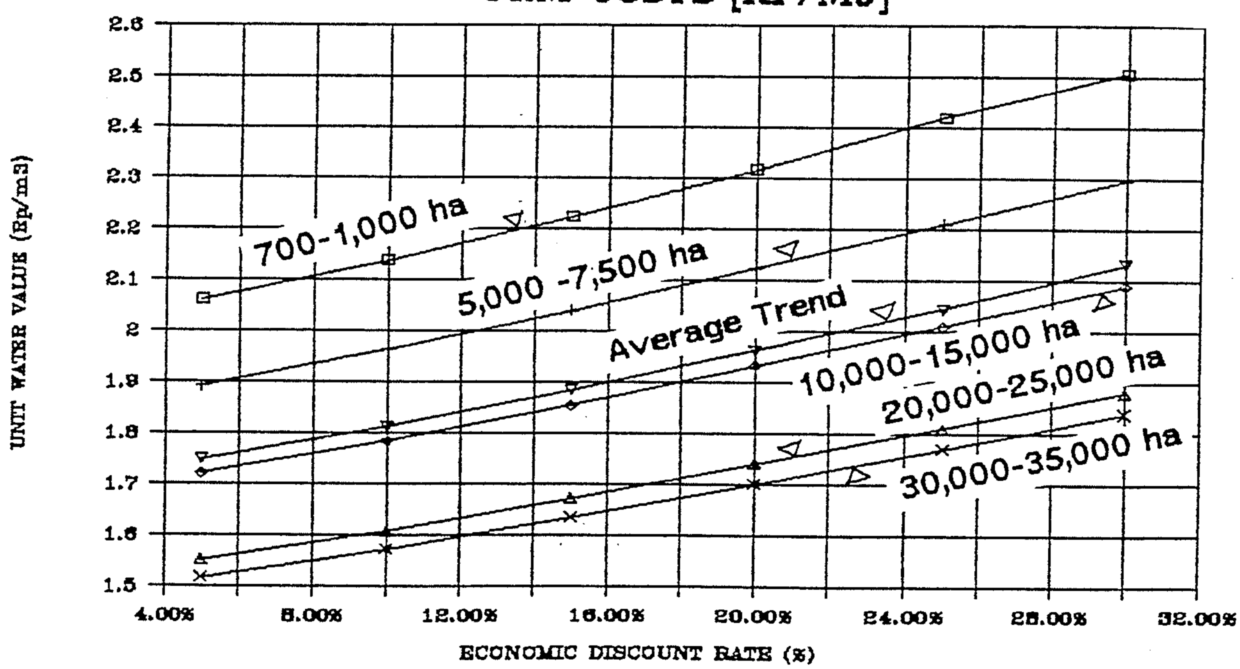

FIGURE 7-3B ESTIMATED VALUE OF IRRIGATION WATER BASED ON THE RECOVERY OF O&M COSTS [RP/HA/CROP]

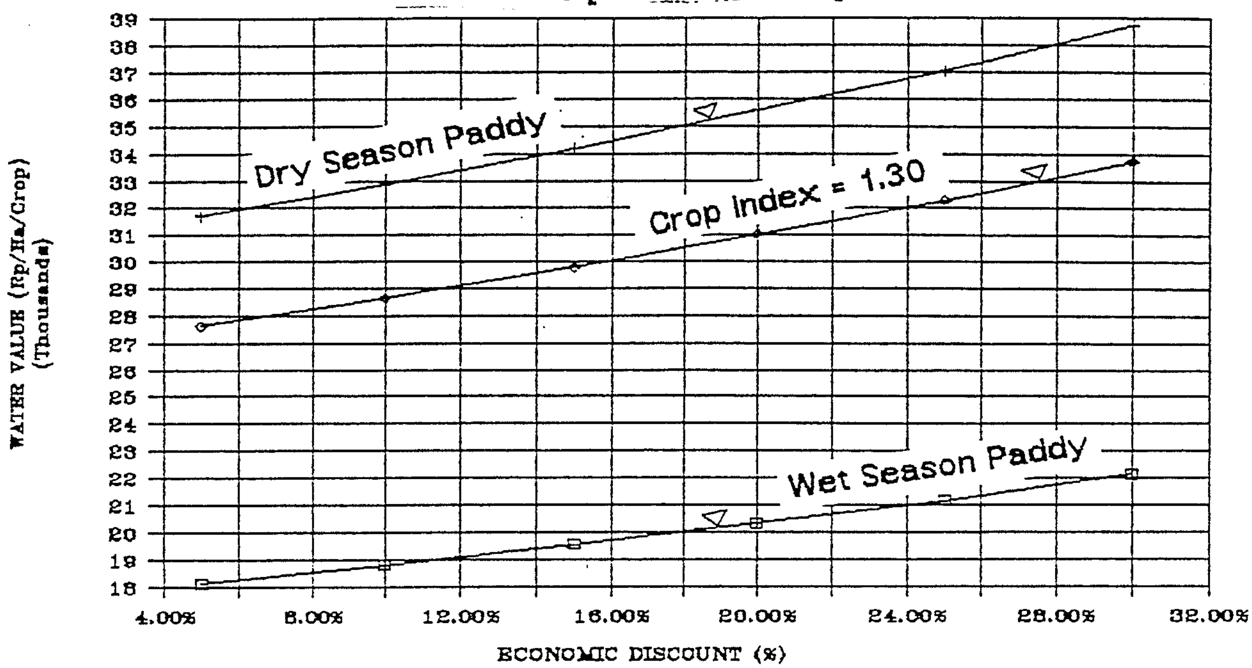

FIGURE 7-3C ESTIMATED VALUE OF IRRIGATION WATER BASED ON THE RECOVERY OF O&M COSTS [US$/HA/CROP]

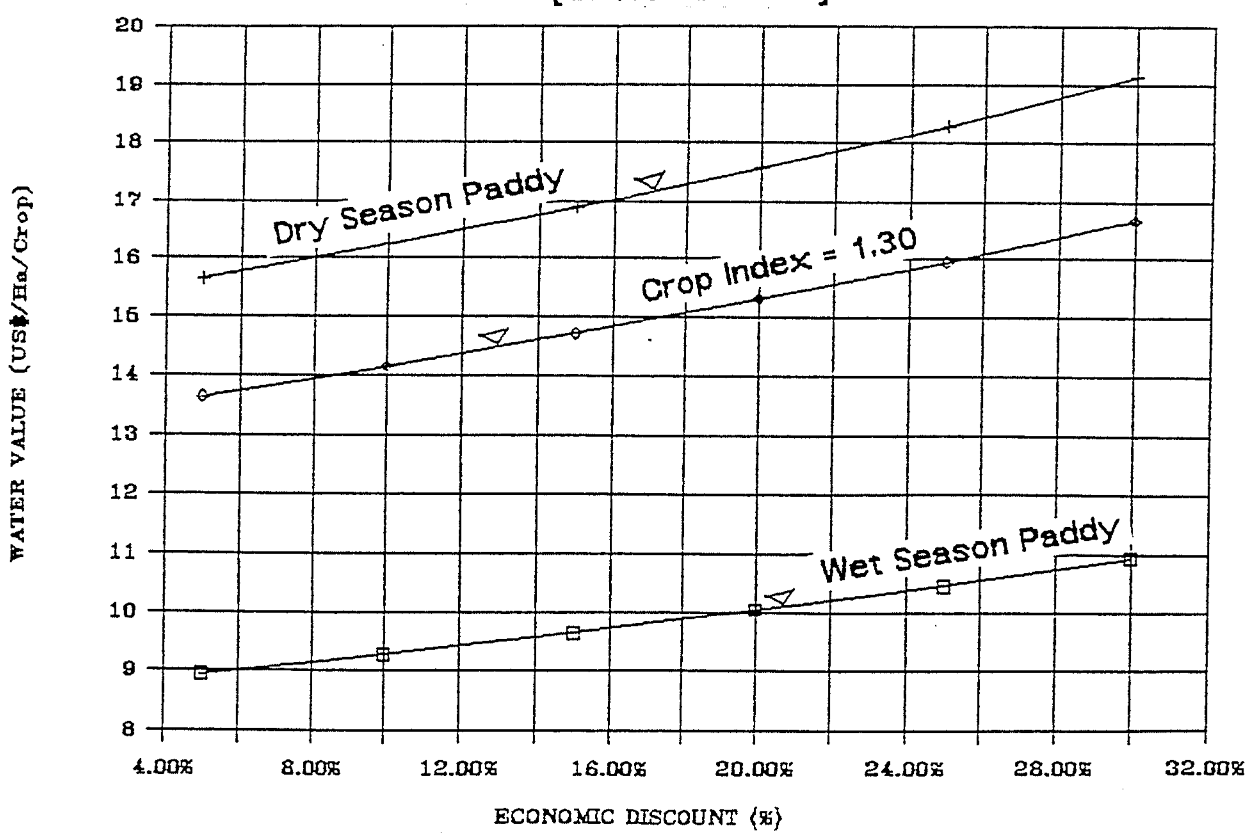

Figure 7-3c for the water value configuration in US$/ha/crop.[▷47]

To give an example, a land holding of 1.0 ha with the same condition of the previous example, should be levied at about Rp30,000/ha/year (US$14.815/ha/year) for recovering operation and maintenance costs of the associated irrigation scheme. More detailed results of the cost analysis of irrigation water are presented from *Appendix 7-1a* to *Appendix 7-1f*.

7.6.3 ALTERNATIVES FOR PARTIAL COST RECOVERY WATER VALUE

To examine the water value for partial cost recovery, the analysis was based on average figures for all the irrigation schemes. Percentage intervals were used ranging between the two end points of a continuum, namely "free water" and "full cost recovery" water value. The result of the analysis is presented in *Table 7-3a* and *Table 7-3b (Estimated value of irrigation water for several cost recovery alternatives in Rp/m^3 and in US$/$m^3$ respectively)*. The results are also shown in the simplified charts presented in *Figure 7-4a (estimated value in Rp/m^3)* and

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47 ▷ *The figure presents the average level of irrigation water value for the dry season paddy crop, for the wet season paddy crop and for the annual average paddy crops at a cropping intensity of 130% (100% of the area is cultivated at the wet season and only 30% at the dry season due to the underlying water constraint).*

TABLE 7-3A SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER [RP/M3]

No.	CATEGORY OF COST RECOVERY	Estimated Value of Water [Rp/m3] Discount Rate [%]					
		5%	10%	15%	20%	25%	30%
1.	RECOVERY OF CAPITAL AND O&M COSTS	19.153	31.62	47.736	67.226	89.956	115.92
2.	RECOVERY 80% OF CAPITAL AND O&M COSTS	15.222	27.934	38.188	53.853	71.965	92.728
3.	RECOVERY 60% OF CAPITAL AND O&M COSTS	11.492	19.111	28.854	40.644	54.399	65.513
4.	RECOVERY 40% OF CAPITAL AND O&M COSTS	6.898	12.736	19.216	27.068	36.809	46.649
5.	RECOVERY 20% OF CAPITAL AND O&M COSTS	3.831	6.324	9.544	13.446	18.01	23.183
6.	RECOVERY OF O&M COST	1.174	1.182	1.885	1.963	2.044	2.133

TABLE 7-3B SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER [US$/M3]

No.	CATEGORY OF COST RECOVERY	Estimated Value of Water [US$/m3] Discount Rate [%]					
		5%	10%	15%	20%	25%	30%
1.	RECOVERY OF CAPITAL AND O&M COSTS	0.0094	0.0156	0.0235	0.0331	0.0444	0.0572
2.	RECOVERY 80% OF CAPITAL AND O&M COSTS	0.0075	0.0137	0.0188	0.0265	0.0355	0.0457
3.	RECOVERY 60% OF CAPITAL AND O&M COSTS	0.0056	0.0094	0.0142	0.02	0.0268	0.0323
4.	RECOVERY 40% OF CAPITAL AND O&M COSTS	0.0034	0.0062	0.0094	0.0133	0.0181	0.023
5.	RECOVERY 20% OF CAPITAL AND O&M COSTS	0.0018	0.0031	0.0047	0.0066	0.0088	0.0114
6.	RECOVERY OF O&M COST	0.0005	0.0005	0.0009	0.0009	0.001	0.001

FIGURE 7-4A ESTIMATED VALUE OF IRRIGATION WATER BASED ON SEVERAL COST RECOVERY ALTERNATIVES [RP/M3]

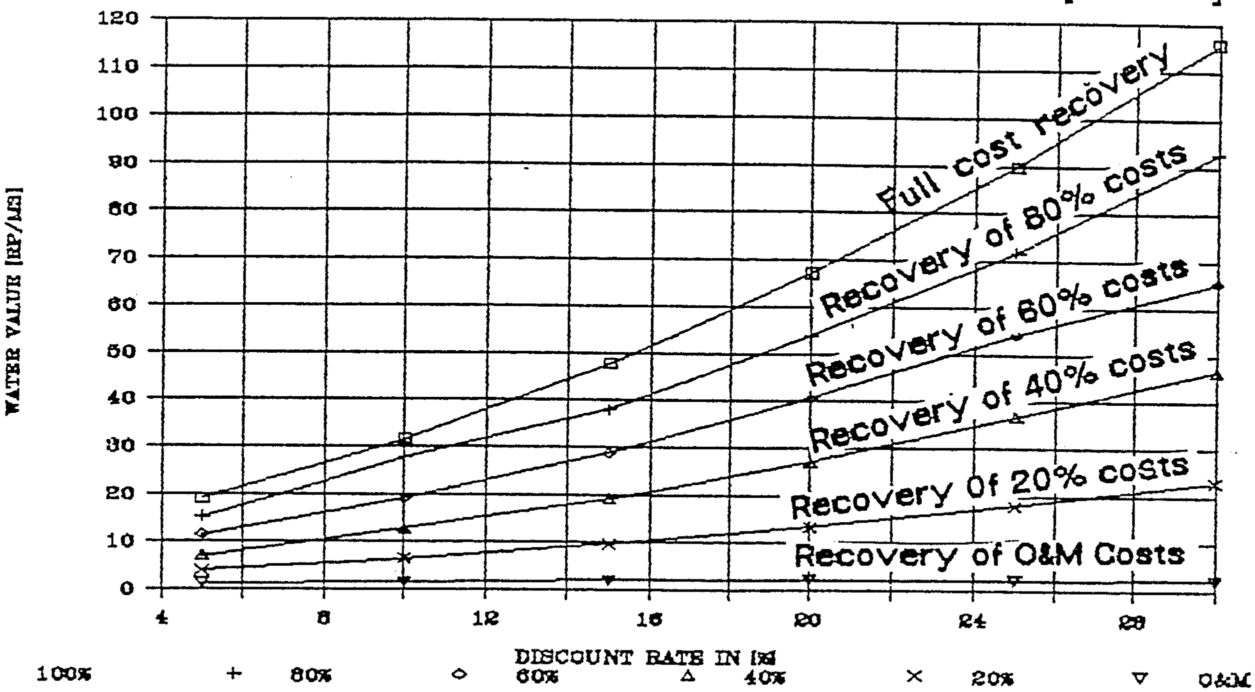

FIGURE 7-4B ESTIMATED VALUE OF IRRIGATION WATER BASED ON SEVERALE COST RECOVERY ALTERNATIVES [US$/M3]

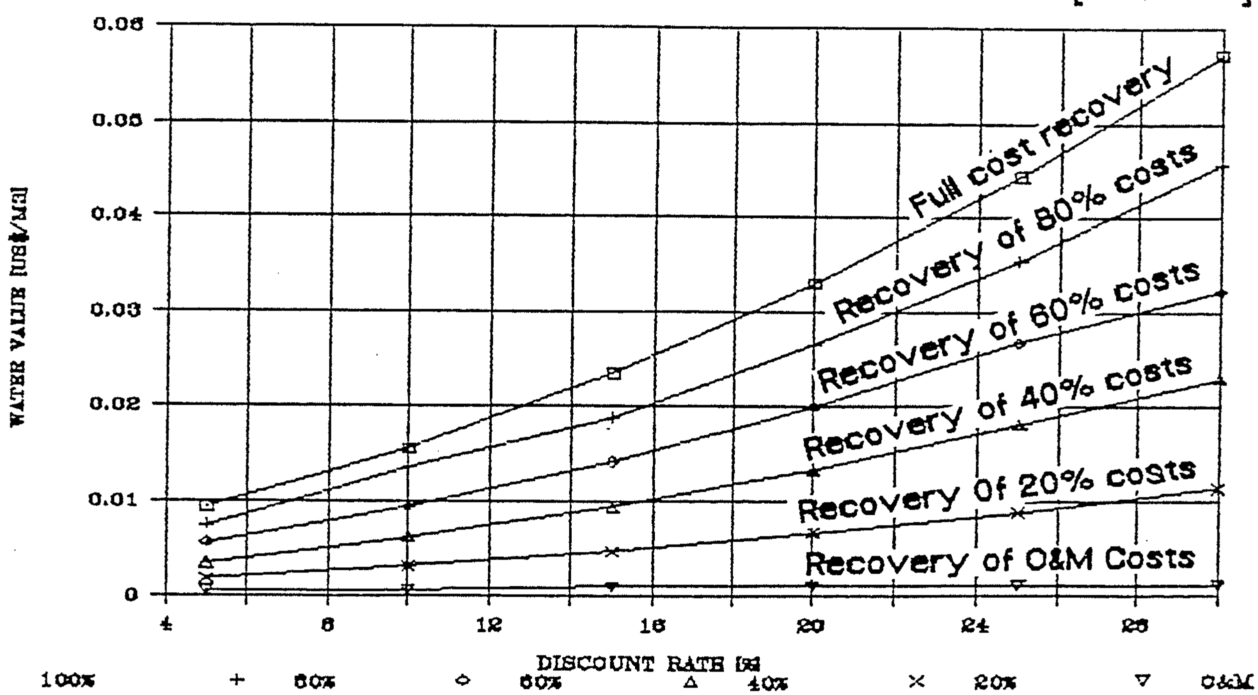

Figure 7-4b (estimated value in US$/$m^3$).

For example a farm holding of, say, 1.00 ha with a cropping intensity of 130% and 15% discount rate at the cost recovery level of 60% will bear a cost of irrigation water of about Rp439,700/year or about US$74.80.▷[48] (More figures are presented in *Appendices 7-9a and 7-9b* for estimated value of irrigation water for several cost recovery alternatives in Rp/ha/crop and US$/ha/crop respectively.

7.7 METHOD AND POLICY OF WATER CHARGING

In Indonesia, irrigation water has traditionally been distributed without charge to the farmer. Therefore, the introduction of an irrigation water charge,▷[49] if not properly managed, could create complicated problems, not only in financial terms but also of a social and even psychological nature.

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48 ▷ *The irrigation distribution efficiency is taken at 80%, hence the estimated water value for rainy season crop is 15,000m^3 x Rp19.22 = Rp288,300, while the water value for the dry season is 30% x 26,250m^3 x Rp19.22 = Rp151, 358 or about Rp439,700 in total.*

49 ▷ *Traditionally, the farmers always consider water as a natural resource bestowed by Almighty God, that should be enjoyed freely to support their life. Thus, in most cases the term* **"water charge"** *is still difficult for the traditional farmers to accept. Instead, a term* **"water service fee"** *is now being introduced --in the sense that the water itself is free, but the beneficiaries should pay for the service for conveying irrigation water right into the farm land, which requires a substantial amount of capital investment.*

On the other hand, the policy for providing irrigation water should be geared, if possible, toward the ability to provide the recovery of invested capital. Thus, the policy is concerned with the effort of the project to maximize the net economic benefit on the one hand, and the ability to stabilize the market prices to allow the increase of government revenue from taxes on the other. A number of questions then arise. (1) How pressing is the need for government to have additional irrigation infrastructure? (2) What is the current and the expected income position of beneficiaries? (3) How important is financial independence for the project? (4) How feasible is it to levy additional charges, and will the charges create unwanted effects for the net benefit of the project?▷[50]

A policy of requiring farmers, particularly small land holding farmers, to refund the estimated value of irrigation water on the basis of full cost recovery may not be fair because the advantage of providing irrigation water also goes to the non-farming members of the rural community. Moreover, there is no doubt that irrigation will contribute, directly or indirectly, a number of benefits to regional development; for example, it will create new employment, generate income tax and so on. These advantages, however,

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50 ▷ *According to Paul Duane in "A Policy Framework for Irrigation Water Charge", IBRD, Bank Staff Working Paper, No. 218. July 1975, pp.I-VII.*

are very difficult to quantify in terms of tangible benefits.

The following discussions are concerned first of all with the expected income position of the beneficiaries. In the second place, the discussion will investigate to what extent water charges could be levied on transmigrant farmers without exhausting their farm income.

7.7.1 METHOD OF CHARGING

There are two general ways of charging for irrigation water: (1) "volumetric charging", and (2) "non-volumetric charging".[▷51] A volumetric charge is proportional to the amount of water that is consumed by the water user within a given period of time. A non-volumetric charge is determined annually on the basis of acreage of land, average crop production or land classes served by irrigation.

Volumetric charging is in theory more efficient because it motivates farmers to use water as effectively as possible. In practice there are many problems with it. It is quite expensive because volumetric charging requires reliable water measurement devices and a large number of trained irrigation personnel. In addition, it requires a

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51 ▷ *Soedarmo, "Policies of Pricing of Irrigation Water, with Special Reference to Indonesia", unpublished M.Sc. Thesis, Southampton University, England, 1978:8-11.*

well established administrative institution which is fully authorized to deal with both the financial and the technical aspects of water charging.

In Indonesia in general, and in the study area in particular, the implementation of volumetric charging for irrigation water cannot be recommended. This is partly due to the fact that existing irrigation schemes are rarely equipped with the required control and measurement devices. The other reason is that the farmers are mainly small land holders who lack the skill and experience to operate advanced farming systems that rely on operating the large number of water measurement devices that are required for each individual farm ditch. A strong water user's organization is an important prerequisite for proper water management, but the establishment of such an organization is hardly possible within a short period of time under small land holding conditions.

On the other hand, "non-volumetric-charging" does not require the precise measurement of water. The water charges are usually based on the level of crop production and the level of agricultural income obtained from land served by the irrigation scheme. It may also be based on the acreage of land, and take into account the distance of the land from irrigation turnout. It may further be based on land classification.

In practice, this non-volumetric water charging is easy to implement and it has the advantage that the rate of charging is proportional to the level of production or acreage of agricultural lands that are served by the irrigation scheme. However, the farmers and other beneficiaries are not much concerned with actual volume of water use. Since they have paid the irrigation water charge, they tend to insist on a continuous water flow, irrespective of plant demand. As a result, the field water is often allowed to run freely into the drainage channel for no reason. Under such circumstances, it is almost impossible to expect the farmer to participate fully in maintaining sustainable water management at the farm level.

Despite the weaknesses of this system, the "non-volumetric" charging is recommended, at least to serve as an ad-hoc measure during the early stages of water charging implementation. Subsequently, continuous guidance should be given to the farmers for a gradual implementation of "volumetric" charging after the system and its related supports have been well established.

7.7.2 PROFILE OF THE CURRENT FARMING CONDITION

A. Analysis of Transmigrant Farm Income

To examine the ability of the farmer to pay the estimated value of irrigation water, one should know the the farm budget situation in the irrigation area in question. One of the most straight forward ways to obtain a reliable farm budget profile is by interviewing farmers. The present section deals with an analysis of farm budgets based on primary data obtained on actual farming conditions; however, due to time constraints, it was not possible to complete the survey questionnaire in every detail with information on individual farm budgets.

Where data are inconsistent or unavailable, the information was supplemented with average figures on the surveyed household conditions and with some assumptions based on the author's previous knowledge and experience from having worked for many years in the study area.

Some of the assumptions are as follows:

- The analysis of the farm budget is based on typical sizes of land holdings per farm family in the study area. Ten types of land holdings have been assumed for the analysis, ranging from 0.5 ha to the maximum of 5.0 ha per individual land holding. These typical sizes are grouped into three farm categories; small, for an area between 0.5 and 1.25 ha; medium, for an area between 1.25 ha and 2.0 ha; and large for an area between 2.0 and 5.0 ha or larger. Each category has an explicit budget for the production system.
- The analysis includes mainly low land paddy with an overall average cropping intensity of 145% (190% for the Kalaena scheme, an average of 140% for the Lamasi scheme, and an average of 120% for the for the Way Rarem scheme). The rate of production is taken at an average of 3.70 tons

of grain rice for a rainy season crop and 4.00 t/ha for a dry season crop.[▷52]

○ Agricultural inputs are assumed to be proportional to the size of land holding.

○ The financial analysis assumed family labor for small land holdings (0.5-1.25 ha). For medium land holdings (1.25-2.0 ha), the analysis included hired labor and additional hired cattle power at the rate of 15 md (man-days), and 15 td (cattle team-days) respectively. For large land holdings (2-5ha or larger) land preparation was assumed to involve the use of small agricultural machinery.

○ No irrigation water charge was included in the analysis at this stage.

○ Food consumption and other household expenditures were taken at average household survey figures, regardless of the land holding size.

An agro-economic survey and analysis was conducted for the purpose of analyzing the farm income that occurs from land allocated the transmigrant farmers[▷53] by using

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52 ▷ *The average paddy production for the first rainy season paddy crop in the Lamasi scheme is about 4.28t/ha, the dry season crop is at 4.5 ton/ha; the Kalaena scheme at 3.15 t/ha for the rainy season and 3.5 ton/ha for the dry season crop; for the Way Rarem scheme, the rainy season paddy production is 3.72t/ha and for the dry season, an average is 4.00t/ha.*

53 ▷ *The land allocation for the transmigration program at the initial resettlement implementation is standardized at*

information and assumptions mentioned above. These provided the following information: (1) actual size of land holding, (2) cropping pattern, (3) production inputs, (4) cropping intensity (5) crop production, (6) effect of season, including types of soils, the extent of land development and water consumptions on crop production, (7) method of farming, (8) labor requirement and the extent of family labor, (9) non-agricultural incomes, (10) household expenditures, (11) household consumptions, (12) taxes and other such expenditures.

From the average farm income profile, an estimation was made of the minimum size of land allocation from which the transmigrant farmer and his family could be expected to make a reasonable living.

B. Results of the Analysis

The results of the farm budget analysis are summarized and presented in *Appendix 7-2* (The Kalaena scheme), *Appendix 7-3* (The Lamasi scheme), *Appendix 7-4* (the Way Rarem scheme) and *Appendix 7-5* (the schemes altogether), i.e., *"The farm budget analysis for typical size of land holding"*. These tables show that the land holding types from

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2.00 hectares per transmigrant household. This two hectare land is broken down into 1.00 hectare for irrigable land, 0.75 ha for upland crop and 0.25 ha for house yard. However, the land holding pattern might change after several years due to one reason or another; for example, the effect of land fragmentation.

the smallest size up to 0.90 ha/farm family mostly suffer from negative income, after deducting the total household expenditures. Thus the farm income from these types of land holdings is not sufficient to support a family without other sources of income. The trends are clearly depicted by the plotted charts presented in *Figure 7-5a* (the small farm size), *Figure 7-5b* (medium farm size), and *Figure 7-5c* (large farm size). More detailed figures, which include the characteristics of the irrigation projects are presented in *Appendices 7-6, 7-7, and 7-8.*

It should be noted that this analysis demonstrates present farming conditions at the transmigrant site. The farm budget itself, being based on perfectly inelastic demand for water, is only meant to test whether under the present conditions farm budgets are in any condition to absorb part of the cost of irrigation water. These results are negative, however, it may be noted that the present farm income has not reached an optimum level.

To improve the farming condition several possible alternatives need further consideration.

(1) An increase of the cropping intensity by providing a reservoir that stores excess water during the rainy season and releases it gradually during the dry season. This is quite expensive and not always technically possible.

(2) Increase cropping intensity by diversifying crops (especially if cash crops or industrial crops are possible).

FIGURE 7-5A INCOME PROFILE OF SMALL FARM SIZE (0.5-1.25HA]

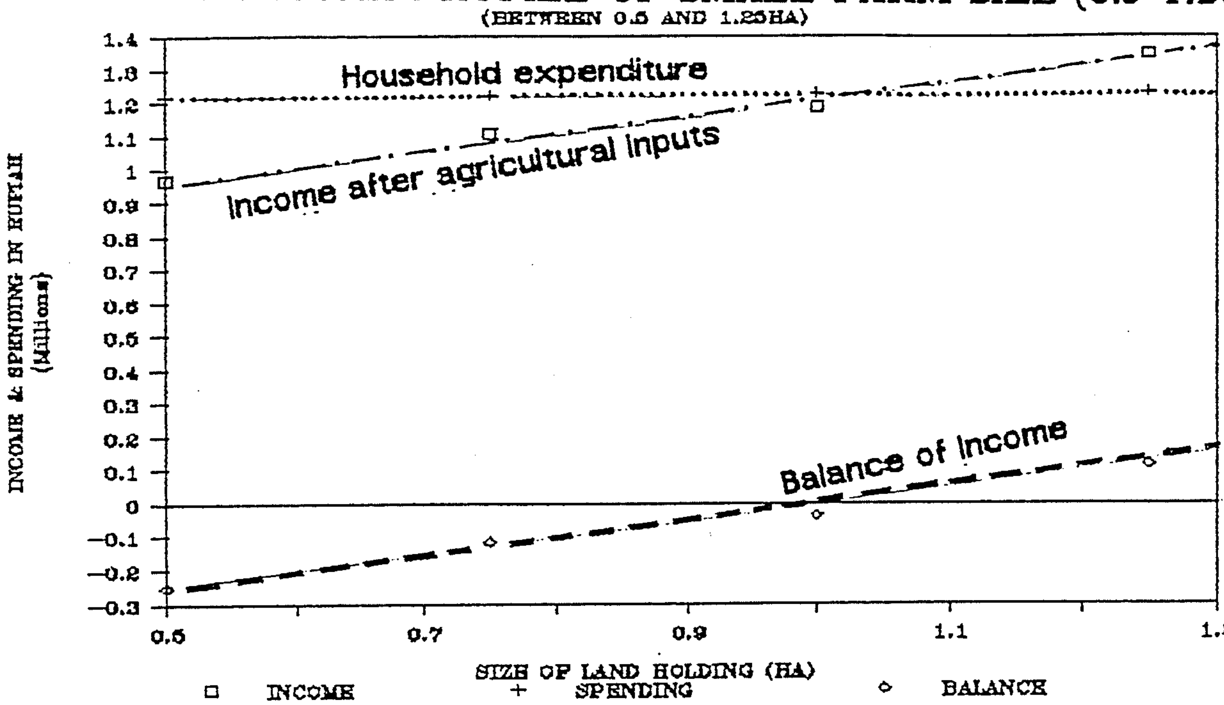


FIGURE 7-5B INCOME PROFILE OF MEDIUM FARM SIZE (1.25-2.0HA]

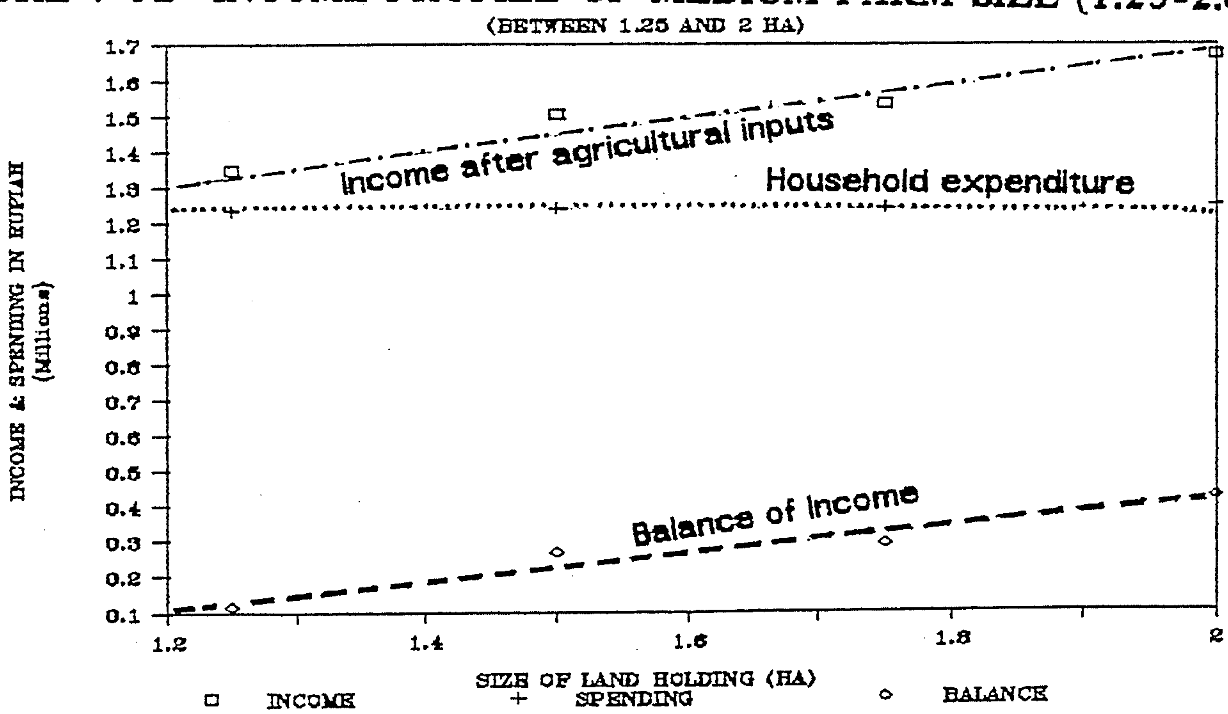
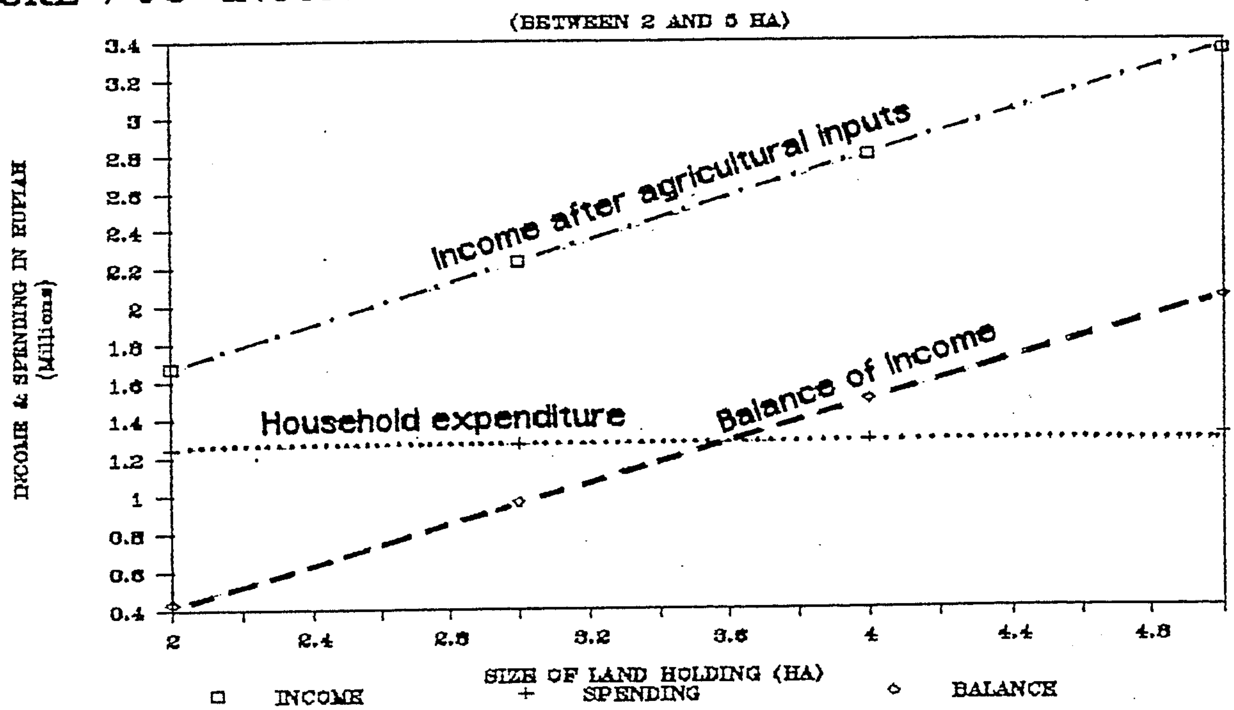


FIGURE 7-5C INCOME PROFILE OF LARGE FARM SIZE (2.0-5.0 HA]



This measure is recommended, but before it can be implemented careful consideration should be given to the available market as well as to factors involved in substantial change of traditional agricultural practices.

(3) Improve irrigation distribution efficiency by practicing intensive operation and maintenance, and establishing a strong water user's organization. This measure is highly recommended, but it entails increased O&M costs. It also requires a great deal of effort and time to develop institutional structures and to teach farmers improved water management practices.

(4) Secure a better and more stable price through a well established market and transportation systems.

7.7.3 THE ABILITY OF THE TRANSMIGRANT FARMER TO PAY THE ESTIMATED VALUE OF IRRIGATION WATER

From the previous analysis of irrigation water and farm budget information, a direct comparison can now be made by superimposing the current profile of farm incomes onto the estimated irrigation water value. This procedure provides a concrete example of the present capacity of the transmigrant farmer to pay the estimated value of irrigation water.[▷54] *Figures 7-6a, 7-6b, and 7-6c* present the comparison between the profile of farm income and household expenditures and the estimated values of irrigation water for small, medium and large farm size categories. The results, assuming full cost recovery, indicate that no farm holding in any of the the analyzed categories would produce a positive income if the water charge were applied.

The estimated water value based on 60% cost recovery produces similar effect on small and medium farm category, and the water value is just about equal to the farm income of large farm category. Even with an estimated water value based on 20% cost recovery the charge is still

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54 ▷ *In this example, a fixed water charging, which is proportional to the acreage of the farm land, is assumed.*

FIGURE 7-6A INCOME AND COST RECOVERY OF SMALL FARM SIZE

(BETWEEN 0.5 AND 1.25HA)

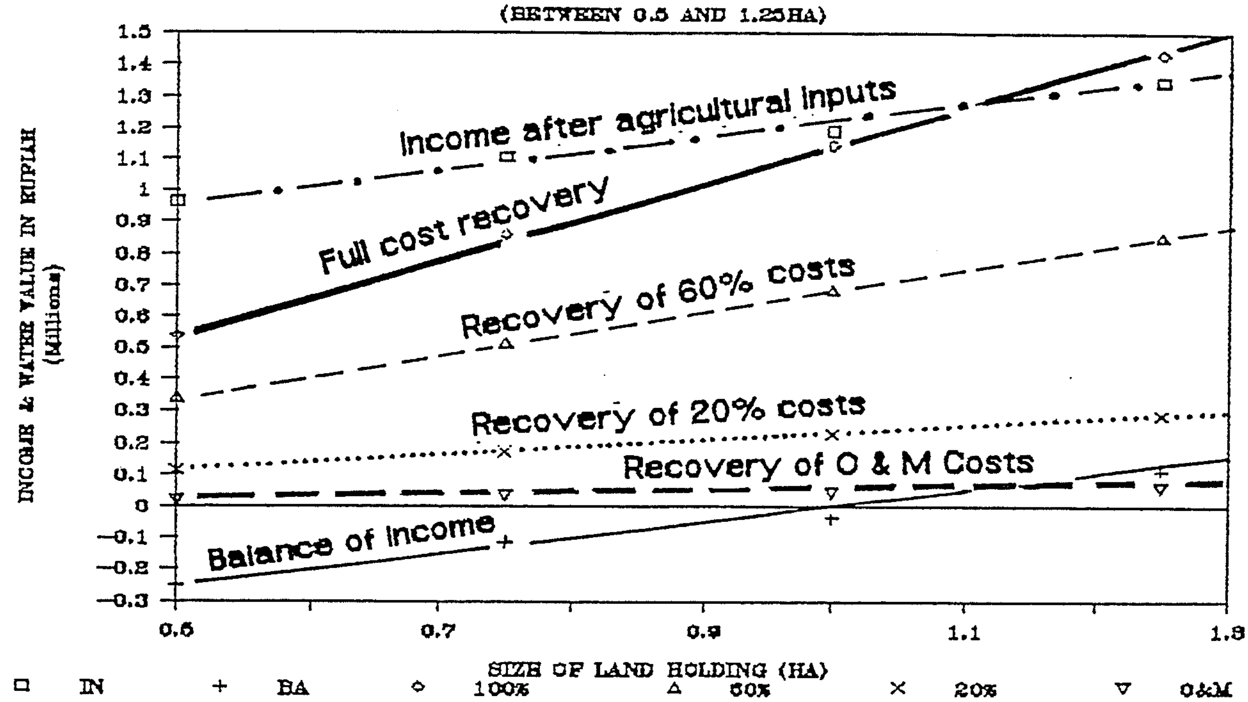


FIGURE 7-6B INCOME AND COST RECOVERY OF MEDIUM FARM SIZE

(BETWEEN 1.25 AND 2 HA)

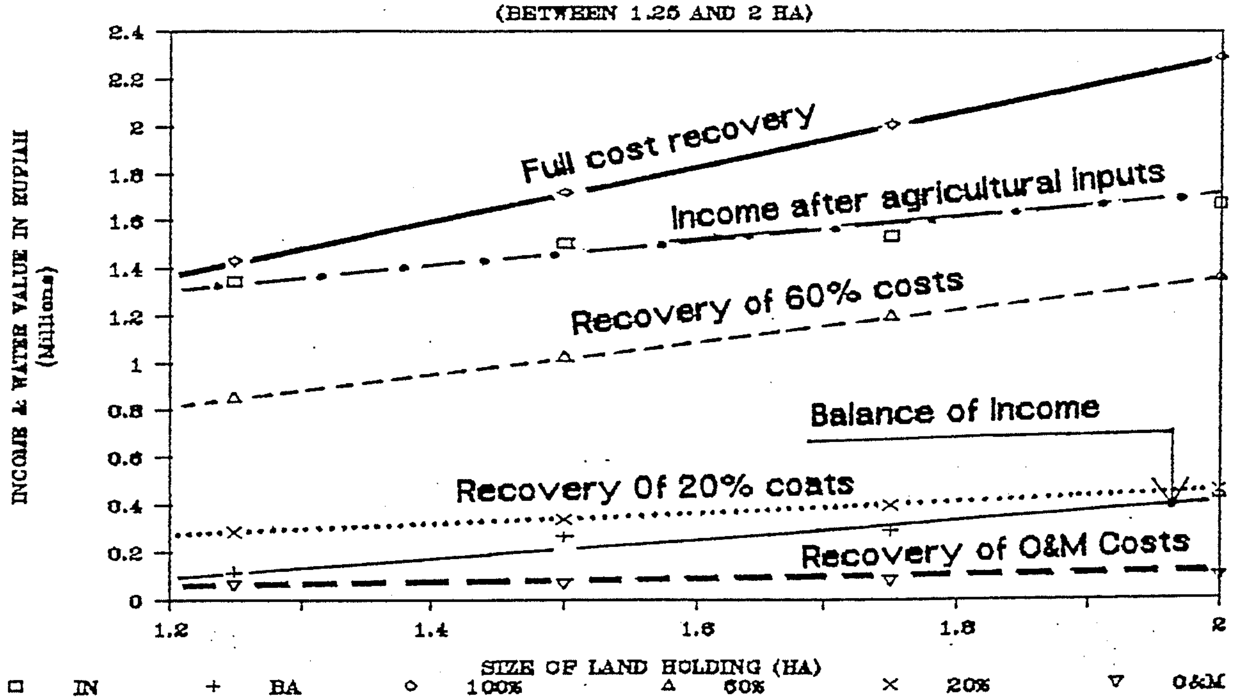
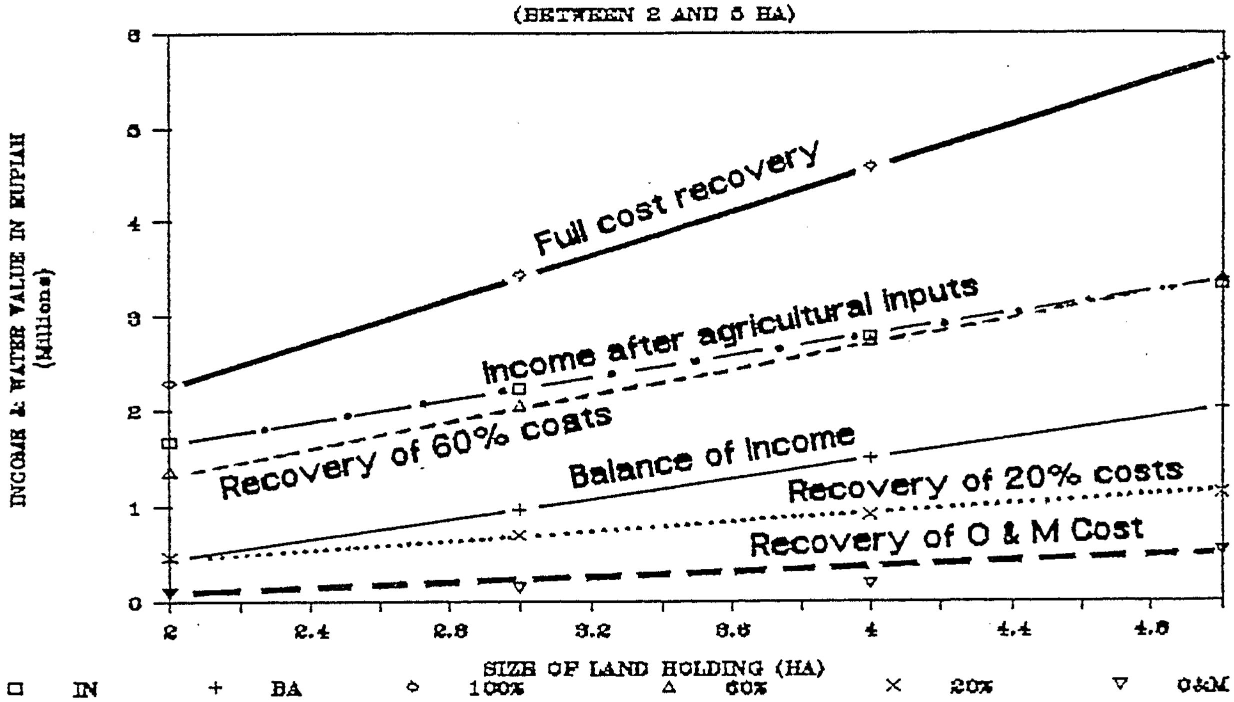


FIGURE 7-6C INCOME AND COST RECOVERY OF LARGE FARM SIZE



higher than the average income of small and medium farm category. It is somewhat lower than the average income in the large farm category. These results suggest that the present level of income of the transmigrant farmers is quite insufficient to recover an appreciable part of capital and O&M costs.

The second alternative of basing the water charge on the recovery of O&M costs only, leads to the following conclusions:

(1) It is apparent that the irrigated area of 1.00 ha per holding, which is standard for the transmigrant farmers,

will produce a substantial negative income if the water charge is applied. The revenue, after the agricultural and labor inputs, is just enough to pay a very small portion of the family expenses without any opportunity for savings.

(2) A land holding less than 1.00 ha is by no means able to provide a reasonable level of family income, indeed, the land holding of less than 1.00 ha always suffers from a negative income, so that the farmer is not able to make a living from this type of land holding without having extra revenue from another job.

(3) The farm size of less than 1.00 ha cannot bear any form of irrigation water charge be it on the basis of the full or partial recovery of capital and O&M costs or on the basis of the recovery of O&M costs alone.

(4) The medium farm size category (1.25 - 2.0 ha) is marginably able to bear the water service charge on the basis of the recovery of O&M costs alone. For this farm size the farm income just about balances the operation and maintenance costs of the scheme. Only the large farm category in excess of 2.0 ha will be able to produce a positive balance of revenues, thereby making it possible for the farmer to bear the water charge on the basis of the recovery of O&M costs.

From these analysis, it is clear that if irrigation is meant to provide a reasonable standard of living for the transmigrant settlers, the current land allocation policy of

2.00 ha for each transmigrant family is questionable if there are no other sources of income. This is because the two ha land allocation includes 0.25ha of house yard and 0.75 ha upland, thus, only 1.0 ha is available for irrigated paddy field, which is barely enough without water chargefor the marginal level of productivity.

The analysis further suggests that if land allocation is to provide a reasonable level of agricultural livelihood in addition to paying O&M cost then it should be at larger than 2.0 ha (excluding the house yard and upland).

It should be noted however that this conclusion is of limited validity because of the possible impact of future land fragmentation.[▷55] The impact of "fragmentation" on land ownership is a serious problem, however, this matter is beyond the scope of the present study. It urgently requires future studies of transmigration resettlement strategies.

7.8 CONCLUDING REMARKS

Although the principles of engineering economics call for the recovery of the investment at the earliest

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[55] ▷ *The "fragmentation effect" on land allocation for the transmigrant in the study area becomes more significant when the land is passed down to the successive generations. In fact, the current average land holding in the Kalaena, the Lamasi and the Way Rarem is only 1.06ha, 1.18ha and 1.27 ha respectively; and the average number of children of each family in the scheme is 5, 4, and 4 respectively. The figures suggest that the land fragmentation effect has occurred and will continue in the future.*

possible time, this objective is difficult to put into practice in transmigration irrigation project because the transmigrant farmers in the study are currently unable to pay for these costs, although one could argue that the capital cost should be borne by the government. Nevertheless, the operation and maintenance costs of irrigation schemes, should be the responsibility of the beneficiaries; otherwise, farmers will develop a "dependency attitude", by continuously expecting subsidies or financial assistance from the government. It is essential for the relevant agencies to convince the farmer that irrigation water provided for by the government is not a free commodity. Thus, the beneficiaries should also actively participate in the effort of maintaining a stable and sustainable irrigation water distribution which means that, where possible, the transmigrant farmers must be held responsible for the recovery of operation and maintenance costs of irrigation facilities. However, it is recommended that farmers with land holdings of less than two hectares not pay any water charge at all.

To improve the underlying agricultural means of livelihood, while introducing "irrigation service fees", based on the recovery operation and maintenance costs, efforts should also be geared toward improvement of farming techniques, cropping pattern, cash crops, price stability, and sustainable agricultural practices. This effort will allow a substantial increase of farm production per unit area which will eventually provide a better income for the farmer. Thus, before the water charging efforts are implemented, the relevant authorities should undertake a careful study so as to be able to identify all impacts that might be associated with charging for water. Determination of the level of charging, water charge collection, method of charging and institutional mechanisms need judicious consideration prior to actual implementation.

Special attention should be given to the newly established irrigation based transmigration programs, to make sure that the resettlement phase is at a stable condition before there is any attempt to introduce charges for irrigation water; otherwise, the transmigrants will never becoming self sustaining in the new living area.

Since irrigation is meant to provide a reasonable standard of living for supporting the transmigration settlers, the current 2.00 ha land allocation policy for each transmigrant family is not adequate without other sources of extra income.

Indeed, the analysis suggests that the size of land allocation should be larger than 2.0 ha (excluding the house yard and upland). This matter is beyond the scope of the present study and will be left to future studies of transmigration resettlement.

It is difficult to asses how a larger land allocation would effect future land fragmentation. On one hand it might encourage it. On the other hand, having an inadequate land base to begin with, the transmigrant is forced to seek other sources of income and the pattern of regarding a farm as only part of one's source of income may become permanently established.

CHAPTER EIGHT

ANALYSIS OF SOCIO-CULTURAL AND ECONOMIC ADAPTATION TO RESETTLEMENT SCHEMES

CHAPTER EIGHT

ANALYSIS OF SOCIO-CULTURAL AND ECONOMIC ADAPTATION TO RESETTLEMENT SCHEMES

8.1 INTRODUCTION

The analysis of the socio-cultural and economic aspects of transmigration focuses on the capacity of transmigrants to adapt to the resettlement schemes. The analytical methods are designed to accommodate both qualitative and quantitative analyses.

The data obtained from an open-ended questions were analyzed qualitatively. The descriptive answers from the respondents were classified and organized into groups which have more or less similar characteristics.

The data obtained from the structured questions, were interpreted using a regression technique which was employed to test the hypotheses on the relationship between socio-cultural and economic variables and the settlers' adaptation to the scheme. The variables that provide a concrete indication of the current adaptation status were found to be related mostly to the pre-resettlement experience rather than to the post-resettlement experience of settlers in conducting their household economy.

The first section of this chapter presents a general profile of the sample and the socio-demographic composition of the resettlement schemes such as migration status, rural development condition, and characteristics of the transmigrant households. The subsequent part deals with agricultural and land use patterns, agricultural conditions, land tenure, irrigation water management, agricultural production, marketing, financial conditions, education facilities, the historical outline of the resettlement process, and current status of living conditions and social structures. The next section presents the transmigrants' living conditions, social interaction, resettlement motivation, rural development problems, perception about resettlement conditions, rural infrastructures and interaction with officials. The transmigrants' adaptation to the scheme and their commitment, participation and cooperation with the scheme management are presented in the last section of this chapter.

8.2 GENERAL SUMMARY OF THE STRUCTURED DATA

8.2.1 GENERAL FEATURES OF THE HOUSEHOLD SAMPLES

Since the transmigration program prescribes that the applicant should be married and registered for resettlement as a household unit, the primary data collection in this study were based on the household unit, taking the household head as the respondent.

Out of 253 household-heads, 97.63% are men; only six household-heads are women (widows). The age of respondents ranges from 26 to 78 years; the average is 47 years with a standard deviation of 10.32 years. The vast majority are Javanese 73.91%; the rest are Torajanese 10.28%, Bugisnese 7.11%, Balinese 5.53%, Sundanese 1.98%; and Lomboknese 1.19%. In the above ethnic composition, the Bugisnese and Torajanese represent the local transmigrants in the Luwu schemes. The majority of the respondents (80.63%) are Moslem who number slightly below the national average; 11.46% are Protestant, 2.37% are Catholic and the rest, 5.54%, are Hindu.

In terms of education level, the majority of respondents (65.61%) have attended only primary school, while 14.23% are illiterate; 12.25% have secondary school education, and the rest (7.91%) are high school graduates. The household size is 6.74 persons with an average of four children.

8.2.2 GENERAL CIRCUMSTANCES OF RESPONDENTS' INVOLVEMENT WITH THE TRANSMIGRATION PROGRAM

Regarding the involvement of respondents with the transmigration program, the respondents are classified into nine major groups namely: (1) spontaneous transmigrants *(swakarsa berbantuan)* representing about 36% of respondents; (2) general transmigrants *(transmigrasi umum)*, involving about 23% of the respondents; (3) local transmigrants *(transmigrasi lokal)* at about 10%; (4) colonization program settlers,[▷56] involving about 8.7%; (5) *swakarsa murni* (purely self initiated without assistance) transmigrants at about 6.72%; (6) organized resettlement participants (spontaneous with partial assistance) at about 5%; (7) settlers motivated by natural disaster at about 5%; (8) social and special program participants (organized by the Ministry of Social Affairs) at about 5% and (9) integrated transmigration program participants (general transmigrants with integrated approach) at about 0.80% of the total respondent households.

Most respondents, with the exception of those who moved during the Colonization Program, arrived in the early 1970's. In addition, some moved into the area in the early 1990's. The latter are mostly transmigrants whose move was spontaneous and self initiated. The respondents came mostly from Central Java (42.69%), from East Java (23%), from South Sulawesi (22.5%), from Bali (5.5%), from West Java (3%), from Lampung (1.2%) and the rest from NTB (West Nusa Tenggara), (3%). For more details see *Table-8.1* below:

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56 ▷ *The Colonization Program was organized by the Dutch Colonial Government in the Luwu Scheme just before the Second World War. The majority of the settlers were incorporated in the scheme in the early 1940's.*

TABLE 8-1 SUMMARY OF TRANSMIGRATION CATEGORY BASED ON ACTUAL SAMPLE REPRESENTATION

TRANSMIGRATION AND MIGRATION CATEGORY	PROPORTION (%) (%)	PROPORTION (%) SUB TOTAL	MIGRANTION ORIGIN (SOURCE)	TYPE OF SITE PREPARATION (IMPLEMENTATION)	TYPE OF ASSISTANCE RECEIVED	TYPE OF MIGRATION MOVEMENT (MOTIVATION)
I. GENERAL TRANSMIGRATION (Transmigrasi Umum)	22.95%	37.17%	-CENTRAL JAVA -EAST JAVA -WEST JAVA -BALI -WEST NUSA TENGGARA	TRIPARTIATE (Triparsial) INTEGRATED (Terpadu)	LAND HOUSE HOUSEHOLD YARD TRANSPORTATTION HOUSEHOLD FACILITIES AGRICULTURAL FACILITIES LIVING ALLOWANCE MISCELLANEOUS MATTERIALS TECHNICAL GUIDANCE (SOME COMBINATTION)	VOLUNTARY SEMI VOLUNTARY INVOLUNTARY
1.1. Colonization Migration	8.70%					
1.2. Natural Disaster	4.74%					
1.3. Integrated Program	0.80%					
II. LOCAL TRANSMIGRATION (Transmigrasi Lokal)	10.28%	10.28%	-SOUTH SULAWESI -LAMPUNG	TRIPARTIATE (Triparsial) INTEGRATED (Terpadu)	LAND HOUSE HOUSEHOLD YARD TRANSPORTAT'ION HOUSEHOLD FACILITIES AGRICULTURAL FACILITIES LIVING ALLOWANCE MISCELLANEOUS MATTERIALS TECHNICAL GUIDANCE (SOME COMBINATTION)	VOLUNTARY SEMI VOLUNTARY INVOLUNTARY
III. SPONTANEOUS TRANSMIGRATION (Transmigrasi Swakarsa)		47.40%	-CENTRAL JAVA -EAST JAVA -WEST JAVA -BALI -WEST NUSA TENGGARA -SOUTH SULAWESI -LAMPUNG	-TRIPARTIATE (Triparsial) -INTEGRATED (Terpadu) -INFIX (INSERTION) (Sisipan)	LAND HOUSE HOUSEHOLD YARD TRANSPORTAT'ION HOUSEHOLD FACILITIES AGRICULTURAL FACILITIES LIVING ALLOWANCE MISCELLANEOUS MATTERIALS TECHNICAL GUIDANCE (SOME COMBINATION)	VOLUNTARY SEMI VOLUNTARY INVOLUNTARY
3.1. Organized Resettlement	4.70%					
III-A. SPONTANEOUS (ASSISTED) (Swakarsa Berbantuan)	35.98%					
III-B. SPONTANEOUS: (UNASSISTED (Swakarsa Tanpa Bantuan)	6.72%			-INFIX (INSERTION) (Sisipan)	TECHNICAL GUIDANCE	VOLUNTARY
IV. SPECIAL PROGRAM OF OTHER DEPARTMENT (AGENCY)			-CENTRAL JAVA -EAST JAVA -SOUTH SULAWESI -LAMPUNG	-REHABILITATION OF NATIVE VILLAGE (Rehabilitasi Desa Asli) -INFIX (INSERTION) (Sisipan)	LAND HOUSE HOUSEHOLD YARD TRANSPORTAT'ION HOUSEHOLD FACILITIES AGRICULTURAL FACILITIES LIVING ALLOWANCE MISCELLANEOUS MATTERIALS TECHNICAL GUIDANCE (SOME COMBINATION IN PARTIAL)	VOLUNTARY SEMI VOLUNTARY INVOLUNTARY
4.1. Ministry of Social Affairs	5.15%	5.15%				
GRAND TOTAL		100.00%	CENTRAL JAVA (42.69%); EAST JAVA (23%)	BALI (5.5%); WEST JAVA (1.2%);	SOUTH SULAWESI (22.5%); LAMPUNG (1.2%);	NTB (3%)

8.2.3 LAND ASPECTS

A. Land Use and Tenureship Status

Regarding the status of land tenureship, 76.68% of respondents stated that they possessed legal land ownership certificates, while for the rest of the respondents, 23.32%, the ownership was not legalized (some 20% had temporary ownership and the rest possessed only the right to cultivate). All respondents stated that land certificates are vitally important for them to be able to cultivate the land. The average area owned is 1.29 ha of irrigable land, 0.87 ha upland and about 0.30 ha for homestead (including other non-agricultural purposes). However, the transmigrant's irrigable land is not always located at the same site as the homestead, though 90.50% is in the same village. The average distance from land to house, as stated by 96.84% of the respondents, is about 1.20 km.

In terms of present agricultural land use, 80% of land is used for irrigation, for upland crops and fruit trees, while some minor portions remain uncultivated. The average cropping intensity of irrigated lands is mostly at about 145% annually, compared to about 90% for upland and 70% for other land-use categories. The average land productivity is about 3.70 tons of rice per ha/crop while the average agricultural and labor input is about Rp665,000 per ha/crop.

B. Irrigation Circumstances

Concerning the availability of irrigation facilities at the time of arrival of settlers, about 85% of respondents stated that there were no irrigation facilities at all. About 54% of respondents stated that irrigation water had been adequate, while 56% stated that irrigation delivery is not yet sufficient to fully meet their agricultural requirements. Irrigation water distribution, as stated by 62% of respondents, was still conducted on an irregular basis, while the remaining 38% stated that irrigation had been delivered on a continuous basis in accordance with their expectation. The importance of water management at the farm level was stated by 98% of the respondents to be very significant, and therefore 93% of them are currently involved with the Water User's Association (WUA). Through the WUA, the members pay irrigation service fees in kind (in the form of unhusked rice) for the operation and maintenance of the farm level irrigation facilities. About 75% of respondents stated that they pay irrigation service fees to the WUA (about 40 to 50 kg of grain rice, equivalent to about Rp10,000 to Rp14,000) in the harvest season. The rest, 25%, do not have irrigation on a stable basis, so that they do not have to pay any irrigation service fees to the association.

C. Condition of Household Economy

Regarding the profile of farm income, the average farm budget shows a disposable income of only about Rp30,000 after deducting agricultural inputs and household expenditures. The average gross annual income from agriculture is about Rp1,500,000, and from non-agricultural origins it is about Rp350,000. Costs of agricultural inputs such as fertilizer, seeds, insecticides, etc., are about Rp600,000. The household expenditures are food (Rp795,000), clothing (Rp115,000), education for the children (Rp130,000), health care (Rp50,000), transportation (Rp55,000), taxes and other socially related events (Rp75,000), totaling about Rp1,220,000 annually.

Concerning participation in rural financial institutions, 60% of respondents stated that they are not involved while 40% are participating. About 56% of respondents stated that they have no rural cooperative in their village, 85% stated that they have no rural banks and credit facilities, and 46% stated that there are no market facilities in their villages.

8.2.4 RESETTLEMENT, FACILITIES, ENVIRONMENT AND ADAPTATION TO THE RESETTLEMENT SCHEME

In general, the transmigration resettlements lacked adequate site preparation when settlers initially moved there. About 75% of respondents stated that on arrival the land allocation was about 64% completed, housing was about 58% completed, and land clearing was about 62% completed. They also also stated that irrigation facilities were not yet provided. About 56% of respondents stated that they found settlement preparation worse than what they had anticipated, whereas, the remaining 44% stated that, when they first arrived, they found conditions better than what they had anticipated.

Concerning ties with their place of origin, 36% of respondents stated that they still had property (mostly small pieces of land in the range of 0.25 - 0.50 ha) in their place of origin, and that they maintained communication with their relatives. The remaining respondents had no property left in their place of origin, but the majority maintained occasional contact with relatives.

Regarding social participation, 97% actively participate in social events such as mutual aid and other activities that are required by the community such as periodical gatherings, traditional celebrations, maintenance of village buildings and so on. Of this figure, 80% are regular participants and 17% are only occasional participants. Only about 3% of the settlers do not participate in any social activities of the community.

The majority (93%) of the settlers considered the present location to be their new home where conditions are better than had been their previous living conditions. About 3% of respondents are not better off, but of this 3%, only 1% feel unhappy with their present conditions. About 85% stated that they are quite happy and about 14% that they are moderately happy. The settlers' adaptation is also indicated by the present condition of their houses and living environment. They are mostly established in a rural environment with about 24% living in very simple housing, 37% in moderately simple housing, 32% in moderate housing, and the rest, 7%, in permanent brick houses. (For more detailed figures, see the tables of the field data collected as presented in *Appendix 8-1*).

8.3 ANALYSIS OF THE UNSTRUCTURED DATA

This section tests the hypothesis indicated below. A number of indicators collected in the survey are used to support the hypothesis using a simple descriptive analysis.

The hypothesis in question is:

"Better pre-resettlement preparation and consistent follow-up extension services will help in off-setting the frustration that farmers experience in starting up the new agricultural operations on irrigation schemes, and thereby, maintain a greater level of settlers' commitment to and cooperation with the scheme's management.

The data, collected through open ended questions, are analyzed by categorizing them into a number of classifications. Due to the nature of the questionnaire, some respondents answered the questions with adequate explanations, while others did not respond at all.

8.3.1 TRANSMIGRATION RESETTLEMENT EXPERIENCE

A. Pre Migration Information

Concerning information provided to the respondents about the transmigration program, 32.20% stated that they had heard about the program for the first time from a transmigration extension officer who came to their village to campaign and promote the concept of the transmigration program to villagers. About 14% were introduced to the transmigration program by rural extension staff. Other sources of information were village heads (11%), previous transmigrants (10%), friends (10%), close relatives (7%) and local government extension offices through promotional films. In total, some 68% of respondents had not been introduced to the transmigration program by the transmigration agency per-se, but by other sources including close relatives, friends and previous transmigrants who had returned home occasionally *(see Appendix 8-2.1 for more details)*.

These figures show that the dissemination of pre-resettlement information is more effective through informal communication such as close relatives, friends and previous transmigrant. It is apparent that the pre-resettlement information was in most cases not obtained from the extension officer. This situation may have caused misperceptions regarding actual facilities and assistance settlers would be provided with and the obligations they undertook when they decided to move.

Very little clear-cut information about prospects and facilities was made available to settlers prior to resettlement.

Concerning the expectation transmigrants had about the program before joining it, about 65% stated that they thought they would get access to abundantly available land resources. While the prospect of improving their way of life while remaining in their areas of origin seemed increasingly dim, the prospect in the newly opened lands seemed much more brighter. About 13% of respondents stated that participation in the transmigration program offered the best chance of improving their prosperity and livelihood.

Almost 50% of respondents had heard that those who participated in the transmigration program would receive substantial benefits such as agricultural land, a homestead, a simple house, and a living allowance. However, on arrival, most respondents were disappointed when they found that the facilities did not conform to what they had been led to expect, nor to what they felt they were entitled to. *(see Appendix 8-2.2 and Appendix 8-2.3 for more details).*

It is quite obvious that the decision to participate in the transmigration program was largely made because of facilities that were promised by the Transmigration Agency. About 75% stated that this was the case. They were primarily interested in pursuing a better livelihood than they had in their areas of origin by obtaining ownership of adequate agricultural land. The rest had decided to participate for a variety of reasons: seeing the success of their friends who had previously participated in the program; feelings of desperation in their areas of origin when they had no land to cultivate; overcrowded environments; encouragement of their close relatives; and natural hazards such as volcanic eruptions and earthquakes *(see Appendix 8-1.4 for more details)*.

It is therefore very important that prospective settlers be given pre-migration information in order to avoid a decision to join the transmigration program based on expectations that are too high. It is obvious that one cannot expect much from settlers that are motivated only by promised facilities without having a strong desire to work hard in pursuing their new life.

B. Pre-resettlement Economic Activities

The economic activities of prospective participants are an important factor that must be taken into consideration in the selection process, since it is an indicator of the future commitment of settlers. Ideally, high priority should be given to participants who have work experience that is similar to what they are expected to do in the new settlement scheme. It is apparent from the greatly diversified pre-resettlement economic activities of transmigrants that this was not done in the past.

Regarding the question about pre-resettlement employment, about 20% of respondents did not give answers. About 38% of those who did respond indicated that they had previously worked as agricultural laborers; 32% had worked as daily laborers or construction workers; the rest had worked as share croppers under upland agricultural practices (4%), as part-time government workers (3%), shifting cultivators (2%), carpenters, masons, and brick layers (2%), fishermen and timber cutters, poultry, food stuffs and cattle traders, as barbers, and tricycle pullers and at kiosks and stalls (1%). The majority of settlers had been totally landless, which explain their desire to participate in a scheme that would give them a chance to obtain land *(see Appendix 8-2.5 for more details)*.

8.3.2 LAND USE

A. Land Use and Land Tenureship Issues

One of the most important benefits anticipated by transmigrants was the security of farming their own land. Once moved, they would have to rely primarily on income from their agricultural land allocation at the new destination. It is therefore understandable that all respondents stated that land tenureship is very important to them. The reasons that were given are summarized as follows: (1) about 50% stated that they badly needed legal land ownership status in order to have assurance and legal protection to cultivate the land in perpetuity; (2) almost 16% of respondents stated that a land certificate will give them legal evidence regarding the actual size and physical location of their land; (3) about 15% stated that they need secure legal land title in order to have government accreditation, so that the land can be used as collateral to obtain agricultural credit when the necessity arises; (4) about 12% stated that the legal land title will protect them from any possible claims; and (5) others (about 7%) stated that having a land certificate will increase the value of their land. In case of land acquisition for a government project such as construction of roads, a legal land ownership certificate will also help ensure that they receive just compensation for lands acquired by government *(see Appendix 8-3.1 for more details)*.

This information supports the hypothesis with respect to the importance of pre-resettlement preparations in the context of the land tenureship issue. It is important for the resettlement project to arrange security of land tenure prior to settlement so that transmigrants will not suffer from uncertainty in this respect, which would detract from their level of commitment.

Poor resettlement preparation is also evident in the present condition of agricultural practice and land use. With respect to the questions on this subject, 26.5% of respondents did not comment. The answers of the rest of the sample are summarized as follows: (1) 21.85% of the respondents stated that they are suffering from water shortages during the process of new land development, and also during land preparation and raising the rice crop; (2) 19.5% stated that they have difficulty arranging a uniform cropping schedule due to the irregularity of land development stages. As a result, the cropping intensity is very low and planting patterns are too diversified; (3) 19% of respondents reported severe dry land problems in new land development prior to the commencement of irrigation and because the land has an excessively high water consumption demand[▷57] in the initial stages of development; (4) 18.5% of respondents asserted that they were currently hampered by a severe lack of skill and experience with agricultural techniques; (5) 9.50% claimed that their agricultural land has suffered from severe agricultural pest attacks due to the non-uniformity of the planting stages and the lack of

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[57] ▷ *Based on the present experience of the farmers, as stated spontaneously by many of the respondents, the high water consumption demand for the newly developed agricultural lands will take place for several years. During such an unstable condition, it is almost certain that crops will not bring in a reliable level of productivity.*

cultivation of much of the land in the immediate vicinity; (6) 5.85% stated that they enjoyed stable and good crops as well as consistent irrigation services; (7) 3.3% claimed that the present status of land allocations are still uncertain, or under dispute, and that they still do not feel secure in cultivating the land, while some of the allocated land is not suitable for irrigated paddies due to poor soils and irregular topography; and (8) the rest of the responses (2.5%) indicated that respondents are currently suffering from an agricultural labor shortage and a lack of agricultural mechanization especially during the land preparation and transplanting season. *(See Appendix 8-3.2 for more details).*

B. Irrigation Operation and Management

The problems associated with irrigation are usually rooted in poor settlement preparation, particularly a delay in the provision of irrigation facilities. Mobilization of settlers is usually conducted quickly in order to meet the targeted number of people to be settled. On the other hand, the irrigation development cannot be completed to match the time required for mobilizing people. The provision of irrigation infrastructure requires surveys, investigations, planning, structural design and construction, all of which takes time. Too often, transmigration settlers spend years waiting for irrigation water to come to their agricultural land. The settlers then resort to dry-land farming while waiting for irrigation services. Unfortunately, land farmed by traditional dry-land practice without irrigation quickly deteriorates. Thus transmigrants need temporary employment while waiting for the provision of irrigation services.

Among the most immediate consequences of mobilizing people prior to the provision of irrigation infrastructure, is the inability of settlers to operate irrigated farming the way they had expected. The longer the waiting period the more serious the problem. The ability to survive depends largely on the individual's ability to find other employment, which may not be readily available. Otherwise the settlers will find it difficult to participate fully in the settlement scheme.

Regarding settlers' employment prior to the provision of irrigation, the following responses present a general outline of the transmigrant experiences: (1) the majority of respondents (73.80%) stated that prior to irrigation services, they cultivated upland crops such as cassava, upland paddy, corn, beans, root-crops and other mixed crops; (2) about 8.7% of respondents declared that they worked temporarily as agricultural laborers or as share croppers; (3) another 6.4% worked at seasonal employment such as, factory work, timber processing, construction work or carpentry; (4) some 5.4% stated that they had initiated low land paddy cultivation through their own efforts to provide simple irrigation facilities; in addition, they also cultivated fruit trees such as orange, banana, mango, and coconut trees in their yards; (5) about 2% worked as food and other retailers or were engaged in buying and selling cattle from the villagers; (6) the rest (3.70%) worked as wood cutters or fishermen. *(See Appendix 8-4.1 for more details).*

Another indication of transmigrants participation is explained by their direct involvement with water management activities. This can be seen from the transmigrant perception of and involvement with the Water Users Association (WUA).

The Water User Associations, which deals with management at the farm level, provide a reliable communication between the government agencies in charge of irrigation development and the farmers.

Regarding the importance of the WUA, 98% of respondents stated that they considered the organization to be quite useful. About 93% of them were involved in WUAs as active members. The following opinions were expressed by respondents concerning the WUA: (1) 75.5% of respondents stated that the WUA is important for proper water management at the farm level because it provides an organized group arrangement; (2) 10.50% of respondents stated that the WUA facilitates uniform and well organized cropping practices by encouraging efficient irrigation; (3) the WUA, as stated by 9% of respondents, also helped to establish reliable means of communicating information about agriculture and irrigation among the members; (4) the rest of the respondents (5%) indicated that the WUA allows for proper representation of farmers in dealing with other institutions. *(See appendix 8-3.2 for more details).*

Since irrigation is designed to be the basic support for transmigrants' way of life, it is important that the irrigation infrastructure is operational as soon as possible. The transmigrants' response to question about this issue reflects the problem of inadequate preparation for irrigation.

About 25% of respondents did not answer the question about their personal perceptions on the adequacy of present irrigation infrastructures. The answers obtained indicated concerns about a shortage of facilities, about the knowledge, the personnel, and the organization of the water management structure. Some presented constructive criticism on how to improve the current irrigation system. The following results are obtained: (1) almost 50% of respondents stated that they currently experience irrigation water shortages for new land development, for land preparation, and for cropping; (2) 18.75% of them suggested measures to solve the problems, such as lining the canals to avoid excessive conveyance losses; giving early attention to irrigation *bloks* located further downstream in the project; setting reasonable irrigation service fees to allow proper facility maintenance; avoiding intermittent or rotational irrigation distribution to avoid severe pest attacks; minimizing the impact of excessive water requirements for land development; (3) some 10.50% of respondents claimed that the implementation of the water distribution was often inconsistent with the predetermined schedule, so that cropping practice could not be as scheduled; (4) there had been a lack of qualified personnel (as stated by 6%) for reliably performing operation and maintenance of the irrigation system, both at the farm level and at the main system; (5) 4.8% of respondents stated that the WUA had not been effective in solving problems; (6) 4% indicated that farm level irrigation infrastructures had not functioned properly; and (7) only 3.2% of respondents said that they are satisfied with the better living standards that resulted from successful irrigation practice *(See Appendix 8-4.2 for more details)*.

The above information clearly shows that the land use aspect of the transmigration scheme, in particular the irrigation practice, requires both careful preparation before settlement and consistent extension service after the settlement implementation.

8.3.3 RURAL FINANCIAL INSTITUTIONS

One of the major problems that often hampers resettlement is a shortage of financial institutions at the village level. On several occasions, farmers claimed that the crops they produced often fetched prices that were too low. Their explanation usually was the lack of available markets that would serve to guarantee or stabilize prices, especially during harvest time.

Concerning the farmers' opinion on rural financial institutions, about 22% did not respond. For those who did respond (78%), the following presents a general summary of their comments, opinions and suggestions; (1) some 36% indicated that they had no rural financial institution in their village to support the rural economy; (2) about 32% said that they badly needed rural financial institutions that can provide agricultural credit at low interest. They also stated that they urgently need a stable market that is easily accessible, has reasonable prices,[▷58] and is available

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58 ▷ *On many occasions, according to the immediate responses of the villagers, the author found that prices for agricultural products in rural areas are unrealistically low compared to other commodities. For instance, farmers claim that they have to sacrifice a large proportion of their agricultural products to satisfy non-agricultural needs, including agricultural inputs, fertilizer and clothing. Therefore, they need secure, stable prices that are comparable to prices of daily necessities for their agricultural products, otherwise it will discourage others, especially those in the younger generation, from working in agricultural activities and thereby stimulate urbanization.*

to satisfy the daily needs of villagers; (3) 19% of the remaining respondents stated that the cooperative units existing at the village level are frequently not effective due to a lack of capital and qualified personnel; and (4) about 4% stated that they could get access to a local market in nearby villages, but prices for agricultural products were not stable and often far too low compared to prices of other goods that they needed. *(See Appendix 8-5.1 for more details).*

In terms of actual use of rural financial institutions, some respondents had already become used to them, but others still do not know what to expect from them. About 26% of respondents did not comment or respond to this issue. The answers of the remaining respondents (74%) are summarized as follows: (1) 51.30% stated that since there was no market in the village, they had to resort to selling their agricultural products at remote markets with uncertain prices as well as incur high transportation costs; (2) 28.5% stated that they had taken advantage of Village Cooperative Units to obtain agricultural credit and agricultural inputs, and then had paid back their debts after harvest; (3) 14.50% stated that they had sold their products to door-to-door buyers; they also had sold their products through a system called *"tebas"*,[▷59] in which buyers pay cash for crops in the

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59 ▷ *Under the* tebas *system, buyers purchase crops in the*

field at the time of harvest; (4) since the Village Cooperative Units cannot provide credits, nor guarantee a good price for agricultural products, 5.7% of respondents had resorted to obtaining credit at very high interest rates from private money lenders. *(See Appendix 8-5.2 for more details).*

The information presented above demonstrates that the present condition of rural financial institutions is inadequate to fully support the rural economy in settlement areas. This is another issue that is highly dependent on the settlement planning and preparation, as well as on follow-up extension. To have successfully operating financial institutions requires not only inter-departmental cooperation during the settlement implementation, but, most importantly, it also requires inter-departmental relationship in the follow up.

8.3.4 RESETTLEMENT ADAPTATION

There are a number of conditions in the community that provide indicators about the present status of settlers' adaptation to resettlement schemes. These include

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field at harvest time, so that the farmers do not need to transport crops to their houses. This system is becoming more popular in the Luwu scheme and its surrounding areas. Particularly, for farmers who are already acquainted with the money economy, this system is highly preferred; however, it is still too risky for those farmers who are not accustomed to cash accounts.

social climate and participation, efforts to rebuild their houses, communication with their relatives in their areas of origin, property that they still have in their areas of origin, future expectations, and expenditures on durable goods. These responses provide a good indication about present socio-cultural and economic level of adaptation to resettlement schemes.

Maintaining an emotional or economic dependency on the area of origin, may indicate that settlers are not yet feeling at home in their new environment or have not made a strong commitment to the new settlement. For example, maintaining valuable property or assets in the area of origin could tempt settlers to return to their place of origin in the future. Similarly, social participation as well as participating in maintaining a balanced rural environment and feelings of togetherness in the resettlement area could also provide indications of adaptation. The willingness to sacrifice for the community they are attached to is another indication of adaptation to the resettlement scheme.

The ability to generate secondary income, at least up to the level of income they had previously, may also give an indication of economic adaptation. It could, however, also indicate that the agricultural way of life has not been successful in supporting the settlers the way this was expected by settlement planners.

The following features describe the transmigrant conditions with regards to the above mentioned indicators.

A. Property in Areas of Origin

About 58% of respondents stated that they still have property in their areas of origin, mostly consisting of small pieces of land between 0.10 to 0.5ha.

The following summarizes their plans for such property: (1) slightly more than 40% stated that as they had enough income at the present time, they would give their land to close relatives for additional income; (2) almost 37% said that they had authorized relatives to cultivate, or to sublet the property to share croppers for additional income, but they wanted to keep the land to meet unexpected future needs; (3) 14.2% had purchased the land from them but that they hold a mortgage on it, or they are keeping the land so that their children can pursue higher education; and, (4) another 8.8% stated that they had sold the land to buy new but cheaper land in the resettlement areas and that they had used some of the money as working capital. *(See Appendix 8-6.1 for more details).*

It is possible that settlers would still be hesitant to give up land and to adapt fully to their new area, despite the fact that the property the transmigrants have in the areas of origin consists mostly of small pieces of land and although the majority would have enough income.

B. Social Participation

Regarding social participation and adaptation, about 27% did not respond. The following presents a summary of respondents' comments: (1) 53.2% indicated that their villages are still having problems of insecurity, such as occasional theft, robbery, vandalism and juvenile delinquency; (2) more than 16% stated that they now enjoyed a secure and better rural environment with harmonious working relations among community members; (3) 9.8% felt that they currently need more knowledge and skills about agricultural techniques as well as equipment and credit facilities; (4) 7.8% stated that they badly need better coordination in order to encourage a cooperative spirit among transmigrants to solve their problems; (5) 6.30% felt that special attention should be given to rural financial institutions; (6) 5.4% claimed that they had very limited access to public facilities such as health services, school, transportation, drinking water and rural electrification; and (7) another 1.5% stated that they still had problems with land ownership status. They also stated that they were currently suffering from low income due to costly agricultural inputs and living costs, and unrealistically low prices for agricultural products. *(See Appendix 8-6.2 for more details).*

C. Non-agricultural-Based Employment

The ability to generate secondary incomes from non-agricultural sources is an indication of economic adaptation. The following summary outlines non-agricultural employment of 64% of the responded samples:

1.	Fruit trees and yard plantation farmer	23.35%
2.	Food kiosk/stall/retailer/grocer	20.00%
3.	Agricultural laborer/share cropper	13.40%
4.	Construction worker/mason/carpenter etc.	12.35%
5.	Buying and selling cattle	7.20%
6.	Coconut and cocoa trader	5.50%
7.	Part-time worker/seasonal laborer	2.80%
8.	Poultry breeder	2.40%
9.	Coconut processor/cracker maker	2.40%
10.	Rice mill owner	2.40%
11.	Factory worker/mechanics	2.05%
12.	Handicraft/furniture maker	2.05%
13.	Wood hunter/fisherman	1.36%
14.	Goods trader	1.37%
15.	Tricycle puller	1.03%
16.	Barber/tailor	0.34%

From the above statistics, one can observe that the majority of respondents had permanent non-agricultural employment. This is a significant indication that most settlers are beginning to adapt to their new living environment. At the same time, this statistic also indicates that agriculture has not provided adequate income for settlers. *(More detail figures in Appendix 8-6.3).*

D. Housing and Environment

Another indication of adaptation is the condition of the housing and living environment of settlers. This does not measure the extent of adaptation, but it gives an indication of whether or not settlers are in the process of adaptation. Once this process starts, they do more to improve their houses, gardens, and other facilities related to their environment and living conditions. In as much as settlers improve their living condition, they will be less inclined to move back to their areas of origin.

Regarding housing and living conditions, *Table 8-2* provides a general summary. From this table, it is clear that only about 14% of settlers are currently living in simple housing, and of them , only about 3.6% are in the very simple housing category, even though their house-yards and living environments are properly maintained. In other words, the majority of settlers are already living in good housing and well-maintained living conditions. This is clear evidence that settlers have at least developed a sense of ownership and a willingness to make sacrifices for improving their living condition in the resettlement area, if not yet adapting well. *(more detailed figures are presented in Appendix 8-6.4).*

However, the figures do not give conclusive evidence about the adaptation condition. While the transmigrant still encounters a lot of problems, which indicates that the adaptation process is still progressing, yet, some respondents stated that they are quite happy with the present situation.

Table 8-2 Summary of Housing Conditions

No.	House Type (from permanent to simple category)	Percent
1)	Permanent house with masonry foundation, brick walls, plastered floors, tile roofing, glass decorated window, fully painted and well maintained house-yard.	2.80%
2)	Permanent house with brick foundation, brick plastered floors, brick walls, tile roofing, plastered floors, fully painted and well maintained house-yard.	6.82%
3)	Permanent house with masonry foundation, corrugated metal roofing, brick plastered walls fully painted, and well maintained house yard.	14.85%
4)	Permanent house with masonry foundation, brick plastered walls, plastered floor, corrugated metal roofing, partly painted, and moderately maintained house-yard.	11.24%
5)	Semi permanent house with brick foundation, partly brick and partly plank walls, tile roofing, unplastered floors and well maintained house-yard.	16.10%
6)	Wooden house, corrugated metal roofing, plank walls and floors, no foundation and moderately maintained house-yard.	15.67%
7)	Semi permanent wooden house, high post, corrugated metal roofing, glass windows, plank walls and floor, no foundation, and well maintained house-yard.	11.24%
8)	Simple wooden house, as most houses prepared for the transmigrants for their first arrival, plank walls, no foundation, unplastered floors, corrugated metal roofing, and poorly maintained house-yard.	7.23%
9)	Simple wooden house, palm leaf roofing, plank walls, no foundation, unplastered earth floors, and moderately maintained house-yard.	10.44%
10)	Very simple wooden house, palm leaf roofing, bamboo walls, no foundation, bare soil floors, and moderately maintained house-yard.	3.61%

Indeed, the degree of adaptation is a private matter that differs from one individual to another. There seems to be evidence that in spite of the significant problems settlers currently have, their overall condition has given them a better feeling of security and has made them economically better off compared to their previous living circumstance in areas of origin. This would give significant additional support to the hypothesis concerning the importance of pre-resettlement preparation for maintaining the settlers commitment and their adaptation to the resettlement scheme.

8.3.5 RESETTLEMENT PROBLEMS

This section discusses particularly significant problems that currently prevail in irrigation-based transmigration programs and how these hamper the past and present development. The settlers were asked to state three of the most significant problems they had encountered in their resettlement experience and adaptation. They were also asked to rank these problems in order of significance.

A. The Most Significant Problems

About 12% did not reply to the questions because of an inability to express themselves adequately during the interview. They insisted on not stating the most important problems to avoid making irrelevant statements. The responses that were obtained are summarized as follows: (1) 28% stated that severe irrigation water shortages as the most important problem that they still encountered; (2) 18% mentioned that paddy prices, as well as prices for other agricultural products, were unrealistically low so that they could not earn an adequate income from agriculture; (3) 16% stated that they were currently experiencing insecurity problems in the form of thefts, robberies, vandalism and juvenile delinquency; (4) some 8% claimed that their irrigation infrastructures were currently poorly maintained, so that irrigation efficiency had gradually declined; (5) another 8% stated that village cooperative units were not available or unable to satisfy their needs for agricultural credits, price stabilization and the provision of agricultural inputs; (6) around 4% stated that their farms were currently suffering from poor cropping schedules; (7) 3% stated that the villagers tended to show less and less cooperative spirit, so that it was difficult to get them to assist in the collective maintenance of public facilities; (8) 3% stated that poor public transportation often prevented them from marketing their agricultural products; and (9) the rest of the problems stated by the respondents (about 2.0 to 0.5%) were: poor farm level irrigation facilities and management, poor Water Users' Association, severe pest attacks, no rural electricity, poor tax arrangements, and severe problems with land development.

It is apparent that irrigation and agricultural problems are by far the most significant, followed by the problem of crop prices, problems with village security, and poor interagency cooperation at farm level implementation. This demonstrates that poor planning of resettlement projects is still the dominant cause of problems. Whatever the resettlement objectives, pre-implementation planning and preparation should first be vigorously pursued. An integrated approach is needed, first of all, for planning and afterward throughout all stages of design, implementation and the actual resettlement process; otherwise, future resettlement programs will eventually end up with the same problems as are currently experienced *(see Appendix 8-7.1 for more details figures)*.

B. The Second Most Significant Problems

The problems stated in the category of second most importance, are almost the same as those mentioned above, except that the percentages change. Some 20% of respondents gave no second significant problem.

The following summary presents the problems in descending order of magnitude: (1) about 22% stressed the problem of village security due to occasional thefts, robbery, juvenile delinquency and vandalism; (2) about 17% was stated that they were suffering from unrealistically low crop prices; (3) about 12% claimed that agricultural inputs are expensive relative to the price they can get for their agricultural products; (4) almost 10% contended that irrigation water shortages were still hampering their irrigation implementation; (5) some 6% stated that they had insufficient market facilities near by so that they had to resort to selling their products at remote markets with high transportation costs and uncertain prices; (6) three problems stated by about 5% of respondents were: poor village cooperative units, low agricultural productivity, and high living expenses relative to the agricultural source of income; (7) another two problems stated by 3% of respondents were: poor irrigation facilities and lack of agricultural extension services; and (8) the rest of the second order problems stated by respondents in the range of 3.00 to 0.50% were: poor agricultural schedules, poor social participation, and severe pest attacks.

From the above figures, it becomes clear that the villagers see as the second most significant problems as village security, followed by price uncertainty, and costly agricultural inputs and irrigation water shortages. An explanation of this ranking is that after land productivity has been achieved, villagers need the assurance of security and price stability so they can obtain adequate incomes from their agricultural investments. It is therefore essential that marketing mechanisms be provided so that farmers can enjoy a good return for their effort to attain greater productivity. Next, the village environment should be kept more secure in order to provide a better social climate for resettlement development. *(See Appendix 8-7.2 for more detailed configuration).*

C. The Third Most Significant Problems

Only about 42% of settlers responded to this question during the interview. The problems that they mentioned are almost exactly the same as those above, except that the percentages were different. The summary of the remaining respondents' opinions arranged in descending order are: (1) about 16% stated that the third most significant problem is the unrealistically low prices of agricultural products; (2) about 13% claimed that they were having problems with poor irrigation services and ineffective facilities; (3) more than 10% stated that there were no village cooperative units to help solve the problems of rural financial hardships; (4) two problems stated by about 8% of respondents were serious problems with village security and low agricultural productivity; (5) two other problems mentioned by about 7% of the respondents each were the lack of market facilities and costly living expenses relative to the agricultural source of income; (6) about 6% stated that they were having problems with unsolved land disputes; (7) prices for paddy and other agricultural products that are too low were problems stated by about 3%;

(8) the rest of the problems as stated by 3.00 to 0.50% of respondents were poor agricultural schedules, poor social participation, and poor public services.

These figures indicate that the central problem emphasized by the farmers in the third problem category is the same as the second problem mentioned in the first problem category, namely the problem of uncontrolled and unrealistically low prices for agricultural products. They then mentioned irrigation problems that were listed first in the first problem category. Poor village cooperative units, severe problems with village security and low agricultural productivity are the third, fourth and fifth most significant items in this third problem category.

Therefore, from the farmers' perspective, the problems of price stability, irrigation water management, village cooperative units, village security and low agricultural income should be the center of attention and should be addressed immediately to sustain their livelihood and hence to attain the means to achieve social and economic adaptation to the resettlement schemes *(see Appendix 8-7.3 for more detailed figures).*

8.3.6 OVERALL IMPLICATION OF THE ANALYSIS RESULTS

The results that were obtained from a simple descriptive analysis of the unstructured data, show that the a transmigration programs represented in this study have achieved different degrees of success. Some of them are highly successful, others are not. The success of transmigration program does not directly translate into satisfaction on the part of the settlers, who are faced with a number of problems, since satisfaction depends on expectations. Some problems are aggravated by disappointment, others are not. Disappointment stems mostly from the fact that the level of support transmigrants received on arrival was not that anticipated when the decision to participate was made.

It is therefore very important that during the pre-migration phase prospective settlers are given adequate and clear information so that they understand their rights, obligations and responsibilities. This is important to avoid subsequent misperceptions or expectations that are too high and that lead to disappointment and frustration. It was not always done.

A lack of adequate preparation is also apparent in the selection of prospective transmigrants. High priority should have been given to participants with similar economic experiences to those occurring in the new settlements. This was not done previously as is apparent from the diversified pre-resettlement economic activities reported by transmigrants in the survey.

The most important problem that hampers transmigrants in their efforts to make resettlement a success is the difficulty in establishing a properly functioning irrigation system. The problem that ranked next in importance is price assurance followed by security of land ownership. All these problems stemmed largely from the lack of attention given in the pre-resettlement stage, and from inadequate follow-up by agencies involved with the transmigration program. Hence, the overall result gives support to the hypothesis that pre-resettlement preparation and follow-up is of primary importance to obtain greater commitment by the settlers to the management of the scheme.

8.4 QUANTITATIVE ANALYSIS OF LAND DEVELOPMENT

This section presents a quantitative analysis of the survey information that was obtained. The purpose is to identify more precisely reasons behind the slow achievement of land reclamation (land development).[▷60] This analysis concentrates on the impact of non-technical aspects -- such as farmer's participation, ethnicity, income distribution, migration status, and land ownership status. As such, it deals with the social, economic, and other non-technical aspects of irrigation based resettlement. In particular, the

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[60] ▷ *the term* **land reclamation** *is commonly used in Indonesia to refer to the activity of breaking the previously unused land into irrigated paddy field. However, the term* **land development** *is used in this thesis to represent the activity of turning virgin land into new irrigated paddy fields* **(sawah)**.

impact of land ownership on the transmigrant farmer's participation in the land development process is examined.

The degree of participation in development activities can serve as an indicator of social, cultural and economic adaptation of transmigrant settlers for the following reasons: (1) land development activities require mutual cooperation among transmigrant farmers who are still in process of establishing social ties with their new farming community; (2) the transmigrant, faced with a new agricultural area, new irrigation practices, and a different climate, must resort to farming technique in order to adapt; (3) the establishment of a fully developed irrigated land enterprise gives the transmigrant and his family permanent employment.

8.4.1 SOCIO-ECONOMIC PROBLEMS OF LAND DEVELOPMENT

The many socio-economic problems of land development are reflected in the willingness of farmers to cultivate their land under conditions of severe technical constraints, low income, and poor land ownership administration. The administrative process of obtaining title to land is very complicated and tenure is usually not obtained prior to land clearing.

One of the complications is that land tenure is governed by *"hukum adat"* or traditional law. Within this legal framework there is no clear demarcation of the physical boundaries between land that has been assigned to transmigrants and land that is still owned by indigenous people. Hence, transmigrants are often hesitant to undertake land clearing. They know from past experience that farm lands could be claimed by local people after it had been cultivated. The reason why resettlement is usually implemented prior to the issuance of legal land title is to enable transmigrants to cultivate land as early as possible and to avoid the long delay that would be incurred if the complicated administration process had to be first completed.

From a socio-economical point of view, the development problems are usually related, on the one hand, to complications in the linkages between institutional management, rural community leadership, and the farmer, and on the other hand to social and economic constraints on development.

It has been argued that farmers' participation in the development process is determined by their level of satisfaction with the resettlement process which would depend then on the adequacy of services received from government. However, it is difficult to reliably measure farmers' satisfaction. Moreover, satisfaction may be related to income level and to the feeling of being financially secure. It is certainly positively affected by the degree of adaptation achieved. In other words, satisfaction is a result as well as a contributing factor to successful adaptation.

8.4.3 DEVELOPMENT OF THE MODEL FOR MULTIVARIATE ANALYSIS

A. Research Hypotheses

As outlined in Chapter II, the research hypotheses were developed by taking into account both the documented experience with transmigration and the theoretical explanations obtained from existing literature. There is a good reason to believe that progress in land development depends strongly on the farmers' income, skills, experience in agriculture prior to resettlement, and on their motivation to participate in transmigration. This propensity is articulated in the following hypotheses:

- *The ability of the farmer to perform the initial land development is dependent upon the level of farm income: the higher the income of the farmer, the greater the percentage of land development.*
- *The status of land ownership is related to land development performance. The more uncertain the land status the more reluctant the farmers will be to perform the initial land development.*
- *There is also a relationship between land development progress and the type of transmigration program attached to the resettlement implementation in the newly established*

irrigated lands. Other factors that influence the development are the place of origin of the transmigrant, the geographic location of irrigation project and adequacy of irrigation water at the site since these are related to the ability and the willingness of the farmer to perform land development.

B. Data and Method of Analysis

Chapter-V described how the primary data for this analysis were obtained by field surveys in the study areas. It was also explained the sample size was set at a total of 253 households *(rumah tangga)*. Stratified random sampling was used with proportional allocation according to population size of the strata. Thus, 121 sample households were selected using simple random sampling procedure from the Way Rarem Irrigation Project and 132 sample households in the Luwu Irrigation Project, or 253 households in total. These households will provide the income profile, the progress of land development, the transmigration status, the area of transmigrant origin, and the legal land ownership status.

Regression analysis was used to test the above hypotheses. Net farm income is measured in *Rupiah* per household per year; progress of land reclamation is measured in the cumulative percentage of each farm family's achievement. Land status -- the progress of obtaining individual land title from the Agrarian Agency -- is measured by the percentage of administrative and legal procedure currently completed for each individual ownership concerned.

Past experiences in agricultural practice shows that transmigrant farmers who originate from West Java, Central Java and East Java generally have agricultural experience prior to resettlement and are highly skilled in low-land paddy farming practices, while settlers from other provinces are less skilled. Therefore, a high percentage of land development is expected from these categories of transmigration settlers, followed by the transmigrant farmers who originated from Bali and Nusa Tenggara Barat (NTB). The indigenous settlers, on the other hand, are considered to be the least skillful in agricultural practices compared to the other categories. Some of them are accustomed to farming as "shifting cultivators", and others were not previously engaged in irrigated farming at all.[▷61]

It was also identified that the transmigrants' status is an indicator of settlers' motivation to undertake farming practices. A high percentage of land development is expected from spontaneous transmigrant settlers since these

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61 ▷ *This traditional agricultural practice is often referred to as "slashed-and burned". Which is undertaken by cutting and burning the forest for transplanting short-term crops. The lands are usually abandoned after several crops, which often brings about serious erosion and land deterioration.*

are highly motivated individuals who have migrated on a voluntary basis from different parts of the country. Next follows the general transmigrant, after that other transmigrant categories.

Geographic characteristic of irrigation, which is a dichotomous variable, is also expected to make significant difference in the effect of land development progress. A high percentage of development is expected from irrigated areas in the Luwu region, which is characterized by higher rainfall intensity and is located on a low-land plain adjacent to the coast. Another dichotomous variable is irrigation adequacy at the site. This variable is also expected to produce different characteristics. A high percentage of land development is expected from farm land which has sufficient water available at the field on demand.

In order to consider these issues, the variables are included in the regression analysis as four dummy variables. In accordance with the general procedure of multivariate analysis, a dummy variable is created to represent a nominal variable *(see Blalock, Jr, 1975:498-460)*. The corresponding variable is referred to as *dummy variable* since simple scores of [1] and [0] have been arbitrarily assigned, and they are treated as interval variables in the regression procedure. In the case of dummy variables, one category of the variable should be excluded, because if all dummies that are constructed from a given variable are included, it is likely that the equation will become unsolvable. This is because the [nth] dummy variable is entirely determined by the first [n-1] dummies entered into the equation *(see Halli, 1988:10)*. The excluded category, however, will automatically become a reference category by which to compare the effect of other categories that are evaluated.

In the present analysis, the ethnicity of the respondents consists of five categories: (1) transmigrants from West Java; (2) transmigrant from Central Java; (3) transmigrant from East Java; (4) transmigrant from Bali and NTB, and (5) from other places in Indonesia. The Central Java category is excluded from the equation as the reference category.

Transmigration status consists of five categories: (1) colonization transmigrant; (2) general transmigrant; (3) local transmigrant; (4) spontaneous transmigrant; and (5) other categories. The general transmigrant category is treated as the reference category.

B. Result of Analysis and Discussions

The results of analysis are presented in the following table:

NO	INDEPENDENT VARIABLE	SLOPE	LEVEL OF SIGNIFICANCE	BETA	CODE OF VARIABLE
1	NET OF FAMILY FARM INCOME	0.0000	0.8710	-0.0080	INCOME
2	GENERAL TRANSMIGRANT STATUS	-2.6230	0.6280	-0.0410	TS2
3	LOCAL TRANSMIGRANT STATUS	2.8210	0.6730	0.0300	TS3
4	SPONTANEOUS TRANSMIGRANT	-2.8600	0.5840	0.0480	TS4
5	OTHER MIGRATION STATUS	-3.1130	0.6170	-0.0340	TS5
6	PROGRESS OF LAND OWNERSHIP STATUS	0.6890	0.0000	0.7370	LAND_STA
7	ORIGIN FROM CENTRAL JAVA	7.2560	0.3200	0.1230	RO1
8	ORIGIN FROM EAST JAVA	5.1670	0.4330	0.0720	RO3
9	ORIGIN FROM BALI AND NTB	5.5900	0.5130	0.0480	RO4
10	ORIGIN FROM OTHER AREAS	7.7180	0.3380	0.1120	RO5
11	IRRIGATION SCHEME	-0.0060	0.9980	0.0000	IRSCHEME
12	ADEQUACY OF IRRIGATION WATER	5.9910	0.0270	0.1010	IRRI_ADQ

MULTIPLE R: = 0.7630

ADJUSTED R. SQUARE = 0.5610

Table 8-3. Regression analysis of land development with related variables from the Way Rarem and the Luwu Irrigation Projects

From the above table, 56% of the variance of land development progress is explained by the independent variables. The model is therefore a reasonable.

Surprisingly, net farm income is not a significant factor affecting the progress of land development as indicated by the insignificant coefficient at 0.87 and *beta* at -0.008. This result does not support the assumption with respect to the effect of the level of pecuniary income in promoting land development in particular, and the level of participation in the development process in general.

The transmigration status variables are insignificant in the context of their causal relationship with the progress of land development, as indicated by the level of significance. In other words, the colonization transmigrant, general transmigrant, local transmigrant, and spontaneous transmigrant do not differ in terms of their progress on land development.

The result of this analysis also show no significant relationship between the progress of land development and province of origin of the transmigrant. The dummy variables, that are, origin from West Java, Central Java, East Java, Bali and Lombok, and origin from from other places, result in insignificant coefficients.

The level of significance of irrigation variable indicated that an irrigation scheme, whether it is located in the low-land plain of Luwu region, South Sulawesi Province or located in the high land plain in Lampung Province, do not differ in their progress of land development as indicated by the insignificant coefficient. However, the variables of irrigation adequacy at the site turns out to be significant in the context of their causal relationship with the progress of land development, as indicated by the level of significance at 0.027 and *beta* at 0.101. This result, indicates that adequacy of irrigation water at the site has a significant impact on the level of land development progress. In other words, land development progress differs in terms of irrigation water adequacy at the farm block.

The most striking feature in this analysis is the fact that the land ownership status in terms of assurance of legal titles turns out to be the most significant factor affecting the level of farmers' participation in the land development process. This indication is explained by the level of significance at 0.00 with *beta* coefficient of 0.74. Both imply high significance and a very strong relationship. An explanation for this result lies within the socio-psychological context that the more certain land ownership status -- by means of legal entitlement -- the more the farmers are encouraged to participate in the land development process. This tendency is supported by Cernea (1988) who stated that the resettlement program, by its nature, is always extraordinarily disruptive and painful economically and culturally *(Cernea, 1988:7)*. Therefore, migrants might only feel secure enough if they have a legal ownership of land. It does not seem an exaggeration to consider that legal title means everything for transmigrant farmers, even though it may not be economically or financially viable enough to support their subsistence through time, as suggested by Daroesman:

> ......*"Owing to the fact that in reality it is not always easy to keep a sizable of more than one hectare of land in cultivation, and the fact that the high production costs and low marketing of surplus crops, in most instance, the farmers should pay additional effort to finding outside work to provide cash income." ..... (Daroesman, 1981:86).*

It is therefore quite obvious that the newly resettled transmigrants, dealing with the disruptive, stressful and painful process of resettlement, would perceive legal land title as the most crucial issue, often more so than agricultural production itself. Thus, prior to the issuance of legal land title, farmers may suffer from extraordinary distressing uncertainties, after already making the uncertain decision to join the transmigration program. Unfortunately, the transfer of official land title to transmigrant farmers is time-consuming and involves very complicated procedures. Each land holding must be carefully surveyed, inventorized and clearly marked, physically, administratively, traditionally and legally.

The distribution of land is conducted after the transmigrant arrives at the site. However, due to a number of considerations, land allocation is mostly done prior to issuing legal land ownership certificates. The most common reason for this delay is the underlying difficulties in conducting simultaneous cadasteral surveys for such a large number of individual holdings. A second reason, based upon past experience, is the policy of giving land ownership certificates to transmigrants only after their achieving agricultural productivity, so as not to tempt farmers to sell their land in order to obtain easy money to satisfy both primary and secondary consumer goods -- for instance for buying a motor cycle, transistor radio, television set and other such electronic appliances. There are several documented cases where transmigrants sold their land and returned to their place of origin or to other destinations. Finally, there is the possibility that some irresponsible officers may gain advantage from this delay. This likelihood, however, is subject to further examination.

The most obvious impact of the slow administrational process is that transmigrant farmers may feel they have no assurance of land ownership. Moreover, experience has indicated that land without legal ownership certificates is very susceptible to claim by local speculators after the land had been fully developed. Though the physical boundaries of land can be identified by existing cultivation, without a legal land ownership certificate, the speculator may claim ownership by imposing the traditional boundary through the provision of traditional law. Such claim will bring about a feeling of uncertainty for transmigrants. Moreover, the process of arbitration is time-consuming and fairly complicated. As a result, transmigrant farmers often maintains a *"wait-and-see"* attitude, which leads to apathy or continuous dependency on subsidy assistance from government or charity from other external organizations. The farmer is not willing to take perceived risks if they believe there is some uncertainty to their land status.

Under such complicated circumstances, the government bureaucratic machinery should always maintain consistent, effective, efficient and honest working conditions, especially by simplifying the process of land status assignment. Otherwise, farmers may not wish to participate voluntarily.

8.4.4 OVERALL IMPLICATION OF THE MULTIVARIATE ANALYSIS

The magnitude of land development achievement of the newly established irrigation project under the *Transmigration Settlement Program* is strongly determined by assurance of land ownership status. This assurance is measured by issuance of *official land title* undertaken by the Cadasteral Agency. This issuance is granted after the farmer has shown a serious attempt to cultivate the land.

The transference of land title presents a contradictory and complex situation. On one hand, the land ownership status is fully authorized only after a farmer has shown a certain integrity and active participation in taking care of the land. This check on the farmer guarantees the intention of the farmer to develop the land. On the other hand, this study has shown that land ownership status contributes to a farmer's willingness to accelerate the land development progress. If, transmigrant farmers adopt a "wait-and-see" attitude until land titles have been issued, development does not proceed according to the desired schedule. During this time, the farmer might rely on prolonged subsidies, gifts, and charity from the government, or other external organizations, often leading to chronic dependency. This analysis strongly supports the research hypothesis with regard to the causal relationship of the status of land ownership and the willingness of farmers to perform land development.

There is no evidence in this analysis to support the hypothesis that the income level of farmers contributes to the progress of land development. The ethnicity or province of origin is also insignificant in its effect on the land reclamation progress. Similarly, migration status does not show any significance with the land reclamation.

The effect of regional irrigation characteristics gives insignificant indication with respect to their relationship with the progress of land development. However, the adequacy of irrigation water at the site gives significant support to the research hypothesis with respect to its causal relationship with the progress of land development.

There is an urgent need for the future research to consider the implications of the existing practices and knowledge pertaining to migration circumstances in order to be able to improve future transmigration programs in Indonesia. In addition, transmigration settlement programs shall take into consideration the quickest measures of providing issuance of official land ownership status. This may take place if the bureaucratic machinery of cadasteral land administration expedites deregulation measures to simplify the assignment of individual land titles. Above all, the government bureaucratic machinery should always maintain consistent, effective, efficient and earnest working conditions, especially by simplifying the process of land status assignment. Otherwise, the transmigration farmer may not wish to participate voluntarily.

The background of farming experience should also be taken into account in order to detract the least motivated farmers from settling on irrigated land development areas. This could be done through a rigid selection criteria prior to resettlement. Planners should be reminded that resettlement is not just a simple process as moving people physically, rather, it is a complex socio-cultural and economic process.

CHAPTER NINE

CONCLUSIONS AND RECOMMENDATIONS

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The irrigation-based transmigration program in Indonesia is one of several human resettlement endeavors undertaken in the interest of improving the distribution of human resources in the country. This program is meant to modify population density by settling people from the most densely populated areas into areas with the least population density, thereby contributing at the same time to large scale development of the islands that until now have lagged behind in development.

Previous experience, however, indicates that the transmigration process has met with varying levels of success and that the development of the new agricultural areas often falls short of the expectations. Indeed, the process of converting dry land to irrigated paddy fields often seems to get stuck before the original target is reached. Some of the reasons for this are purely budget related. There are, however, also other reasons both technical and non-technical, that can explain the often disappointing rate of the development.

Successful implementation of a transmigration scheme requires not only good engineering but also a wide range of appropriate and timely socio-economic supports.

Moreover, existing problems in the engineering component can be shown to have serious adverse economic and social consequences for the development while social and economic problems have repercussions on the technical implementation. Measures aimed at solving existing problems and improving conditions thus have technical, economic, and social dimensions. This means that each of the three disciplines: economics, sociology and engineering are involved in the identification of and the solution for the problems. The integration of these disciplines is the basis of this study. The research methodology of the present study employs an inter-disciplinary approach, blending several interconnected study analyses in each of the three disciplines.

The interdisciplinary approach led to the following general conclusions.

The most important conclusion is that current standard design procedure for water supply and distribution systems, as well as operation and maintenance, that is characteristic of newly developed irrigation schemes, will result in a development pattern that tends to achieve on average only about 80% of the total development target within 25 years. Calculated estimates range from 85% to a more common 60%. The basic reason for this is technical: the newly broken land requires up to five times the normal amount of irrigation water so that the distribution system that is designed for normal conditions is greatly inadequate in the critical early years of the project. Social and economic factors, however, also play an important role.

The initial water shortage is seriously aggravated by low irrigation distribution efficiency. This efficiency depends very much on the effectiveness of farmers in managing and operating the system, which deteriorates rapidly when canals and structures are not properly maintained. But the capacities of farmers to participate in operation and maintenance depends very much on their economic condition and on their adaptation to the new living conditions. Thus a sensitivity test indicates that irrigation distribution efficiency strongly affects the rate of progress in land development. A minor change in the magnitude of irrigation efficiency will have a substantial effect on the time it takes for the development to reach its target. A low level of irrigation efficiency may mean that the target will never be reached.

The farmer's ability to undertake land development is also a key factor in the rate at which the target is approached. The sensitivity analysis, however, showed that it is not as critical as irrigation efficiency. The conclusion is that with present design standards, high initial water demand may prevent the development from reaching its target for a long time. The time can be shortened substantially by a heightened irrigation distribution efficiency and, to a lesser degree, by higher participation of farmers in both land development and operation and maintenance.

To find a technical solution to this problem a modification of current design practice was investigated. Increasing the distribution capacity to meet the full initial demand, called simultaneous irrigation implementation, as a means of accelerating new land development, is technically possible but highly unrealistic. This is not only because of water constraints, but also because of the large canal dimensions needed. This is very costly and the canals would subsequently be too large to cope with sedimentation problems under stabilized water demand conditions.

Another way of dealing with the problem is by means of step-by-step development which means that the development is gradually stepped up. This requires a larger canal capacity than for present design conditions but not as large as for the simultaneous development. The implementation time is longer. The more the area is divided into units that are added stepwise, the smaller the required capacity, but the longer the implementation time. An analysis clearly demonstrates that the step-by-step concept increases the rate of development in the first 10 years of irrigation compared to the conventional approach. After 25 years, however, the trends became similar. Detailed optimization procedures are needed to determine the optimum dimensions of the distribution system while maximizing net productivity. This matter is beyond the scope of the present study, it will need to be considered in future research. The point is crucial for the design as well as the implementation of the project and has serious economic and social ramifications.

Since success of the transmigration project depends crucially on farmers's participation in tertiary (farm) level operation and maintenance, the reasons for less than full cooperation have been examined.

It has been observed in this connection that the present policy of free water leads to an attitude of dependency on the government and a lack of interest in efficient water management on the part of farmers. To rectify this, the government is considering imposing a water user fee which should, if possible, pay for the operation and maintenance of the system and promote a more effective use of the available water. A cost analysis was undertaken to determine the "value" of irrigation water which could be charged to farmers.

The study concluded that transmigrant farmers in the study areas are unable to pay user fees that would provide total capital cost recovery. The analysis also concluded that it is possible to hold transmigrant farmers responsible for the recovery of operation and maintenance costs of irrigation facilities; however, farmers with very small land holdings should not be obligated to pay any water charge at all. The imposition of water user fees, however, should be undertaken only in conjunction with a converted effort at increasing productivity in transmigration areas.

The ability of farmers to pay user fees for water as well as their general ability to participate in land development and operation and maintenance of the system depends on their economic position and this is closely related to the size of their land holding.

The study clearly shows that the current 2.0 ha land allocation is inadequate. Since 0.25 ha is needed for the house yard, and 0.75 ha is upland area, only 1.0 ha is available for irrigated farming. The income from this land is barely enough to cover expenses and leaves no room for improvements. Disregarding the impact of "fragmentation" on land ownership in the long run, the analysis suggests that the allocation of irrigated land should be larger than 2.0 ha. Land for house yard and upland area should be added to this. The exact figure, however, should be determined for each project separately and be subject to further study.

The participation of farmers in the development is not only a matter of economics. It is also very much dependent on their adaptation to the new way of life. The degree in which adaptation is achieved can be measured in a number of ways.

The majority of respondents (97%) indicated that they actively participated in social events, in mutual aid, and other activities required by the community. Eighty percent were active participants and 17% only participated occasionally. Only about 3% of the settlers were not participating in social activities in the rural communities for one reason or another.

Ninety three percent of settlers considered the present resettlement area to be their new home and an improvement over their previous living conditions. About 3% of respondents were not better off, and only 1% stated they were unhappy with their present conditions. About 85% stated that they were satisfied, and about 14% were satisfied with reservations. The degree of the settlers' adaptation can also be seen from the present conditions of their houses and living environment. About 85% stated that they had rebuilt their houses to improve the original conditions of houses provided for them when they first arrived in the area. Overall, they lived in a modest rural environment. About 24% live in very simple housing, 37% in moderately simple housing, 32% in moderate housing, and the other 7% in permanent brick housing.

It should be noted, however, that this degree of adaptation was attained after a good many years. In the crucial first years there were many frustrations.

Lack of adequate preparation at the site was the cause of major problems experienced by respondents. About 75% stated that facilities were not completed on-arrival. On average, land allocation was about 64% completed, housing was 58% completed, land clearing 62% completed. In most cases it took a long time before irrigation facilities were available. About 56% of the respondents state that they found the resettlement preparation worse than they anticipated. The other 44% stated that they found the resettlement conditions better than they had anticipated.

Due to the fact that irrigation implementation requires a long time relative to the time required for human mobilization, more often than not, transmigration settlers spend years waiting before they are able to apply irrigation water to their agricultural lands. These conflicting circumstances force the settlers to resort to dry farming prior to irrigation services. Therefore, settlers have to seek other means of employment prior to their full adaptation to irrigated agricultural practices.

An important expectation of the transmigrants was the security of being able to farm their own land. Therefore, they need assurance about land tenure status in the sense that they are guaranteed permanent occupancy of the land without any potential claim from others.

Multivariate analysis was used in the study to test a number of hypotheses regarding the relationship between the progress of land development and a set of specific factors, namely, household income, land ownership status, migration status, geographic location and the adequacy of irrigation water at the field.

A regression analysis indicate that the status of the transmigrant, general, local, spontaneous, and other does not have a statistically significant relationship with the land development progress. Similarly, the region of origin of transmigrants turned out to be insignificant in explaining the progress of land development. However, the adequacy of irrigation facilities in the field is a significant variable in this respect.

The most striking feature of the multivariate analysis is that land ownership status is a most significant factor determining the level of participating in land development. The analysis thus strongly supports the research hypothesis that there is a causal relationship between the status of land ownership and the willingness of farmers to undertake land development. However, there is no evidence in the analysis to support the hypothesis that income levels of farmers contribute to progress in land development. The effect of geographic location also turned out to be statistically insignificant. The research hypothesis that irrigation adequacy at the site is causally related with the progress of land development is supported by the analysis.

There is an urgent need for future research to consider the implications of the existing practices and knowledge pertaining to irrigation based transmigration program. This is particularly in relation with the size of land allocation, method of implementation in relation with irrigation condition for the newly developed agricultural lands. It is is also important to find the solution of design implication of irrigation scheme with respect to the excessive water requirement in the early stage of irrigation development.

In conclusion, however, any attempt to extrapolate the results of analyses in this thesis broadly to other regions in Indonesia should consider carefully the specific condition of the areas. This study covered the limited study area only with some constraints on the quality as well the availability of data. A number of questions remains uncovered about the settlers adaptation to the transmigration scheme, pre-resettlement planning and preparation as well as socio-cultural and technical supports required for the success of the program. It is obvious that more studies are required before generalizations can be drawn.

The following recommendations are suggested for consideration in future programs:

(1) The expected rate of land development for newly established irrigation schemes should be included both in the technical design and in the implementation of a resettlement program. Opportunity for temporary employment must be provided during the initial resettlement phase

because newly broken irrigated land requires time to stabilize and to become fully productive. Maintaining a high level of irrigation distribution efficiency is highly important for successful irrigation implementation. This can only be achieved only with proper operation and maintenance procedures which are dependent on community participation, personnel capability and crop productivity.

It is also essential for farmers to realize that irrigation water provided by the government is not a free commodity. The beneficiaries should, in return, be required to actively participate in maintaining stable and sustainable irrigation water distribution.

While economic justification for providing irrigation water calls for the recovery of capital costs of investments at the earliest possible time, this objective cannot be realized because irrigated farms cannot support the additional cost. Water charges may be desirable but any attempts to impose them should wait until the resettlement phase has reached a stable condition; otherwise, the self-sustainable stage of resettlement will never become a reality.

(2) Better pre-resettlement preparation is needed, firstly, to make prospective participants better aware of what to expect, secondly, to help them adapt to their new environment and responsibilities, and thirdly, to improve his future ability to pay for operation and maintenance of

the project so as to obtain a sustainable irrigated agricultural operation.

(3) Proper land allocation in terms of quality, size, distance to dwellings and ownership status is also very important. Marginalization of land by providing minimum and often inadequate holdings should be avoided. In addition, the impact of land fragmentation over time must also be taken into consideration. Overall, it is important to include in the planning stages all social, cultural, demographic, technical, and environmental aspects, through an interdisciplinary approach. The selection process should also apply criteria that are more conducive to success in agricultural practice and adaptation such as previous farming experience, education, motivation, and willingness to participate, to work hard and to support the program.

(4) It is essential to increase agricultural productivity by improving farming techniques, operation and maintenance of irrigation infrastructures, cropping patterns, rural institutions and a reliably integrated working coordination, post harvest crop maintenance, price stability and a sustainable means of agricultural practice. All this requires not only better preparation prior to resettlement but also follow-up extension programs.

(5) Short comings of irrigation system provided are the most significant factors that hamper progress in farming practices and rate of development. Second in line is the

proper pricing of agricultural products through a suitable market system; this is then followed by agricultural productivity which tend to be low in the initial stages, a secure village environment, better rural financial institutions and better working cooperation at the farm level. These factors have often been overlooked by planners, implementing agencies and policy makers, but must be taken into account in any resettlement program in the future.

Current experience in irrigation development indicates that there must be a command area large enough to economically serve the irrigation requirements and still small enough to be managed efficiently. The question then is "to what extent is the single irrigation command area determined in order that it can be managed effectively?" The answer to this question is also open to future research as it is beyond the scope of the present study.

Although the transmigration program has met with success in terms of total numbers relocated and total increase in agricultural production, it remains a rural development initiative that is questionable in terms of its cost-effectiveness. It requires heavy capital investment, in the form of the new irrigation projects that are needed to make new settlements operational. There is also considerable evidence that the settlers do not always accept or adapt to their new environment and agricultural practice as readily as planners anticipate, or as politicians promise.

Among the different types of resettlement projects under the transmigration program, irrigation based transmigration still has good prospects for the future provided that the lessons of past experience are applied.

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APPENDICES

APPENDIX 5-1

SUMMARY OF CONSIDERATIONS FOR THE SELECTION OF STUDY AREAS FOR FIELD SURVEY

No.	ITEMS TO BE CONSIDERED	SOME SALIENT FEATURES OF THE AREAS FOR COMPARATIVE CONSIDERATION		
		WAY RAREM IRRIGATION PROJECT	LUWU IRRIGATION PROJECT	GENERAL FEATURES OF OTHER SCHEMES
1	GEOGRAPHIC LOCATION	-Located in Lampung Province, souththern Sumatera, with an average condition represents the western part of Indonesia -Easily accessible from Java Island -Located in the Province where the transmigration resettlement was initially implemented (in 1905 as the birth place of transmigration resettlement, but currently closed for new population resettlement)	-Located in the center-east of Sulawesi, with an average condition represents the easteren part of Indonesia. -Remote, not easily accessible. -Located in the province where old and new population resettlement are currently resided. The first resettlement was in 1930's and this area is still opened for the new population resettlement.	-Other schemes are scattered over the country with distinct characteristics for each particular location. -Except some areas in North Sumatera most schemes are relatively new, having diversified resettlement methods such as: swamp, rainfed, other non irrigation resettlement schemes.
2	TRANSMIGRATION PATTERN AND CURRENT POPULATION DISTRIBUTION	-The majority of population are transmigrant from Java, Bali, Lombok and other islands. Some parts are resided by local inhabitants. -The resettlement was implemented as small land holding farmer with irrigation based-agriculture in 1960s. (However, Irrigation sheme was only constructed in 1980s.) -The average resettlement condition are still under the "stabilization phase". -Populatin density at about 200 cap. per km2.	-The majority of population came from Java, but some came from different parts of the country. Some parts are recided by local inhabitants in separate schemes. -Some resettlement were conducted in 1930s, but the new population resettlements are still continuing. -The old resettlers are now under the the "self-generating condition" while the new resettlers varied, ranging between "survival", "stabilization" and "development" phase condition. -Population density about 100 capita per km2.	-Other schemes mostly represent different pattern of population with different phase of resettlement conditions. (For the purpose of case study, there are very view schemes that could be taken to represent irrigation-based transmigration program.) -Population density on the average ranging between 10-300 cap/km2.
3	IRRIGATION CONDITION	-Cultivable Commanded Area (CCA) = 22,000 ha. (A single sheme irrigation project). -Irrigation development phase is still on-going. (About 60% developed). Some parts are still at the at the preparatory stage, others are under development stage. -Soil and climatic conditions for	-Cultivable Commanded Area (CCA) between 5,000 ha to 15,000 ha for each irrigation scheme. -The area consisted of some independent irrigation scheme, some are old established, others are still under construction. -Soil and climatic conditions for	-The average size of technical irrigation scheme, ranges between 5,000 hectare to above 30,000 ha. - Some are established, others are on going, and vast areas are still planned for the future irrigation based resettlement program.

		agricultural purposes, represent the western parts of Indonesia. -Though the area is still under the development stage, there are many developed irrigation schemes near by. (Successful resettlement) -Located between 50 to 150m above mean sea level. -Planted with low-land paddy	agricultural purposes, represent most of the eastern parts of Indonesia. -Different level of development stages of irrigation are available for study purposes. -Located between 5 to 30m above mean sea level. -Planted with low-land paddy	- Not many schemes are available to satisfy the major aspects of study puposes. -Ranging bertween 1 to 200 meters above sea level. -Planted with low-land paddy
4	POPULATION MOBILITY	-Moderately mobile - Some are travelling occasionally to their place of origin and other places.	-Low mobility -Hardly possible to travel -There is an indication that some economically successful resettlers returned permanently to their home land.	-Varies (Mostly low mobility) -Depending upon many aspects, transportation facilities, economic adaptation/condition and degree of satisfaction to settle in the area
5	ADAPTATION WITH LOCAL ENVIRONMENT AND CONDITION	-The majority are seemingly adaptive to the local conditions. -The number that are permanently returning home, relatively small. -They keep practicing the old tradition and less adjustment with the local condition. -Some friction with local people are occured.	-Many of them are fairly successful with new life in the area. -They keep practicing the old tradition, but slowly adjusting and adapting the local condition. -Minor friction with local people.	-The degree of adaptations are varied, depending upon many aspects, local tradition, remoteness of the area, attitude of local people, resettlement methods, etc.

APPENDIX 5-2A

IRRIGATION ADMINSTRATION AND POPULATION DISTRIBUTION OF THE WAY RAREM IRRIGATION PROJECT

SECTION IRRIGATION ADMINISTRATION	BRANCH IRRIGATION ADMINISTRATION (PELAKSANA E & P)	SUB-BRANCH IRRIGATION ADMINISTRATION (PENGAMAT)	INDEPENDENT IRRIGATION SERVICE UNIT (BLOCK): PHYSICAL BLOCK DIVISION (MAIN SYSTEM)	INDEPENDENT IRRIGATION SERVICE UNIT (BLOCK): SERVICE AREA (HA)	NUMBER OF TERTIARY BLOCK (#)	NUMBER OF FARMER (FAMILY)	REMARK
THE WAY RAREM IRRIGATION PROJECT (NORTH LAMPUNG IRRIGATION SECTION) (22,233 HA)	SIDOMUKTI: [4,942 HA]	(1) PROPAU (3,096 HA)	PRIMARY CANAL AREA	874	20	1108	*)-PROPAU I AND II. WITH AN AREA OF 332 AND 137 HA RESPECT-IVELY WERE EXCLUDED IN THE ANALYSIS AS WERE CONSIDERED TO BE OUT LAYERS. (NOT THE ORDINARY TRANS-MIGRANT SETTLERS)
			SECONDARY CANAL BUMI AGUNG	278	7	362	
			SECONDARY CANAL BANGUN SARI I.	238	4	297	
			SECONDARY CANAL SIDOMUKTI I.	877	15	1102	
			SECONDARY CANAL BUMI RESTU	360	11	457	
			SECONDARY CANAL PROPAU I. *)	0	0		
			SECONDARY CANAL PROPAU II. *)	0	0		
			SUB TOTAL	2627	57	3326	
		(2) BUMI RESTU (2,315 HA)	SECONDARY CANAL SIDOMUKTI II.	389	8	489	
			SECONDARY CANAL SIDOMUKTI II-1KA	166	3	207	
			SECONDARY CANAL BUMI RAHARJA	142	3	175	
			SECONDARY CANAL BUMI RESTU 16-KA	696	16	884	
			SECONDARY CANAL BUMI RESTU	922	25	1177	
			SUB TOTAL	2315	55	2932	
	TATA KARYA [5,738 HA]	(1) PANEMANGAN (2,791 HA)	PRIMARY CANAL AREA	1250	17	1571	
			SECONDARY CANAL PANEMANGAN	958	29	1226	
			SECONDARY CANAL PURWODADI	182	2	232	
			SECONDARY CANAL BANGUNSARI 2	246	5	316	
			SECONDARY CANAL NEGERI BATA	155	2	189	
			SUB TOTAL	2791	55	3534	
		(2) PURBA SAKTI (2,947 HA)	PRIMARY CANAL AREA	620	12	779	
			SECONDARY CANAL MAKARTI	232	4	291	
			SECONDARY CANAL PURBASAKTI-6 KI.	190	3	255	
			SECONDARY CANAL DAYA SAKTI	419	6	531	
			SECONDARY CANAL DAYA SAKTI II-KI	322	6	411	
			SECONDARY CANAL PURBASAKTI	964	25	1216	
			SECONDARY CANAL TATAKARYA	193	3	249	
			SUB TOTAL	2947	59	3732	
	MARGO MULYO [5,663 HA]	(1) DAYA MURNI (2,753 HA)	PRIMARY CANAL AREA	173	6	229	
			SECONDARY CANAL DAYA MURNI	228	3	279	
			SECONDARY CANAL MARGO MULYO	648	10	822	
			SECONDARY CANAL CANDRA KENCANA	703	20	903	
			SECONDARY CANAL MARGO MULYO 6-KA	128	4	145	
			SECONDARY CANAL MARGO MULYO 5-KA	260	7	335	
			SECONDARY CANAL MARGO MULYO 3-KA	444	13	545	
			SECONDARY CANAL MARGO MULYO 8-KI	169	3	229	
			SUB TOTAL	2753	66	3487	
		(2) MULYO ASRI (2,910 HA)	SECONDARY CANAL MARGO MULYO	1083	21	1371	
			SECONDARY CANAL MARGO MULYO 10-KI	283	6	344	
			SECONDARY CANAL MULYA ASRI KA-1	798	12	1015	
			SECONDARY CANAL MULYA ASRI KA-2	299	4	385	
			SECONDARY CANAL MULYA ASRI KA-3	447	7	571	
			SUB TOTAL	2910	50	3686	
	PULUNG KENCANA [5,980 HA]	(1) CANDRA KENCANA (2,977 HA)	PRIMARY CANAL AREA	415	10	521	
			SECONDARY CANAL PLG. KENCANA KI-2	187	5	240	
			SECONDARY CANAL PLG. KENCANA KI-1	166	2	205	
			SECONDARY CANAL MULYA KENCANA 8-KI	385	8	492	
			SECONDARY CANAL PULUNG KENCANA KA.	316	5	397	
			SECONDARY CANAL MULYA KENCANA	1508	27	1914	
			SUB TOTAL	2977	57	3769	
		(2) KARTA RAHARJA (2,913 HA)	SECONDARY CANAL KARTA SARI	438	7	549	
			SECONDARY CANAL KARTA RAHARDJA 2-KA	321	9	492	
			SECONDARY CANAL KARTA RAHARDJA	886	23	1132	
			SECONDARY CANAL KAGUNGAN RATU	1268	23	1516	
			SUB TOTAL	2913	62	3689	
			GRAND TOTAL	22233	461	28155	

APPENDIX 5-2B

IRRIGATION ADMINSTRATION AND POPULATION DISTRIBUTION OF THE LUWU IRRIGATION PROJECT

SECTION IRRIGATION ADMINISTRATION	BRANCH IRRIGATION ADMINISTRATION	INDEPENDENT IRRIGATION AREA (PHYSICAL BLOCK)	INDEPENDENT IRRIGATION AREA AREA (HA)	SUB BRANCH IRRIGATION ADMINISTRATION	NUMBER OF TERTIARY BLOCK (#)	IRRIGATION AREA (HA)	IRRIGATION AREA SUB-TOTAL (HA)	POPULATION FARMER (FAMILY)	POPULATION SUB-TOTAL (FAMILY)
SOUTH LUWU (18,580 HA)	BAJO	D.I. BAJO	2637	BAJO	24	2637	2637	1435	1435
		D.I. KOMBA	350	LAROMPONG	12	996	996	745	745
		D.I. MAMARA	270						
		D.I. LARANDUK	376						
	PADANG SAPPA	D.I. PADANG SAPPA	6491	PADANG SAPPA 1	16	1072		923	
				PADANG SAPPA 2	13	1082		862	
				PADANG SAPPA 3	19	1546		1069	
				PADANG SAPPA 4	34	2791	6491	1073	3927
	POMPENGAN	D.I. LAMASI KIRI	4473	POMPENGAN 1	8	815		732	
				POMPENGAN 2	10	1090		1126	
				POMPENGAN 3	11	1097		1235	
				POMPENGAN 4	8	901		837	
				POMPENGAN 5	9	472		398	
				POMPENGAN 6	5	98	4473	207	4535
		D.I. MAKAWA	880	MAKAWA	11	880	880	612	612
	LAMASI KANAN	D.I. LAMASI KANAN	1487	LAMASI KANAN	17	1487	1487	982	
		D.I. PADANG ALIPAN	800	PADANG ALIPAN	7	800	800	525	1507
		D.I. TABANG	273	TANAH TORAJA	6	816	816	675	675
		D.I. NONONGAN	107		3				
		D.I. TO'WAE	231		5				
		D.I. T.SUMULLUK	75		5				
		D.I. WAE DALLE	50		1				
NORTH LUWU (20,719 HA)	BONE-BONE	D.I. BONE-BONE KANAN	1300	BONE-BONE KANAN	17	1300		624	
		D.I. BONE-BONE KIRI	1454	BONE-BONE KIRI	18	1454		703	
		D.I. KANJIRO	1811	KANJIRO	20	1811	4565	948	2275
	WOTU	D.I. KALAENA KANAN	2265	BANDOA	10	1200		796	
				RANTETIKU	8	1065	2265	679	1475
	KALAENA KANAN	D.I. KALAENA KANAN	10127	KALAENA KANAN A	10	1806		775	
				KALAENA KANAN B1	9	1547		601	
		(TOTAL 12.392 HA)		KALAENA KANAN B2	8	1805		559	
				KALAENA KANAN C	12	1564		859	
				KALAENA KANAN D	9	1254		872	
				KALAENA KANAN E	7	698		497	
				KALAENA KANAN F	19	1453	10127	1289	5452
	KALAENA KIRI	D.I. KALAENA KIRI	3762	KALAENA KIRI 1	10	1254		630	
				KALAENA KIRI 2	11	1350		744	
				KALAENA KIRI 3	12	1158	3762	513	1887
		GRAND TOTAL	39299		404	39299	39299	24525	24525

SOURCE: "THE SOUTH AND THE NORTH LUWU IRRIGATION BRANCH OFFICES", DEC. 1991

APPENDIX 5-2C

RANDOM SAMPLING DISTRIBUTION IN THE WAY RAREM PROJECT

SUB-BRANCH IRRIGATION ADMINISTRATION <PENGAMAT>	SERVICE UNIT IRRIGATION ADMINISTRATION <MAIN SYSTEM BLOCK>	TOTAL COMMAND AREA <HA>	NUMBER OF TERTIARY UNIT <#>	RANDOM SAMPLE TERTIARY UNIT: TERTIARY UNIT <#>	COMMAND AREA <HA>	NUMBER OF FARMER <FAMILY>	NUMBER OF SAMPLE <FAMILY>	REMARK
PROPAU <3,096 HA>	PRIMARY CANAL	874	20	BR4-KI	11	10	5	* NUMBER OF RESPONDENTS ARE DETERMINED PROPORTIONAL WITH THE IRRIGATION AREA SERVED BY THE INDIVIDUAL BLOCK IN THE MAIN SYSTEM.
	BUMI AGUNG	278	7	BDa 3-KI	42	34	1	
	BANGUN SARI I.	238	4	BBS1-2KI	160	144	1	
	SIDO MUKTI I.	877	15	BS1-7KA	28	23	5	
	BUMI RESTU I	360	11	BBr8-KI	28	25	2	
	SUB TOTAL	2627	57		269	236	14	
BUMI RESTU <2,315 HA>	SIDO MUKTI II	389	8	BS2-2KA	70	59	2	* THE TERTIARY BLOCK IN WHICH THE RESPONDENT HOUSEHOLDS ARE TAKEN, IS DRAWN ON SIMPLE RANDOM SAMPLING AMONG THE TERTIARY IRRIGATION UNITS BELONG TO EACH INDEPENDENT UNIT IN THE MAIN SYSTEM.
	SIDO MUKTI II-1KA	166	3	BS2-1KA1.TG	98	91	1	
	BUMI RAHARDJA	142	3	BBRa1-KA	31	25	1	
	BUMI RESTU 16-KA	696	16	BBr16Ka-7KA	104	98	4	
	BUMI RESTU II	922	25	BBr8-KI	62	47	5	
	SUB TOTAL	2315	55		365	320	13	
PANEMANGAN <2,791 HA>	PRIMARY CANAL	1250	17	BR18.KI-KI	51	43	6	
	PANEMANGAN	958	29	BPm13-KA	21	22	5	
	PUNODADI	182	2	BPd1-TG	143	125	1	* THE HOUSEHOLD RESPONDENTS ARE DETERMINED ON SIMPLE RANDOM SAMPLING USING THE LIST OF FARMERS THAT ARE AVAILABLE IN EACH TERTIARY BLOCK.
	BANGUNSARI 2	246	5	BBs2-3KA	93	82	1	
	NEGERI BATA	155	2	BNb2-KA	55	46	1	
	SUB TOTAL	2791	55		363	318	14	
PURBA SAKTI <2,947 HA>	PRIMARY CANAL	620	12	BR22.KI-KI	41	32	4	
	MAKARTI	232	4	MI1-KA	59	51	1	
	PURBA SAKTI 6-KI	198	3	BPs-6K13-KI	14	13	1	
	DAYA SAKTI	418	6	BDS4-KA	130	121	2	
	DAYA SAKTI II-KI	322	6	BDS2KI1-KI	7	6	2	
	PURBA SAKTI	964	25	BPS7-KA	127	109	6	
	TATA KARYA	193	3	BTK1-2KI	70	61	1	
	SUB TOTAL	2947	59		448	393	17	
DAYA MURNI <2,753 HA>	PRIMARY CANAL	173	6	BR29-KI	6	6	1	
	DAYA MURNI	228	3	BDM1-TGH	109	96	1	
	MARGO MULYO I	648	10	BMM1-KA	70	61	3	
	CANDRA KENCANA	703	20	BCK2-KI	48	41	4	
	MARGO MULYO 6-KA	128	4	BMM6Ka-2KA	63	54	1	
	MARGO MULYO 5-KA	260	7	BMM5KA-2KI	20	18	2	
	MARGO MULYO 9-KA	444	13	BMM9KA-2KI	44	39	2	
	MARGO MULYO 8-KI	169	3	BMM8KI-1KI	9	8	1	
	SUB TOTAL	2753	66		369	323	15	
MULYA ASRI <2,910 HA>	MARGO MULYO II	1083	21	BMM12-KI	17	15	6	
	MARGO MULYO 10-KI	283	6	BMM10Ki-1KI	42	35	2	
	MULYA ASRI KA-1	798	12	BMM15-KI	28	27	4	
	MULYA ASRI KA-2	299	4	BMa.Ka2-2KA	31	28	2	
	MULYA ASRI KA-3	447	7	BMa.Ka3-1KI	113	96	2	
	SUB TOTAL	2910	50		231	201	16	
CANDRA KENCANA <2,977 HA>	PRIMARY CANAL	415	10	BR33-KA	45	37	2	
	PULUNG KENCANA KI-2	187	5	BPKK12-1KI	14	13	1	
	PULUNG KENCANA KI-1	166	2	BPKK11-KA	29	26	1	
	MULYA KENCANA 8-KI	385	8	BMK8Ki1-KI	24	19	2	
	MULYA KENCANA KA.	316	5	BPKKa1-KI	22	17	2	
	MULYA KENCANA	1508	27	BMK1-KA	203	184	8	
	SUB TOTAL	2977	57		337	296	16	
KARTA RAHARJA <2,913 HA>	KARTA SARI	438	7	BKS5-KA	110	93	2	
	KARTA RAHARJA 2-KA	321	9	BKR2.KA3-KA	162	148	2	
	KARTA RAHARJA	886	23	BKR3-KA	61	54	5	
	KAGUNGAN RATU	1268	23	BKGR1-KI	54	44	7	
	SUB TOTAL	2913	62		307	339	16	
	GRAND TOTAL	22233	461		2769	2426	121	

APPENDIX 5-2D

RANDOM SAMPLING DISTRIBUTION IN THE LAMASI KIRI, LUWU PROJECT

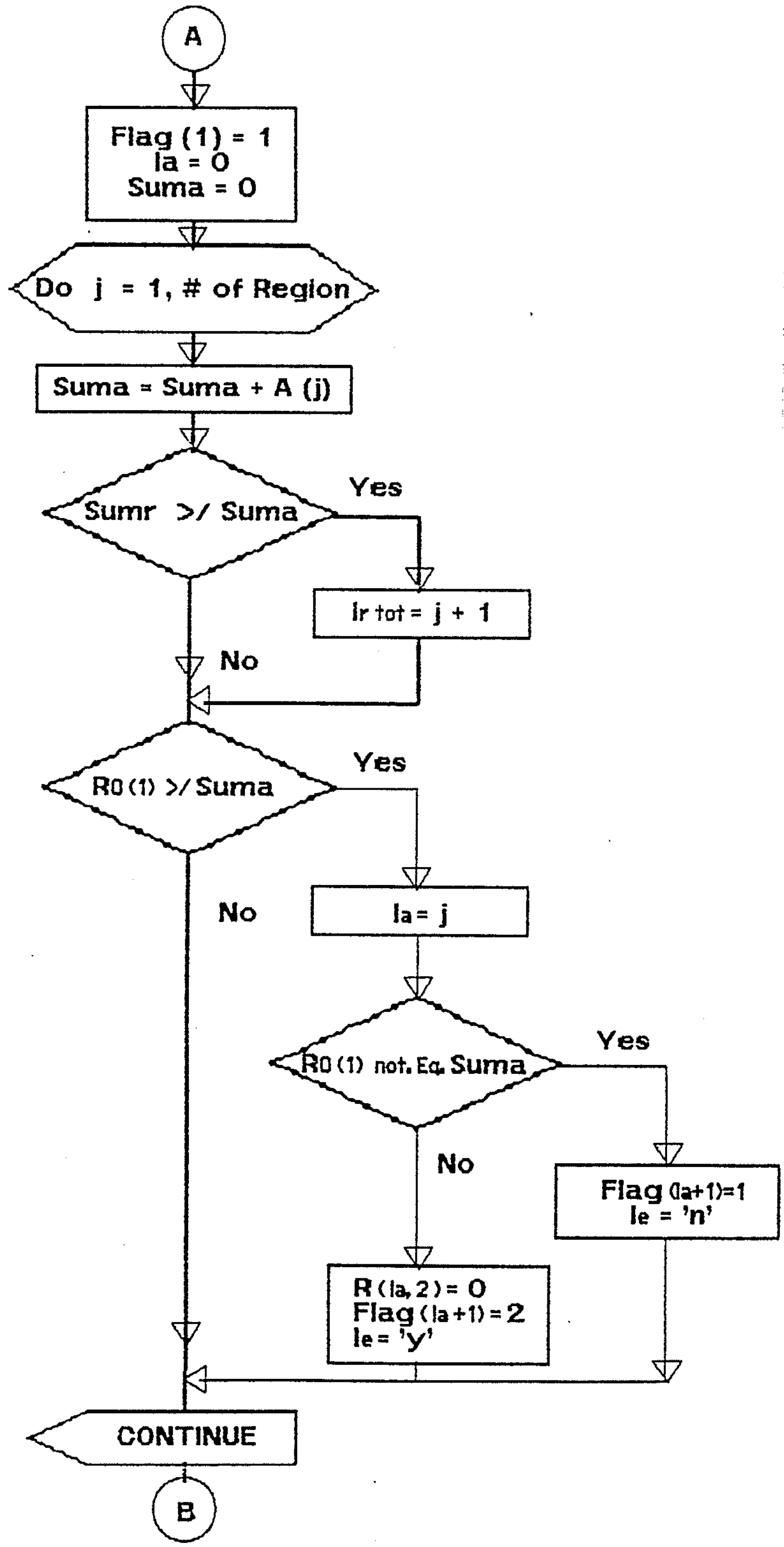
SUB RANTING IRRIGATION ADMINISTRATION (BRANCH UNIT)	TOTAL COMMAND AREA (HA)	NUMBER OF TERTIARY UNIT (#)	RANDOM SAMPLE TERTIARY UNIT				REMARK
			TERTIARY UNIT (#)	COMMAND AREA (HA)	NUMBER OF FARMER (FAMILY)	NUMBER OF SAMPLE (FAMILY)	
POMPENGAN I.	815	8	P.4.	115	186	11	
POMPENGAN II.	1090	10	S1.3	156	196	15	
POMPENGAN III.	1097	11	P.10	96	154	15	
POMPENGAN IV.	901	8	P.12	126	303	12	
POMPENGAN V.	472	9	SI.2.KI	88	86	7	
POMPENGAN VI.	98	5	R.1	43	100	2	
TOTAL	4473	51		624	1025	62	

APPENDIX 5-2E

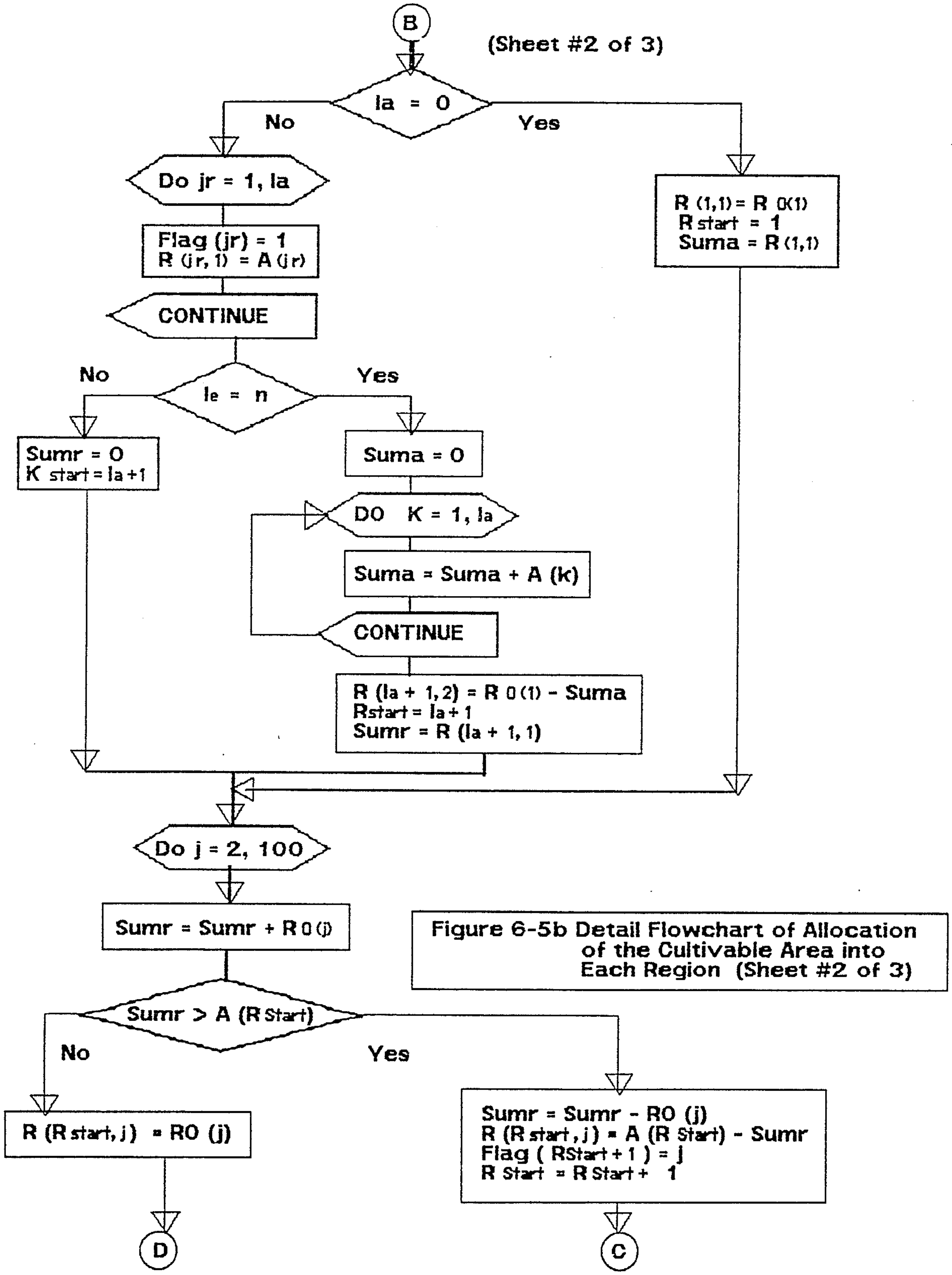
RANDOM SAMPLING DISTRIBUTION IN THE KALAENA KANAN, LUWU PROJECT

SUB RANTING IRRIGATION ADMINISTRATION (BRANCH UNIT)	TOTAL COMMAND AREA (HA)	NUMBER OF TERTIARY UNIT (#)	RANDOM SAMPLE TERTIARY UNIT				REMARK
			TERTIARY UNIT (#)	COMMAND AREA (HA)	NUMBER OF FARMER (FAMILY)	NUMBER OF SAMPLE (FAMILY)	
KALAENA A.	1806	10	K.9.KA.	99	136	10	
KALAENA B.1.	1547	9	PS.2.	111	138	9	
KALAENA B.2.	1805	8	BMS2.KA	156	184	10	
KALAENA C.	1564	12	K.KI.4.	146	159	9	
KALAENA D.	1254	9	K12.KI.	162	183	7	
KALAENA E. + F. BANDOA, AND RANTETIKU= 2265HA	4416	26	BK18.KI.1 BK23.	153 128	189 168	25	BANDOA = 1200 HA RANTETIKU= 1065HA
TOTAL	12392	74		827	1157	70	

APPENDIX 6-1

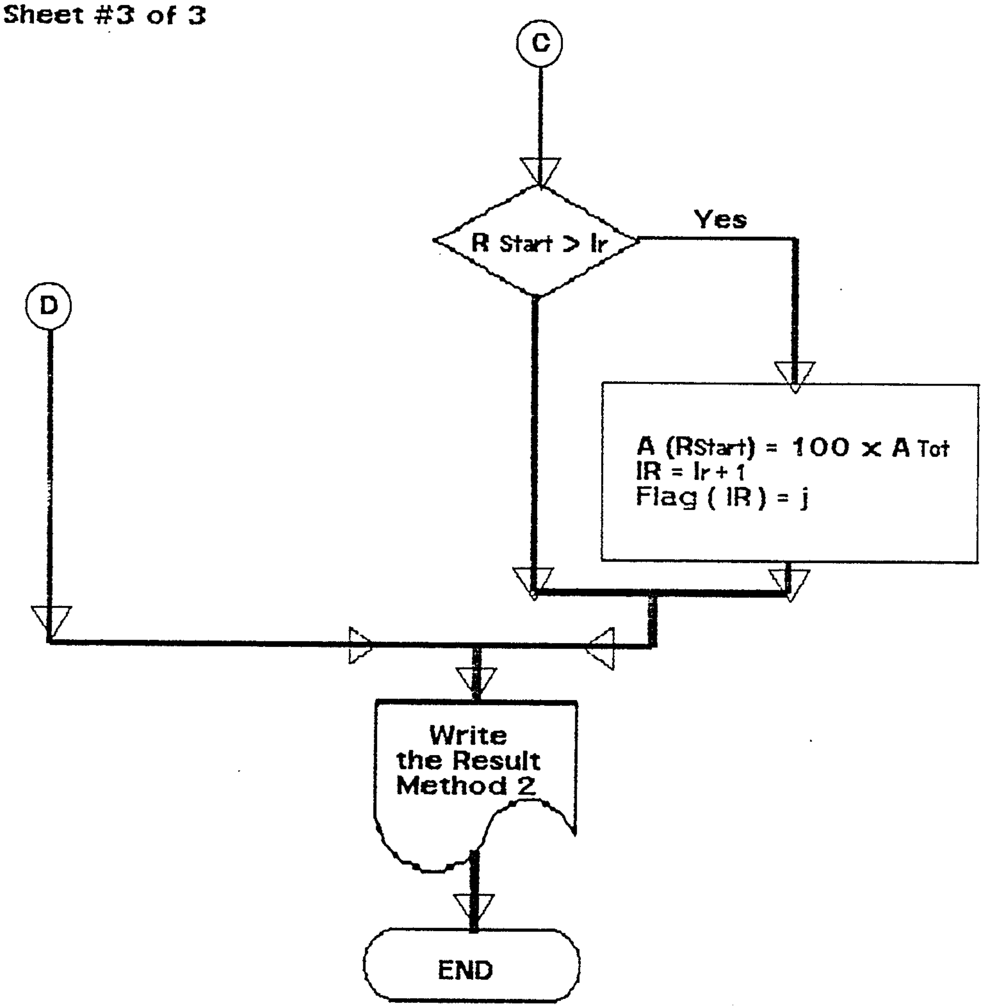


DETAILED FLOWCHART OF ALLOCATION OF THE CULTIVABLE AREA INTO EACH REGION (SHEET #1 OF 3)



DETAILED FLOWCHART OF ALLOCATION OF THE CULTIVABLE AREA INTO EACH REGION (SHEET #2 OF 3)

Sheet #3 of 3



DETAILED FLOWCHART OF ALLOCATION OF THE CULTIVABLE AREA INTO EACH REGION (SHEET #3 OF 3)

APPENDIX 6-4

COMPUTER PROGRAM OF THE SIMULATION MODEL TO DETERMINE ACTUALUTILIZATION OF A PROJECT

```
WATFOR-77 V3.1 Copyright WATCOM Systems Inc. 1984,1989  91/08/11 18:21:30

Options: list,disk,warnings,exe,xtype,terminal,check,arraycheck

C-----------------------------------------------------------------------
C
C
C
C
C-----------------------------------------------------------------------
C234567
      DIMENSION PORT(20),A(20),Qm(100),R0(100),R1(100),R(20,100),Qn(100)
      INTEGER FLAG(21),Rstart
      CHARACTER Ie
      write(6,5)
 5    format(5x,'Value of ALPHA : ',$)
      read(5,6)Alpha
 6    format(f5.3)
      write(6,7)
 7    format(5x,'Value of BETA  : ',$)
      read(5,8)Beta
 8    format(f5.3)
      write(6,9)
 9    format(5x,'Total Area of the System ( ha ) : ',$)
      read(5,10)Atot
 10   format(f10.3)
      write(6,11)
 11   format(5x,'Number of Region in the System : ',$)
      read(5,12)Ir
 12   format(i3)
      write(6,13)
 13   format(5x,'Number of Ordinates in Unit Requirement :',$)
      read(5,12)Iq
 15   write(6,16)
 16   format(/,5x,'INPUT EACH AREA OF A REGION ( % ) ',/)
      sump=0.
      do 30 i=1,Ir
         write(6,20)i
 20      format(5x,'Percentage area of Region : ( ',i3,' ) : ',$)
         read(5,25) Port(i)
 25      format(f5.2)
         sump=sump+Port(i)
 30   continue
      if (sump .gt. 100 ) then
         write(6,35)
 35      format(5x,'The Total Percentage Area is Too LARGE !',/)
         go to 15
      else if (sump .lt. 100 ) then
         write(6,40)
 40      format(5x,'The Total Percentage Area is Too SMALL !',/)
         go to 15
      end if
      do 50 i=1,Ir
         A(i)=Port(i)*Atot/100.
 50   continue

      write(6,60)
 60   format(/,5x,'INPUT THE ORDINATES OF UNIT REQUIREMENT ',/)
      do 80 i=1,Iq
```

```
            write(6,70)i
 70         format(5x,'Unit Requirement (l/sec/ha) at Year ( ',i3,' ) :',$)
            read(6,75)Qm(i)
 75         format(f5.2)
 80      continue
         do 100 i=Iq+1,100
            Qm(i)=Qm(Iq)
 100     continue
         write(6,102)
 102     format(/,5x,'How Many Year is Variation of Design Discharge :',$)
         read(5,12) Iqn
         do 170 j=1,Iqn
            write(6,110)j
 110        format(5x,'Design Discharge, Qn ( ',i4,' ) in m^3/sec. : ',$)
            read(5,120) Qn(j)
 120        format(f10.4)
 170     continue
         do k=Iqn+1,100
            Qn(k)=Qn(Iqn)
         end do
         do I=1,Ir+1
            do k=1,100
               R(I,k)=0.
            end do
         end do
         RO(1)=Beta*Alpha*(Qn(1)*1000.)/Qm(1)
         do 300 i=2,100
            sumrq=0.
            do 200 j=1,i-1
               sumrq=sumrq+RO(j)*Qm(i-j+1)
 200        continue
            RO(i)=Beta*(Alpha*Qn(i)*1000.-sumrq)/Qm(1)
 300     continue
         open(unit=2,file='c:\watfor\dev#3.out', access='append')
         write(2,555) Alpha, Beta, Atot, Ir, Iq
 555     format(//,5x,'                ALPHA =      ',f5.3,/,
        a             5x,'                 BETA =      ',f5.3,/,
        c             5x,'           TOTAL AREA = ',f10.4 ,' ha ',/,
        d             5x,' NUMBER OF REGION =  ',i4,/,
        e             5x,' ORDINATES of qm   =  ',i4)
         write(2,556)
 556     format(/,5x,'-----------------------------------------------------------
        +----',/,
        g5x,' YEAR UNIT-REQT. DESIGN Q           CULTIVABLE AREA          ',/,
        g5x,'                                  Ri         Sigma Ri          ',/,
        h5x,'           l/s/ha      m3/sec          ha            ha          %  ',/,
        i5x,'-----------------------------------------------------------')
         sumr=0.
         do 700 i=1,100
            R1(i)=RO(i)
            sumr=sumr+RO(i)
            write(2,560)i,qm(i),qn(i),RO(i),sumr,100.*sumr/Atot
 560        format(5x,i5,2x,f7.2,2x,f10.2,2x,f10.4,2x,f11.3,1x,f7.2)
 700     continue

         do 380 k=1, Ir
 380        flag(k) = 0.
         flag(1)=1
         Ia=0
         suma=0.
```

```
do j=1,Ir
   suma=suma+A(j)
   if(sumr .ge. suma) then
      Irtot=j+1
   end if
   if(RO(1) .ge. suma) then
      Ia=j
      if(RO(1) .ne. suma ) then
         flag(Ia+1)=1
         Ie='n'
      else
         R(Ia,2)=0.
         flag(Ia+1)=2
         Ie='y'
      end if
   end if
end do
if(Ia .eq. 0 ) then
   R(1,1)=RO(1)
   Rstart=1
   sumr=R(1,1)
else
   do jr=1,Ia
      flag(jr)=1
      R(jr,1)=a(jr)
   end do
   if(Ie .eq. 'n' ) then
      suma=0.
      do k=1,Ia
         suma=suma+A(k)
      end do
      R(Ia+1,1)=RO(1)-suma
      Rstart=Ia+1
      sumr=R(Ia+1,1)
   else
      sumr=0.
      Rstart=Ia+1
   end if
end if
do j=2,100
   sumr=sumr+RO(j)
   if(sumr .gt. A(Rstart) ) then
      sumr=sumr-RO(j)
      R(Rstart,j)=A(Rstart)-sumr
      R(Rstart+1,j)=sumr+RO(j)-A(Rstart)
      flag(Rstart+1)=j
      Rstart=Rstart+1
      if(Rstart .gt. Ir ) then
         A(Rstart)=100.*Atot
         Ir=Ir+1
         flag(Ir)=j
      end if
      sumr=R(Rstart,j)
   else
      R(Rstart,j)=RO(j)
   end if
   write(*,*)j,Rstart,A(Rstart),RO(j),sumr
end do
flag(Irtot+1)=100
flag(Ir+1)=100
```

```
          do k=1,Ir+1
             write(*,*) k, flag(k)
          end do

          write(2,555) Alpha, Beta, Atot, Ir, Iq
          write(2,800)
    800   format(/,5x,' REGION YEAR      Qn        R(REG.,YEAR)      CUMM. R
         +       ',/,
         a5x,'                    m3/sec            ha               ha        %  ',/,
         b5x,'-----------------------------------------------------------------')
          cumr=0.
          do 900 i=1,Ir
             do 880 iy=flag(i),flag(i+1)
                cumr=cumr+R(i,iy)
                write(2,820)i,iy,Qn(iy),R(i,iy),cumr,100*cumr/Atot
    820         format(7x,i4,2x,i4,2x,f10.3,2x,f10.3,2x,f12.3,2x,f7.2)
    880      continue
             write(2,890)
    890      format(/)
    900   continue

          END
```

```
Compile time:                        02.47  Execution time:             00.00
Size of object code:                 4740   Number of extensions:          18
Size of local data area(s):           659   Number of warnings:             0
Size of global data area:            9845   Number of errors:               0
Object/Dynamic bytes free:   331248/47738   Statements Executed:            0
```

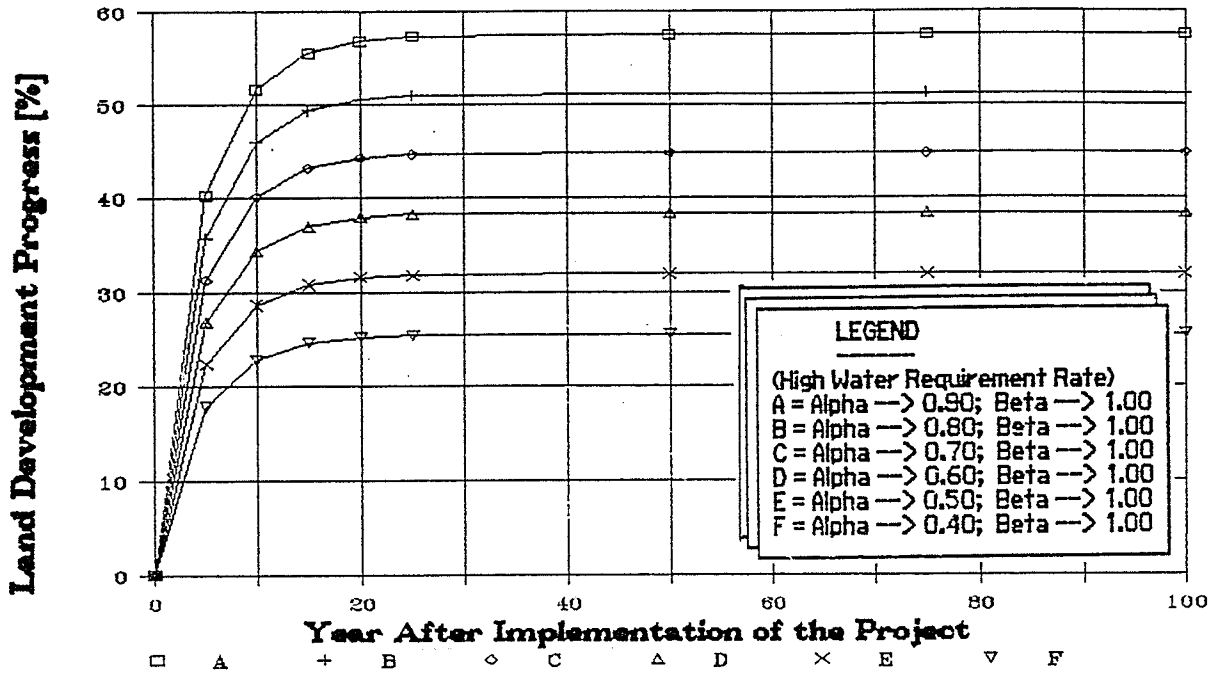
APPENDIX 6-5A

SUMMARY OF LAND DEVELOPMENT ANALYSIS FOR THE WAY RAREM SCHEME

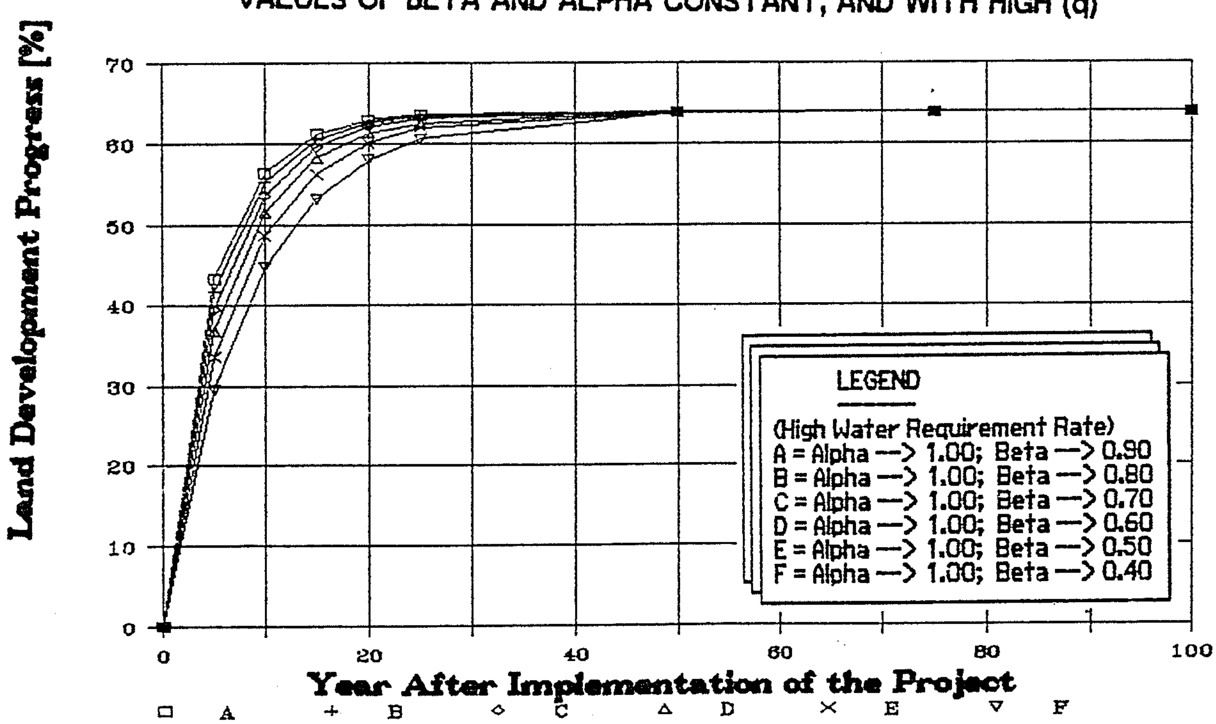
NO.	UNIT OF WATER REQUIREMENT OF THE NEW LAND	COEFFICIENT		LAND RECLAMATION PROGRESS IN (I)TH YEAR, (% OF TOTAL IRRIGATION AREA)								REMARK
		ALPHA	BETA	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	YEAR 50	YEAR 75	YEAR 100	
I	HIGH TREND											TOTAL IRRIGABLE AREA = 22,233 HA
1.1		1.00	1.00	44.79	57.43	61.74	63.23	63.74	64.01	64.01	64.01	
	q(1) = 4.37 l/s/ha											AREA 1 = 4,942 HA
1.2		0.90	1.00	40.31	51.69	55.56	56.90	57.36	57.61	57.61	57.61	
1.3	q(2) = 3.43 l/s/ha	0.80	1.00	35.83	45.94	49.39	50.58	50.99	51.20	51.21	51.21	AREA 2 = 5,738 HA
1.4		0.70	1.00	31.35	40.20	43.22	44.26	44.62	44.80	44.81	44.81	
1.5	q(3) = 2.50 l/s/ha	0.60	1.00	26.88	34.46	37.04	37.94	38.28	38.40	38.40	38.40	AREA 3 = 5,663 HA
1.6		0.50	1.00	22.40	28.72	30.87	31.61	31.87	32.00	32.00	32.00	
1.7	q(4) = 1.56 l/s/ha	0.40	1.00	17.92	22.97	24.70	25.29	25.50	25.60	25.60	25.60	AREA 4 = 5,890 HA
1.8		1.00	0.90	43.39	56.48	61.26	63.00	63.64	64.01	64.01	64.01	PERCENT OF TOTAL
1.9	Q = 22.200 M3/Sec.	1.00	0.80	41.64	55.27	60.60	62.68	63.49	64.00	64.01	64.01	
1.10		1.00	0.70	39.49	53.68	59.67	62.19	63.24	64.00	64.01	64.01	AREA 1 = 22.23 %
1.11		1.00	0.60	36.84	51.58	58.33	61.41	62.62	63.98	64.01	64.01	
1.12		1.00	0.50	33.59	48.72	56.33	60.15	62.07	63.95	64.01	64.01	AREA 2 = 25.81 %
1.13		1.00	0.40	29.56	44.74	53.24	57.93	60.64	63.82	64.00	64.01	
1.14		0.87	0.72	34.76	47.01	52.10	54.20	55.07	56.68	55.69	55.69	AREA 3 = 25.47 %
1.15		0.85	0.85	36.18	47.52	51.81	53.43	54.04	54.40	54.41	54.41	
1.16		0.75	0.75	30.46	40.90	45.13	46.84	47.54	48.00	48.01	48.01	AREA 4 = 26.49 %
1.17		0.85	0.75	34.53	46.53	51.15	53.09	53.87	54.40	54.41	54.41	
1.18		0.75	0.85	31.92	41.93	45.72	47.14	47.68	48.00	48.01	48.01	
II	MEDIUM TREND											TOTAL IRRIGABLE AREA = 22,233 HA
2.1		1.00	1.00	54.16	76.80	87.93	93.45	96.18	98.78	98.86	98.86	
	q(1) = 4.04 l/s/ha											AREA 1 = 4,942 HA
2.2		0.90	1.00	48.75	69.12	79.14	84.10	86.56	88.90	88.97	88.98	
2.3	q(2) = 3.03 l/s/ha	0.80	1.00	43.33	61.44	70.34	74.76	76.95	79.03	79.09	79.09	AREA 2 = 5,738 HA
2.4		0.70	1.00	37.91	53.76	61.55	65.41	67.33	69.15	69.20	69.20	
2.5	q(3) = 2.02 l/s/ha	0.60	1.00	32.50	46.08	52.76	56.07	57.71	59.27	59.32	59.32	AREA 3 = 5,663 HA
2.6		0.50	1.00	27.08	38.40	43.96	46.72	48.09	49.39	49.43	49.43	
2.7	q(4) = 1.01 l/s/ha	0.40	1.00	21.66	30.72	35.17	37.38	38.47	39.51	39.54	39.55	AREA 4 = 5,890 HA
2.8		1.00	0.90	52.06	74.79	86.48	92.49	95.58	98.74	98.86	98.86	PERCENT OF TOTAL
2.9	Q = 22.200 M3/Sec.	1.00	0.80	49.54	72.36	84.63	91.23	94.76	98.68	98.85	98.86	
2.10		1.00	0.70	46.54	69.37	82.25	89.51	93.60	98.56	98.85	98.86	AREA 1 = 22.23 %
2.11		1.00	0.60	42.99	65.63	79.11	87.13	91.89	98.35	98.82	98.86	
2.12		1.00	0.50	38.77	60.88	74.87	83.71	89.29	97.90	98.77	98.85	AREA 2 = 25.81 %
2.13		1.00	0.40	33.71	54.74	68.99	78.63	85.16	96.91	98.59	98.82	
2.14		0.87	0.72	41.05	60.92	72.02	78.21	81.66	85.78	86.00	86.01	AREA 3 = 25.47 %
2.15		0.85	0.85	43.23	62.59	72.77	78.12	80.93	83.91	84.03	84.03	
2.16		0.75	0.75	36.08	53.21	62.64	67.83	70.67	73.97	74.14	74.15	AREA 4 = 26.49 %
2.17		0.85	0.75	40.89	60.30	71.00	76.87	80.10	83.84	84.02	84.03	
2.18		0.75	0.85	38.14	53.23	64.21	68.93	71.74	74.04	74.14	74.15	
III	LOW TREND											TOTAL IRRIGABLE AREA = 22,233 HA
3.1		1.00	1.00	69.81	89.66	96.36	98.66	99.44	99.85	99.85	99.85	
	q12) = 2.62 l/s/ha											AREA 1 = 4,942 HA
3.2		0.90	1.00	62.83	80.69	86.72	88.79	89.50	89.86	89.87	89.87	
3.3	q(2) = 2.49 l/s/ha	0.80	1.00	55.85	71.73	77.09	78.92	79.55	79.88	79.88	79.88	AREA 2 = 5,738 HA
3.4		0.70	1.00	48.87	62.76	67.45	69.06	69.61	69.89	69.90	69.90	
3.5	q(3) = 1.47 l/s/ha	0.60	1.00	41.89	53.79	57.82	59.19	59.66	59.91	59.91	59.91	AREA 3 = 5,663 HA
3.6		0.50	1.00	34.91	44.83	48.18	49.33	49.72	49.92	49.93	49.93	
3.7	q(4) = 1.00 l/s/ha	0.40	1.00	27.92	35.86	38.54	39.46	39.78	39.94	39.94	39.94	AREA 4 = 5,890 HA
3.8		1.00	0.90	67.70	88.29	95.66	98.33	99.30	99.85	99.85	99.85	PERCENT OF TOTAL
3.9	Q = 22.200 M3/Sec.	1.00	0.80	65.18	86.53	94.71	97.87	99.09	99.85	99.85	99.85	
3.10		1.00	0.70	61.53	83.47	92.54	96.30	97.85	98.94	98.95	98.95	AREA 1 = 22.23 %
3.11		1.00	0.60	58.23	81.16	91.45	96.08	98.16	99.82	99.85	99.85	
3.12		1.00	0.50	53.40	76.95	88.56	94.29	97.11	99.77	99.85	99.85	AREA 2 = 25.81 %
3.13		1.00	0.40	43.38	71.13	84.13	91.25	95.14	99.62	99.84	99.85	
3.14		0.87	0.72	54.60	73.73	81.51	84.68	85.98	86.86	86.87	86.87	AREA 3 = 25.47 %
3.15		0.85	0.85	56.53	74.35	80.94	83.41	84.33	84.87	84.87	84.87	
3.16		0.75	0.75	47.79	64.09	70.58	73.17	74.20	74.88	74.89	74.89	AREA 4 = 26.49 %
3.17		0.85	0.75	54.16	72.64	79.99	82.92	84.09	84.87	84.87	84.87	
3.18		0.75	0.85	49.88	65.60	71.42	73.59	74.40	74.89	74.89	74.89	

APPENDIX 6-5B

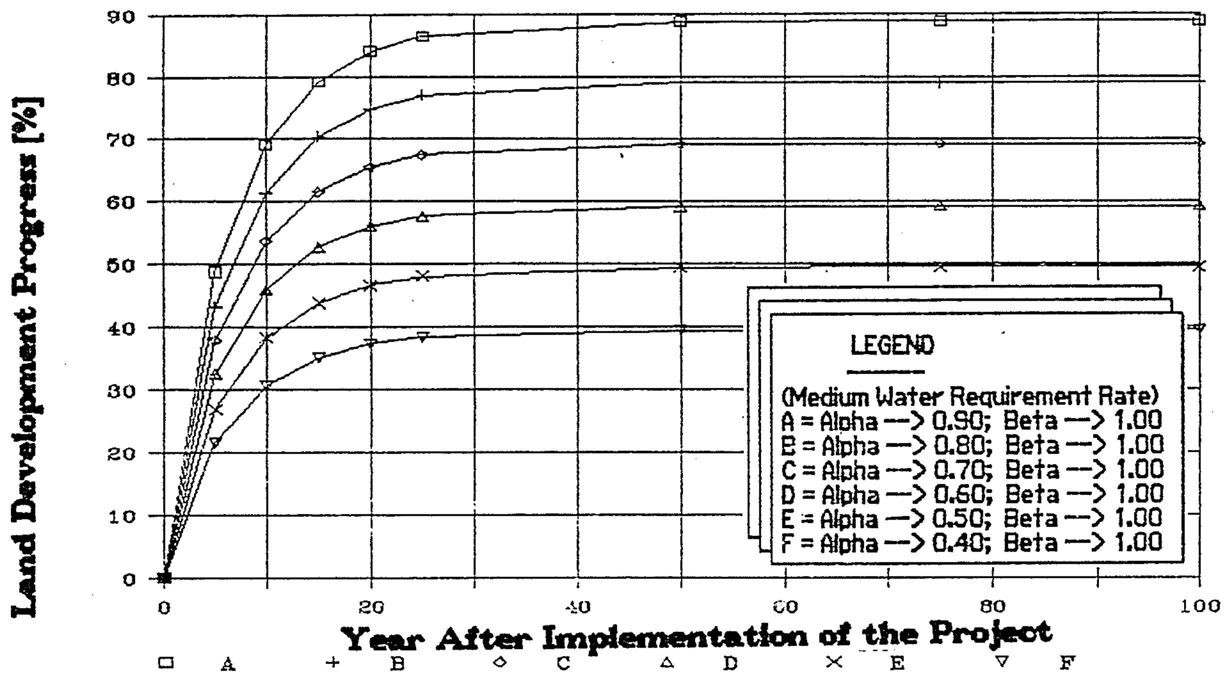
LAND DEVELOPMENT TRENDS OF WAY RAREM BY VARYING VALUES OF ALPHA AND CONSTANT BETA, AND WITH HIGH (q),



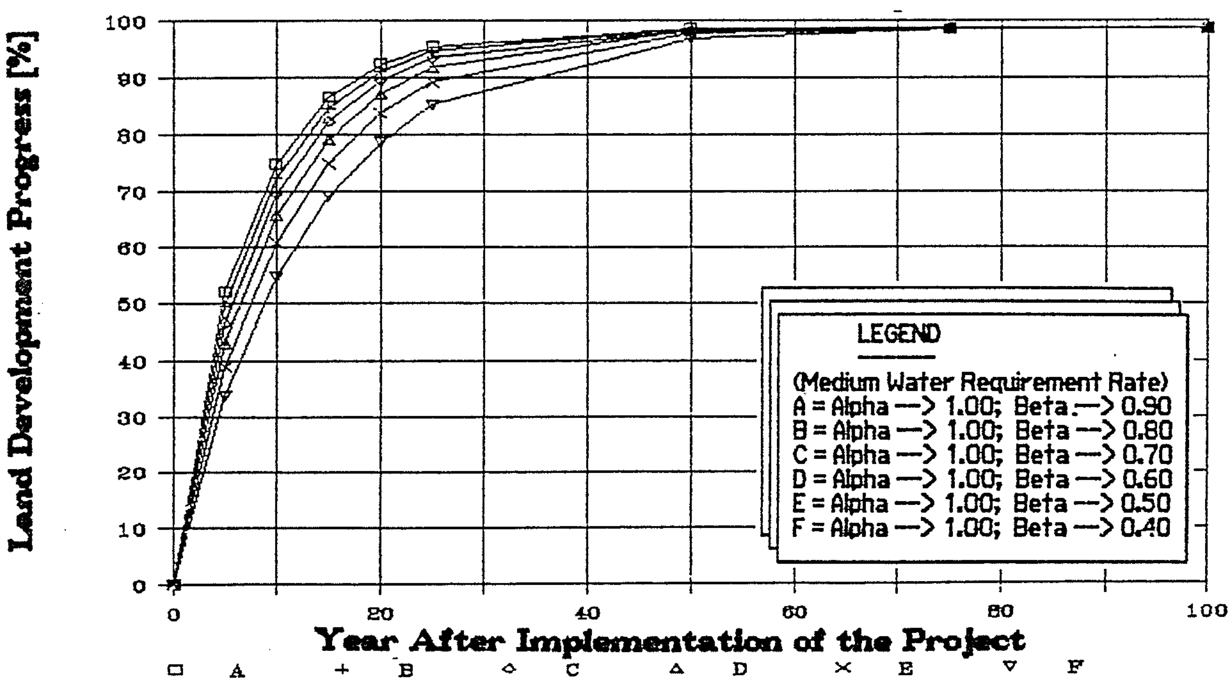
LAND DEVELOPMENT TRENDS OF WAY RAREM BY VARYING THE VALUES OF BETA AND ALPHA CONSTANT, AND WITH HIGH (q)



LAND DEVELOPMENT TRENDS OF WAY RAREM BY VARYING THE VALUES OF ALPHA AND BETA CONSTANT, AND WITH MEDIUM (q)

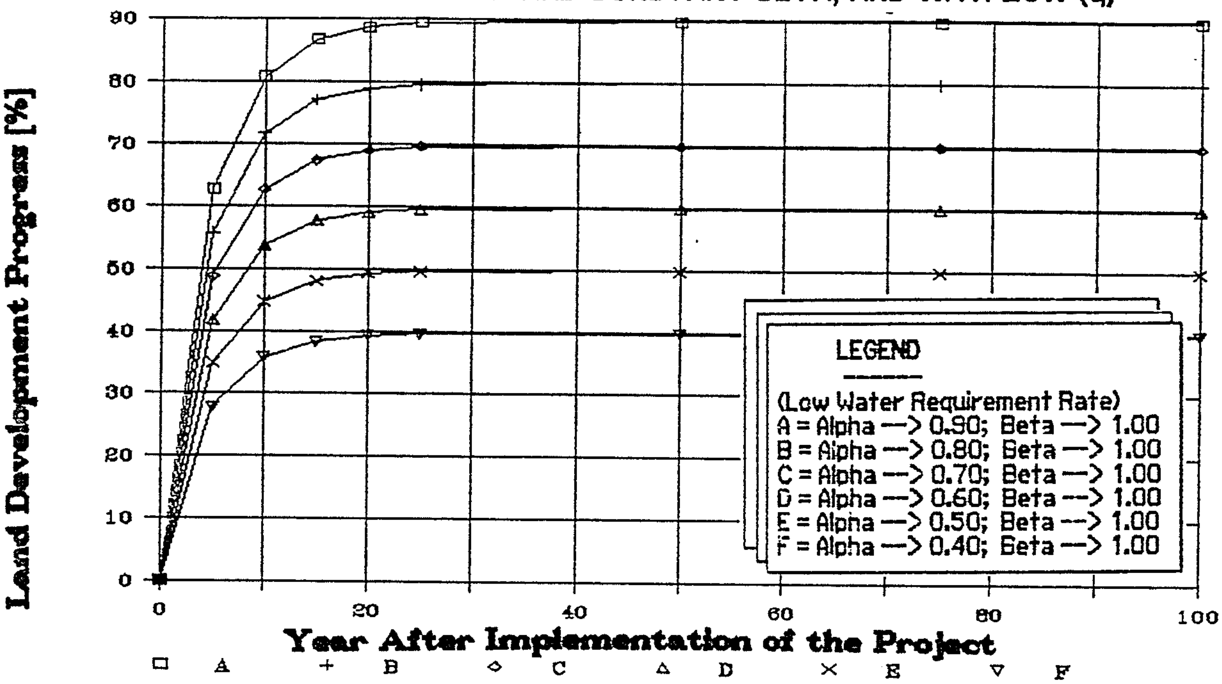


LAND DEVELOPMENT TRENDS OF WAY RAREM BY VARYING THE VALUES OF BETA AND ALPHA CONSTANT, AND WITH MEDIUM (q)

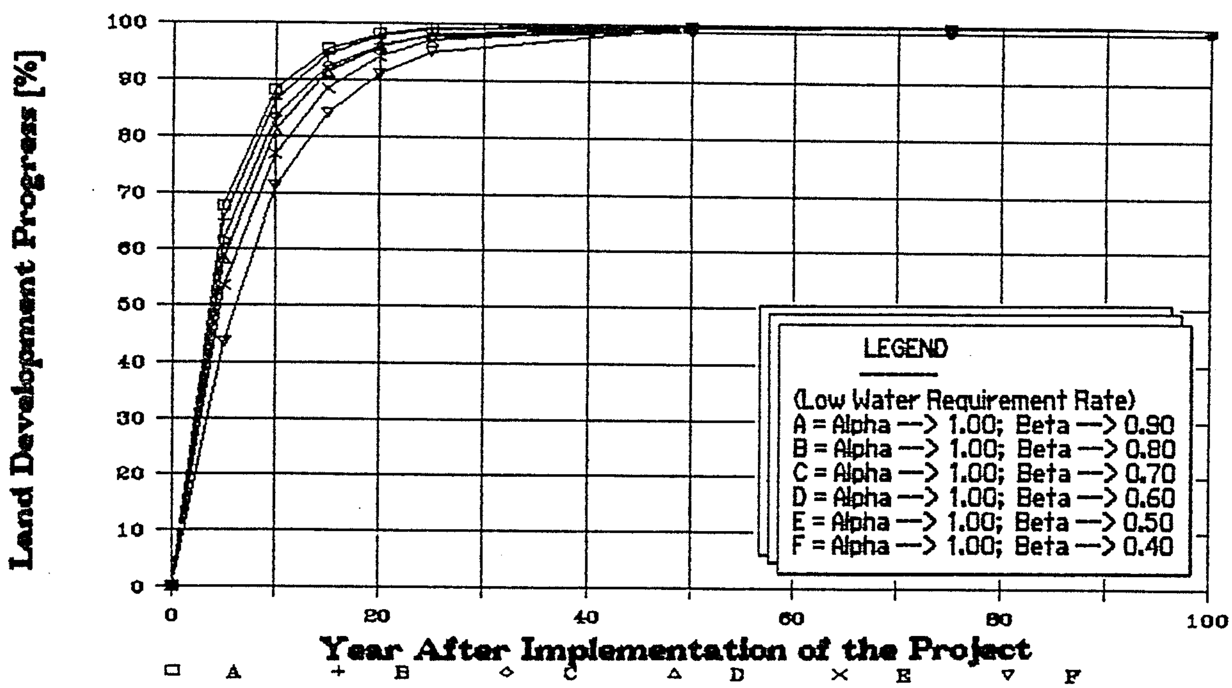


APPENDIX 6-5D

LAND DEVELOPMENT TRENDS OF WAY RAREM BY VARYING THE VALUES OF ALPHA AND CONSTANT BETA, AND WITH LOW (q)



LAND DEVELOPMENT TRENDS OF WAY RAREM BY VARYING THE VALUES OF BETA ALPHA CONSTANT, AND WITH LOW (q)



SUMMARY OF LAND DEVELOPMENT ANALYSIS FOR THE LUWU SCHEMES

APPENDIX 6-6

NO.	UNIT OF WATER REQUIREMENT OF THE NEW LAND	COEFFICIENT ALPHA	COEFFICIENT BETA	LAND RECLAMATION PROGRESS IN (I)TH YEAR, (% OF TOTAL IRRIGATION AREA) YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	YEAR 50	YEAR 75	YEAR 100	REMARK
I	LAMASI AREA	1.00	1.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	TOTAL IRRIGABLE AREA = 4,473 HA
1.1	q(1) = 3.00 l/s/ha	0.95	0.90	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	AREA 1 = 1,905 HA
1.2	q(2) = 2.00 l/s/ha	0.90	0.95	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	AREA 2 = 1,998 HA
1.3	q(3) = 1.25 l/s/ha	0.87	0.72	89.27	100.00	100.00	100.00	100.00	100.00	100.00	100.00	AREA 3 = 570 HA
1.4		0.85	0.75	88.66	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
1.5	Q = 7.500 M3/Sec.	0.75	0.85	81.92	96.83	99.84	100.00	100.00	100.00	100.00	100.00	PERCENT OF TOTAL
1.6		0.60	0.60	56.74	73.18	78.24	79.79	80.27	80.48	80.48	80.48	AREA 1 = 42.59 %
		0.50	0.60	47.29	60.99	65.20	66.49	66.89	67.07	67.07	67.07	AREA 2 = 44.67 %
		0.60	0.50	51.52	69.83	76.55	79.03	79.95	80.48	80.48	80.48	AREA 3 = 12.74 %
II	KALAENA AREA											TOTAL IRRIGABLE AREA = 12,392 HA
2.1	q(1) = 3.00 l/s/ha	1.00	1.00	71.91	81.99	83.61	83.88	83.92	83.93	83.93	83.93	AREA 1 = 3,353 HA
2.2	q(2) = 2.00 l/s/ha	0.95	0.90	66.17	77.20	79.26	79.64	79.71	79.73	79.73	79.73	AREA 2 = 3,369 HA
2.3	q(3) = 1.25 l/s/ha	0.90	0.95	63.75	73.49	75.18	75.47	75.52	75.53	75.53	75.53	AREA 3 = 5,670 HA
2.4		0.87	0.72	55.85	68.73	71.95	72.75	72.95	73.01	73.01	73.01	
2.5	Q = 13.000 M3/Sec.	0.85	0.75	55.47	67.57	70.44	71.12	71.29	71.34	71.34	71.34	PERCENT OF TOTAL
2.6		0.75	0.85	51.26	60.58	62.47	62.85	62.92	62.94	62.94	62.94	AREA 1 = 27.06 %
												AREA 2 = 27.19 %
												AREA 3 = 45.75 %

Appendix 7-1a

TABLE OF SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME MODELS BASED ON FULL RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS (AT 5% DISCOUNT RATE)

No.	Total Area (ha)	P. VALUE C + O&M Costs (Rp10^6)	Economic Value of Water [Rp/US$/ha/Crop]				Total Water [m3/year] Crop Index=1.30 EFFICIENCY= 80%
			Wet Season Paddy		Dry Season Paddy		
			Rp.	US$.	Rp.	US$.	
1	700	2,838.800	251,203.575	124.051	439,606.259	217.090	10.889x10^6
2	1,000	4,055.429	251,215.110	124.057	439,626.443	271.099	15.555x10^6
3	5,000	18,968.236	234,998.940	116.049	411,248.145	203.086	77.775x10^6
4	7,500	22,570.426	247,593.785	122.269	433,289.123	213.970	116.663x10^6
5	10,000	34,228.144	230,538.114	113.846	403,441.700	199.230	155.550x10^6
6	15,000	51,342.215	230,538.114	113.846	403,441.700	199.230	233.325^10^6
7	20,000	61,250.297	221,049.429	109.160	386,836.501	191.030	311.100x10^6
8	25,000	76,562.796	221,049.429	109.160	386,836.501	191.030	388.975^10^6
9	30,000	85,230.932	205,063.140	101.266	358,860.495	177.215	466.650^10^6
10	35,000	99,436.087	205,063.140	101.266	358,860.495	177.215	544.425x10^6
		AVERAGE	229,831.278	113.497	402,204.736	204.020	

TABLE OF SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME MODELS BASED ON FULL RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS (AT 10% DISCOUNT RATE)

Appendix 7-1b

No.	Total Area (ha)	P. VALUE C + O&M Costs (Rp10^6)	Economic Value of Water [Rp/US$/ha/Crop] Wet Season Paddy Rp.	Wet Season Paddy US$.	Dry Season Paddy Rp.	Dry Season Paddy US$.	Total Water [m3/year] Crop Index=1.30 EFFICIENCY= 80%
1	700	2,508.833	407,405.172	201.188	712,959.051	352.079	10.889x10^6
2	1,000	3,584.047	407,423.880	201.197	712,991.790	352.095	15.555x10^6
3	5,000	16,776.714	381,425.440	188.358	667,494.520	329.627	77.775x10^6
4	7,500	23,827.719	410,113.119	202.525	717,698.134	354.419	116.663x10^6
5	10,000	29,608.065	382,203.312	188.742	668,855.796	330.299	155.550x10^6
6	15,000	44,412.098	382,203.312	118.742	668,855.796	330.299	233.325^10^6
7	20,000	51,569.562	369,679.427	182.558	646,938.998	319.476	311.100x10^6
8	25,000	55,671.183	369,679.427	182.558	646,938.998	319.476	388.975^10^6
9	30,000	71,624.669	342,297.094	169.036	599,019.914	295.812	466.650^10^6
10	35,000	83,562.114	342,297.094	169.036	599,019.914	295.812	544.425x10^6
		AVERAGE	379,472.728	180.394	664,077.291	327.939	

Appendix 7-1c

TABLE OF SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME MODELS BASED ON FULL RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS (AT 15% DISCOUNT RATE)

No.	Total Area (ha)	P. VALUE C + O&M Costs (Rp10^6)	Economic Value of Water [Rp/US$/ha/Crop]				
			Wet Season Paddy		Dry Season Paddy		Total Water [m3/year] Crop Index=1.30 EFFICIENCY= 80%
			Rp.	US$.	Rp.	US$.	
1	700	2,269.793	601,111.454	296.845	1,051,945.044	519.479	10.889x10^6
2	1,000	3,242.562	601,139.057	296.859	1,051,993.349	519.503	15.555x10^6
3	5,000	15,184.506	563,011.632	278.030	985,270.355	486.553	77.775x10^6
4	7,500	21,109.004	620,850.113	306.593	1,086,487.698	536.537	116.663x10^6
5	10,000	26,242.069	578,868.918	285.861	1,013,020.607	500.257	155.550x10^6
6	15,000	39,363.104	578,869.918	285.861	1,013,020.607	500.257	233.325^10^6
7	20,000	44,536.946	567,348.624	280.172	992,860.091	490.301	311.100x10^6
8	25,000	55,671.183	567,348.624	280.172	992,060.091	490.301	388.975^10^6
9	30,000	61,795.671	524,803.065	259.162	918,405.363	453.534	466.650^10^6
10	35,000	72,099.949	524,803.065	259.162	918,405.363	453.534	544.425x10^6
		AVERAGE	572,815.447	282.872	1,002,346.857	495.026	

TABLE OF SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME MODELS BASED ON FULL RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS (AT 20% DISCOUNT RATE)

Appendix 7-1d

No.	Total Area (ha)	P. VALUE C + O&M Costs (Rp10^6)	Economic Value of Water [Rp/US$/ha/Crop] Wet Season Paddy Rp.	Wet Season Paddy US$.	Dry Season Paddy Rp.	Dry Season Paddy US$.	Total Water [m3/year] Crop Index=1.30 EFFICIENCY= 80%
1	700	2,079.303	825,450.246	407.630	1,444,537.930	713.352	10.889x10^6
2	1,000	2,970.433	825,488.150	407.648	1,444,604.263	713.385	15.555x10^6
3	5,000	13,913.481	773,315.817	381.884	1,353,302.680	668.298	77.775x10^6
4	7,500	18,965.458	876,327.429	432.754	1,553,573.001	757.320	116.663x10^6
5	10,000	23,583.621	817,290.968	403.600	1,430,259.194	706.301	155.550x10^6
6	15,000	35,375.432	817,290.968	403.600	1,430,259.194	706.301	233.325^10^6
7	20,000	39,060.516	813,725.794	401.840	1,424,020.139	703.220	311.100x10^6
8	25,000	48,825.645	813,725.794	401.840	1,424,020.139	703.220	388.975^10^6
9	30,000	54,165.986	752,273.044	371.493	1,316,477.826	650.113	466.650^10^6
10	35,000	63,193.651	752,273.044	371.493	1,316,477.826	650.113	544.425x10^6
		AVERAGE	806,716.125	398.378	1,413,753.219	697.162	

Appendix 7-1e

TABLE OF SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME MODELS BASED ON FULL RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS (AT 25% DISCOUNT RATE)

No.	Total Area (ha)	P. VALUE C + O&M Costs (Rp10^6)	Economic Value of Water [Rp/US$/ha/Crop]				
			Wet Season Paddy		Dry Season Paddy		Total Water [m3/year] Crop Index=1.30 EFFICIENCY= 80%
			Rp.	US$.	Rp.	US$.	
1	700	1,919.800	1,075,996.582	531.356	1,882,994.018	929.874	10.889x10^6
2	1,000	2,742.571	1,076,045.992	531.381	1,883,080.485	929.916	15.555x10^6
3	5,000	12,848.119	1,008,190.113	497.872	1,764,332.698	871.275	77.775x10^6
4	7,500	17,200.643	1,174,442.198	579.971	2,055,273.847	1,014.950	116.663x10^6
5	10,000	21,392.682	1,095,507.447	540.991	1,917,138.032	946.735	155.550x10^6
6	15,000	32,089.029	1,095,507.447	540.991	1,917,138.032	946.735	233.325^10^6
7	20,000	34,631.833	1,109,334.742	547.820	1,941,335.798	958.684	311.100x10^6
8	25,000	43,289.791	1,109,334.742	547.820	1,941,335.798	958.684	388.975^10^6
9	30,000	48,007.392	1,025,189.132	506.266	1,794,080.981	885.966	466.650^10^6
10	35,000	56,008.624	1,025,189.132	506.266	1,794,080.981	885.966	544.425x10^6
		AVERAGE	1,079,473.753	533.073	1,889,079.067	932.879	

TABLE OF SUMMARY OF ESTIMATED VALUE OF IRRIGATION WATER FOR SEVERAL IRRIGATION SCHEME MODELS BASED ON FULL RECOVERY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS (AT 30% DISCOUNT RATE)

Appendix 7-1f

No.	Total Area (ha)	P. VALUE C + O&M Costs (Rp10^6)	Economic Value of Water [Rp/US$/ha/Crop]				Total Water [m3/year] Crop Index=1.30 EFFICIENCY= 80%
			Wet Season Paddy		Dry Season Paddy		
			Rp.	US$.	Rp.	US$.	
1	700	1,782.552	1,350,421.012	666.875	2,363,236.771	1,167.031	10.889x10^6
2	1,000	2,546.503	1,350,483.023	666.905	2,363,345.291	1,167.084	15.555x10^6
3	5,000	11,930.820	1,265,450.900	624.914	2,214,539.074	1,093.600	77.775x10^6
4	7,500	17,711.020	1,514,716.334	748.008	2,650,753.584	1,309.014	116.663x10^6
5	10,000	19,542.242	1,413,072.525	697.814	2,472,876.918	1,221.174	155.550x10^6
6	15,000	29,313.363	1,413,072.525	697.814	2,472,876.918	1,221.174	233.325^10^6
7	20,000	30,967.655	1,456,019.312	719.022	2,548,033.796	1,258.288	311.100x10^6
8	25,000	38,709.569	1,456,019.312	719.022	2,548,033.796	1,258.288	388.975^10^6
9	30,000	42,917.685	1,354,192.046	664.322	2,354,192.046	1,162.564	466.650^10^6
10	35,000	50,070.632	1,354,192.046	664.322	2,354,192.046	1,262.564	544.425x10^6
		AVERAGE	1,392,763.904	686.902	2,434,208.024	1,212.078	

SUMMARY OF FARM BUDGET CALCULATION FOR TYPICAL LAND HOLDING OF THE KALAENA IRRIGATION SCHEME, LUWU IRRIGATION PROJECT

Appendix 7-2

NO.	Farm size (ha)	Gross Revenue: Agricultural Origin	Gross Revenue: Non Agricultural Origin	Agricultural Inputs	Income (3+4)-(5)	Expenditure: Food Consumption	Expenditure: Clothing	Expenditure: Children Education	Expenditure: Health Care	Expenditure: Transport	Expenditure: Others	Total Spendings	Income Balance (6)-(13)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	0.5	342562.5									78269		
		345493.31	217000	224879.68							26908		
		246779	189250	0							12193.06		
		934834.81	406250	224879.68	1116205.13	891352	116292	148218	40900	53340	117370.06	1367472.06	-251266.93
2	0.75	513843.75									78269		
		518239.97	217000	337319.51							26908		
		246779	189250	94602.84							18289.6		
		1278862.72	406250	431922.35	1253190.37	891352	116292	148218	40900	53340	123466.6	1373568.6	-120378.23
3	1	685125									78269		
		690986.63	217000	449759.35							26908		
		246779	189250	240738.39							24386.13		
		1622890.63	406250	690497.74	1338642.89	891352	116292	148218	40900	53340	129563.13	1379665.13	-41022.24
4	1.25	856406.25									78269		
		863773.28	217000	562199.19							26908		
		246779	189250	300922.98							30482.66		
		1966958.53	406250	863122.17	1510086.36	891352	116292	148218	40900	53340	135659.66	1385761.66	124324.7
5	1.5	1027687.5									78269		
		1036479.94	217000	674639.03							26908		
		246779	189250	361107.58							36579.19		
		2310946.44	406250	1035746.61	1681449.83	891352	116292	148218	40900	53340	141756.19	1391858.19	289591.64
6	1.75	1198968.75									78269		
		1209226.59	217000	787078.87							26908		
		246779	189250	887082.88							42675.73		
		2654974.34	406250	1674161.75	1387062.59	891352	116292	148218	40900	53340	147852.73	1397954.73	-10892.14
7	2	1370250									78269		
		1381973.25	217000	899518.7							26908		
		246779	189250	1013809.01							48772.26		
		2999002.25	406250	1913327.71	1491924.54	891352	116292	148218	40900	53340	153949.26	1404051.26	87873.28
8	3	2055375									78269		
		2072959.88	217000	1349278.06							26908		
		246779	189250	1520713.52							73153.39		
		4375113.88	406250	2869991.58	1911372.3	891352	116292	148218	40900	53340	178330.39	1428432.39	482939.91
9	4	2740500									78269		
		2763946.5	217000	1799037.41							26908		
		246779	189250	2027618.02							97544.52		
		5751225.5	406250	3826655.43	2330820.07	891352	116292	148218	40900	53340	202721.52	1452823.52	877996.55
10	5	3425625									78269		
		3454933.13	217000	2248796.76							26908		
		146779	189250	2534522.53							121930.65		
		7027337.13	406250	4783319.29	2650267.84	891352	116292	148218	40900	53340	227107.65	1477209.65	1173058.19

SUMMARY OF FARM BUDGET CALCULATION FOR TYPICAL LAND HOLDING OF THE LAMASI IRRIGATION SCHEME, LUWU IRRIGATION PROJECT

Appendix 7-3

NO.	Farm size (ha)	Gross Revenue: Agricultural Origin	Gross Revenue: Non Agricultural Origin	Agricultural Inputs	Income (3+4)-(5)	Expenditure: Food Consumption	Expenditure: Clothing	Expenditure: Children Education	Expenditure: Health Care	Expenditure: Transport	Expenditure: Others	Total Spendings	Income Balance (6)-(13)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	0.5	470800									27377		
		209731.5	280779	212073.64							21066		
		180036	196875	0							8423.32		
		860567.5	477654	212073.64	1126147.86	703172	97806	157902	74066	84619	56866.32	1174431.32	-48283.46
2	0.75	706200									27377		
		319597.25	280779	318110.46							21066		
		180036	196875	75886.77							12634.98		
		1205833.25	477654	393997.23	1289490.02	703172	97806	157902	74066	84619	61077.98	1178642.98	110847.04
3	1	941600									27377		
		419463	280779	424147.28							21066		
		180036	196875	186746.73							16846.64		
		1541099	477654	610894.01	1407858.99	703172	97806	157902	74066	84619	65289.64	1182854.64	225004.35
4	1.25	1177000									27377		
		524328.75	280779	530184.1							21066		
		180036	196875	233433.41							21058.3		
		1881364.75	477654	763617.51	1595401.24	703172	97806	157902	74066	84619	69501.3	1187066.3	408334.94
5	1.5	1412400									27377		
		629194.5	280779	636220.92							21066		
		180036	196875	280120.09							25269.96		
		2221630.5	477654	916341.01	1782943.49	703172	97806	157902	74066	84619	73712.96	1191277.96	591665.53
6	1.75	1647800									27377		
		734060.25	280779	742257.74							21066		
		180036	196875	622296.97							29481.62		
		2561896.25	477654	1364554.71	1674995.54	703172	97806	157902	74066	84619	77924.62	1195489.62	479505.92
7	2	1883200									27377		
		838926	280779	848294.56							21066		
		180036	196875	711196.54							33693.28		
		2902162	477654	1559491.1	1820324.9	703172	97806	157902	74066	84619	82136.28	1199701.28	620623.62
8	3	2824800									27377		
		1258389	280779	1272441.84							21066		
		180036	196875	1066794.81							50539.93		
		4263225	477654	2339236.65	2401642.35	703172	97806	157902	74066	84619	98982.93	1216547.93	1185094.42
9	4	3766400									27377		
		1677852	280779	1696589.12							21066		
		180036	196875	1422393.08							67386.57		
		5624288	477654	3118982.2	2982959.8	703172	97806	157902	74066	84619	115829.57	1233394.57	1749565.23
10	5	4708000									27377		
		2097315	280779	2120736.4							21066		
		180036	196875	1777991.35							84233.21		
		6985351	477654	3898727.75	3564277.25	703172	97806	157902	74066	84619	132676.21	1250241.21	2314036.04

SUMMARY OF FARM BUDGET CALCULATION FOR TYPICAL LAND HOLDING OF THE WAU RAREM IRRIGATION PROJECT

Appendix 7-4

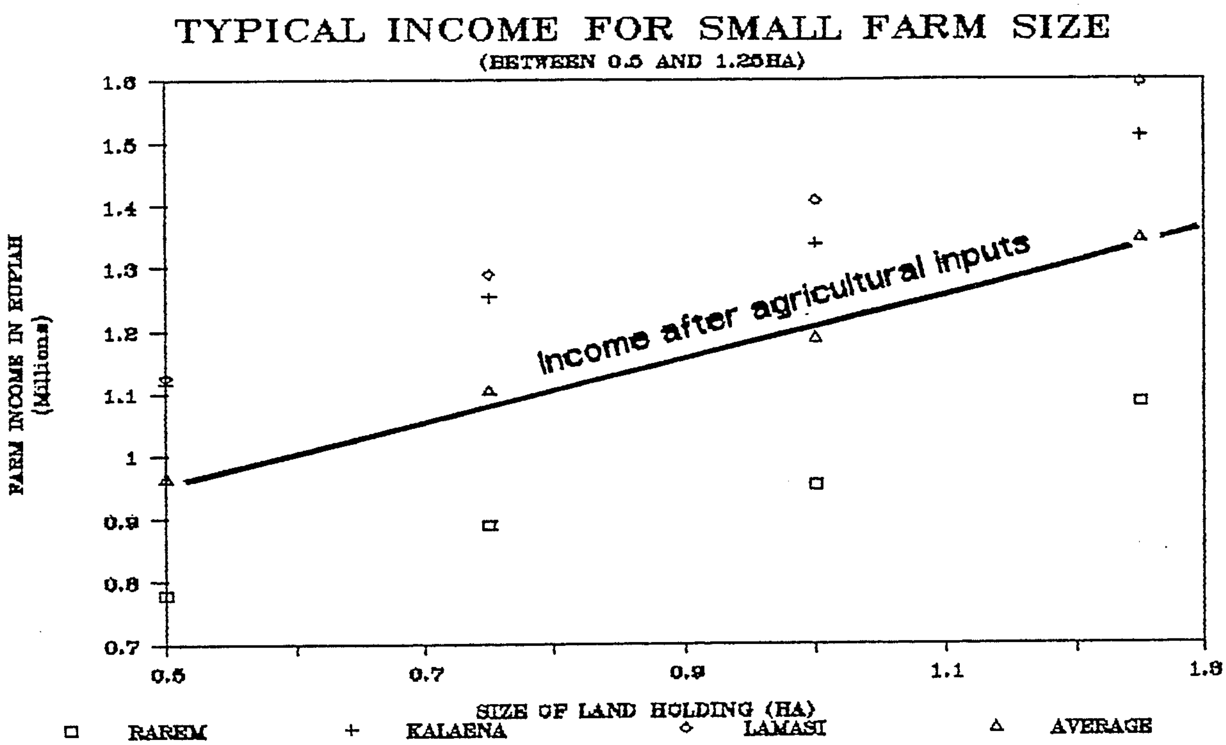
NO.	Farm size (ha)	Gros Revenue: Agricultural Origin	Gros Revenue: Non Agricultural Origin	Agricultural Inputs	Income <3+4>-<5>	Exnditure: Food Consumption	Clothing	Children Education	Health Care	Transport	Others	Total Spendings	Income Balance <6>-<13>
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>	<12>	<13>	<14>
1	0.5	418500									32005		
		98820	142244	173016.72							13741		
		169933	121552.5	0							10329.4		
		687253	263796.5	173016.72	778032.78	786044	128185	104541	48461	44993	56075.4	1168299.4	-390266.62
2	0.75	627750									32005		
		148230	142244	259525.09							13741		
		169933	121552.5	59800.34							15494.1		
		945913	263796.5	319325.43	890384.07	786044	128185	104541	48461	44993	61240.1	1173464.1	-283080.03
3	1	837000									32005		
		197640	142244	346033.45							13741		
		169933	121552.5	168641.41							20658.8		
		1204573	263796.5	514674.86	953694.64	786044	128185	104541	48461	44993	66404.8	1178628.8	-224934.16
4	1.25	1046250									32005		
		247050	142244	432541.81							13741		
		169933	121552.5	210801.76							25823.51		
		1463233	263796.5	643343.57	1083685.93	786044	128185	104541	48461	44993	71569.51	1183793.5	-100107.58
5	1.5	1255500									32005		
		296460	142244	519050.17							13741		
		169933	121552.5	252962.11							30988.21		
		1721893	263796.5	772012.28	1213677.22	786044	128185	104541	48461	44993	76734.21	1188958.2	24719.01
6	1.75	1464750									32005		
		345870	142244	605558.54							13741		
		169933	121552.5	342533.81							36152.91		
		1980553	263796.5	948092.35	1296257.15	786044	128185	104541	48461	44993	81898.91	1194122.9	102134.24
7	2	1674000									32005		
		395280	142244	692066.9							13741		
		169933	121552.5	391467.21							41317.61		
		2239213	263796.5	1083534.11	1419475.39	786044	128185	104541	48461	44993	87063.61	1199287.6	220187.78
8	3	2511000									32005		
		592920	142244	1038100.35							13741		
		169933	121552.5	587200.81							61976.41		
		3273853	263796.5	1625301.16	1912348.34	786044	128185	104541	48461	44993	107722.41	1219946.4	692401.93
9	4	3348000									32005		
		790560	142244	1384133.8							13741		
		169933	121552.5	782934.42							82635.22		
		4308493	263796.5	2167068.22	2405221.28	786044	128185	104541	48461	44993	128381.22	1240605.2	1164616.06
10	5	4185000									32005		
		988200	142244	1730167.25							13741		
		169933	121552.5	978668.02							103294.02		
		5343133	263796.5	2708835.27	2898094.23	786044	128185	104541	48461	44993	149040.02	1261264.0	1636830.21

SUMMARY OF FARM BUDGET CALCULATION FOR TYPICAL LAND HOLDING OF THE THE AVERAGE FIGURE PROJECTS (ALLTOGETHER)

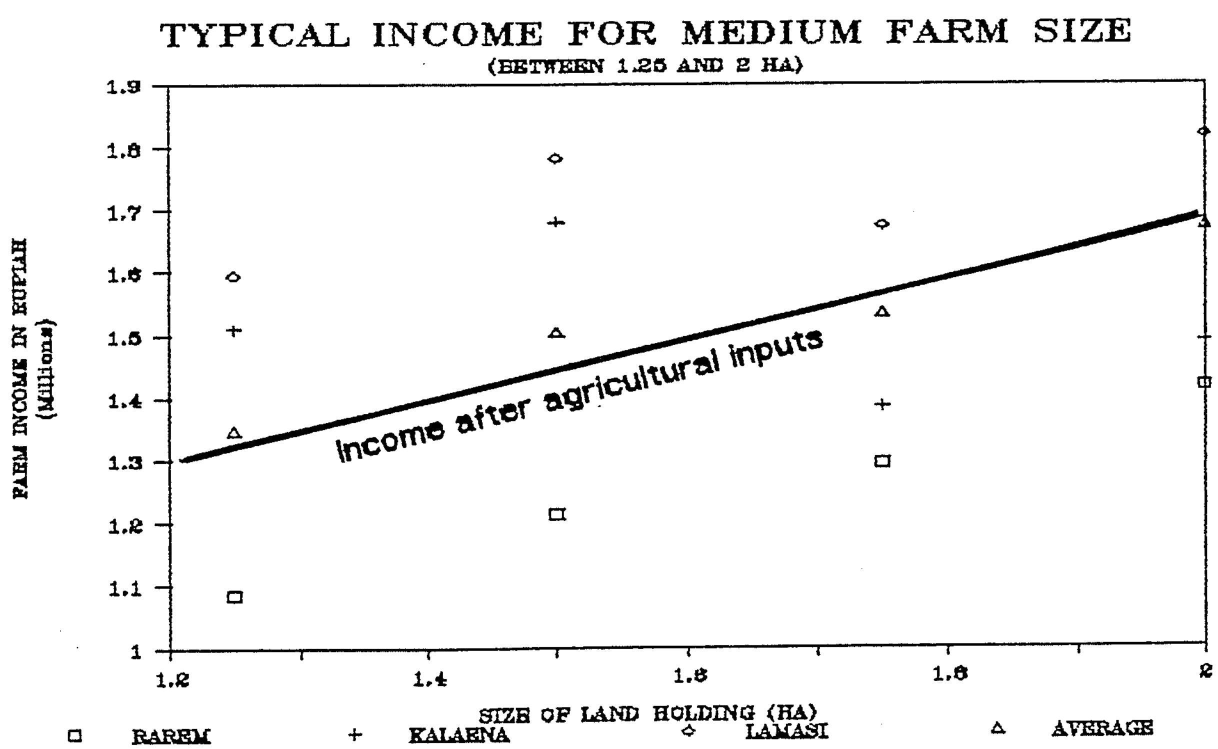
Appendix 7-5

NO.	Farm size (ha)	Gross Revenue: Agricul-tural Origin	Gross Revenue: Non Agri-cultural Origin	Agricul-tural Inputs	Income (3+4)-(5)	E x n d i t u: Food Consump-tion	Clothing	Children Education	Health Care	Transport	Others	Total Spendings	Income Balance (6)-(13)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	0.5	410700									38132		
		200110.8	170997.5	199924.59							19366		
		224521.5	160110	0							10297.79		
		835332.3	331107.5	199924.59	966515.21	794872	117408	128550	51925	57145	67795.79	1217695.7	-251180.58
2	0.75	616050									38132		
		300166.2	177997.5	299886.89							19366		
		224521.5	160110	73414.49							15446.69		
		1140737.7	338107.5	373301.38	1105543.82	794872	117408	128550	51925	57145	72944.69	1222844.6	-117300.87
3	1	821400									38312		
		400221.6	170997.5	399849.19							19366		
		224521.5	160110	188019.42							20595.59		
		1446143.1	331107.5	587868.61	1189381.99	794872	117408	128550	51925	57145	78273.59	1228173.5	-38791.6
4	1.25	1026750									38132		
		500277	170997.5	499811.48							19366		
		224521.5	160110	235024.28							25744.48		
		1751548.5	331107.5	734835.76	1347820.24	794872	117408	128550	51925	57145	83242.48	1233142.4	114677.76
5	1.5	1232100									38132		
		600332.4	170997.5	599773.78							19366		
		224521.5	160110	282029.14							30893.38		
		2056953.9	331107.5	881802.92	1506258.48	794872	117408	128550	51925	57145	88391.38	1238291.3	267967.1
6	1.75	1437450									38132		
		700387.8	170997.5	699736.08							19366		
		224521.5	160110	458833.92							36042.28		
		2362359.3	331107.5	1158570	1534896.8	794872	117408	128550	51925	57145	93540.28	1243440.2	291456.52
7	2	1642800									38132		
		800443.2	170997.5	799698.38							19366		
		224521.5	160110	524381.63							41191.18		
		2667764.7	331107.5	1324080.0	1674792.19	794872	117408	128550	51925	57145	98689.18	1248589.1	426203.01
8	3	2464200									38132		
		1200664.8	170997.5	1199547.5							19266		
		224521.5	160110	786572.44							61786.76		
		3889386.3	331107.5	1986120	2234373.8	794872	117408	128550	51925	57145	119184.7	1269084.7	965289.04
9	4	3285600									38132		
		1600886.4	170997.5	1599396.7							19366		
		224521.5	160110	1048763.2							82382.35		
		5111007.9	331107.5	2648160.0	2793955.39	794872	117408	128550	51925	57145	139680.3	1289780.3	1504175.04
10	5	4107000									38132		
		2001108	170997.5	1999245.9							19366		
		224521	160110	1310954.0							102977.9		
		6332629	331107.5	3310200.0	3353536.49	794872	117403	128550	51925	57145	160475.9	1310375.9	2043160.55

APPENDIX 7-6A



APPENDIX 7-6B



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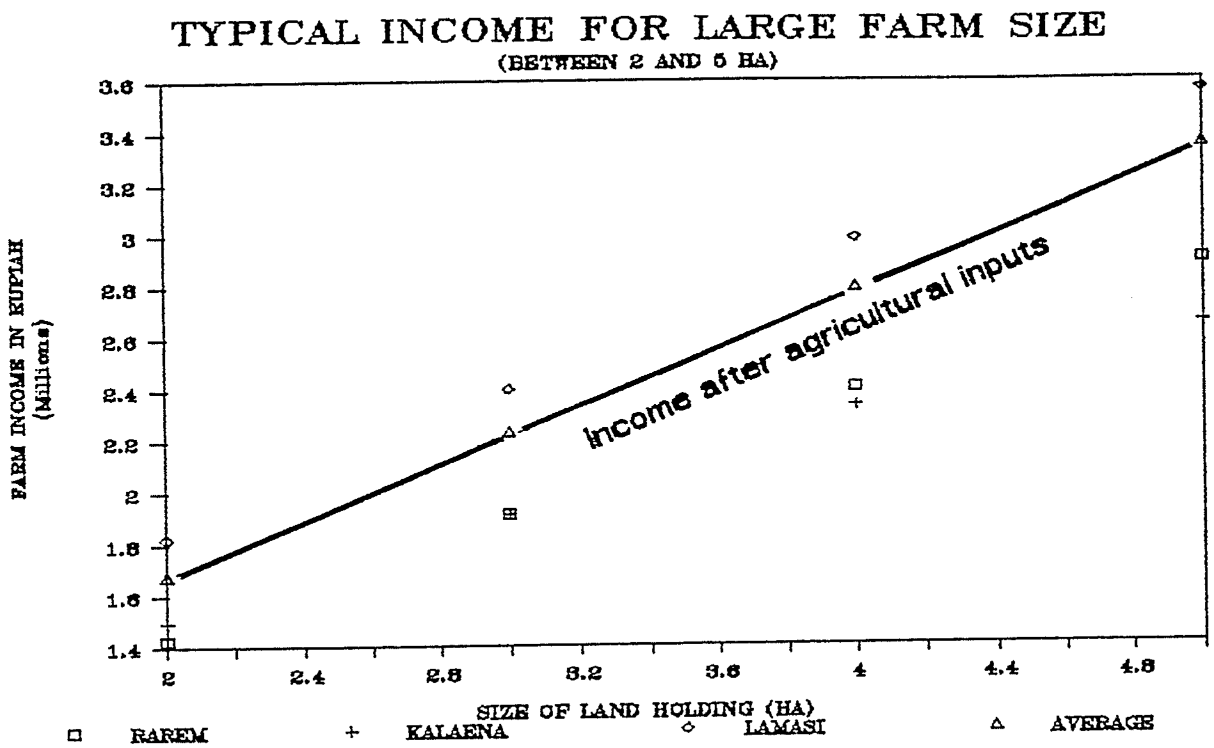

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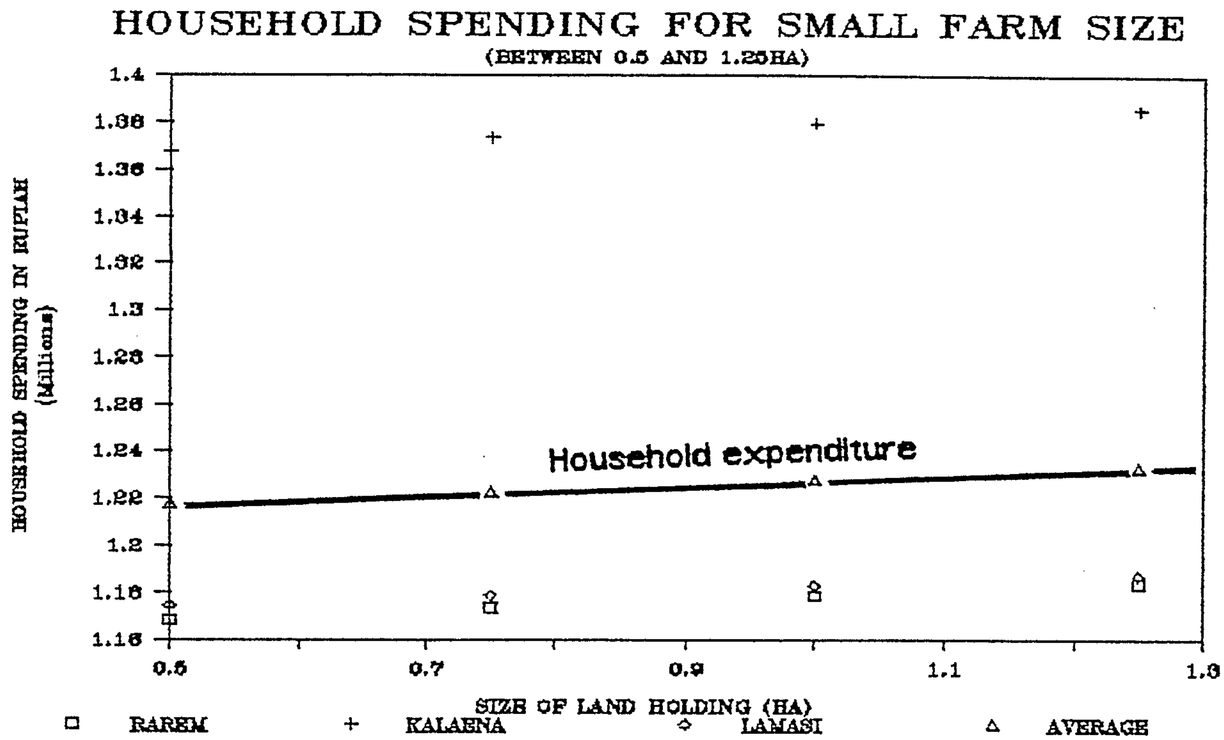

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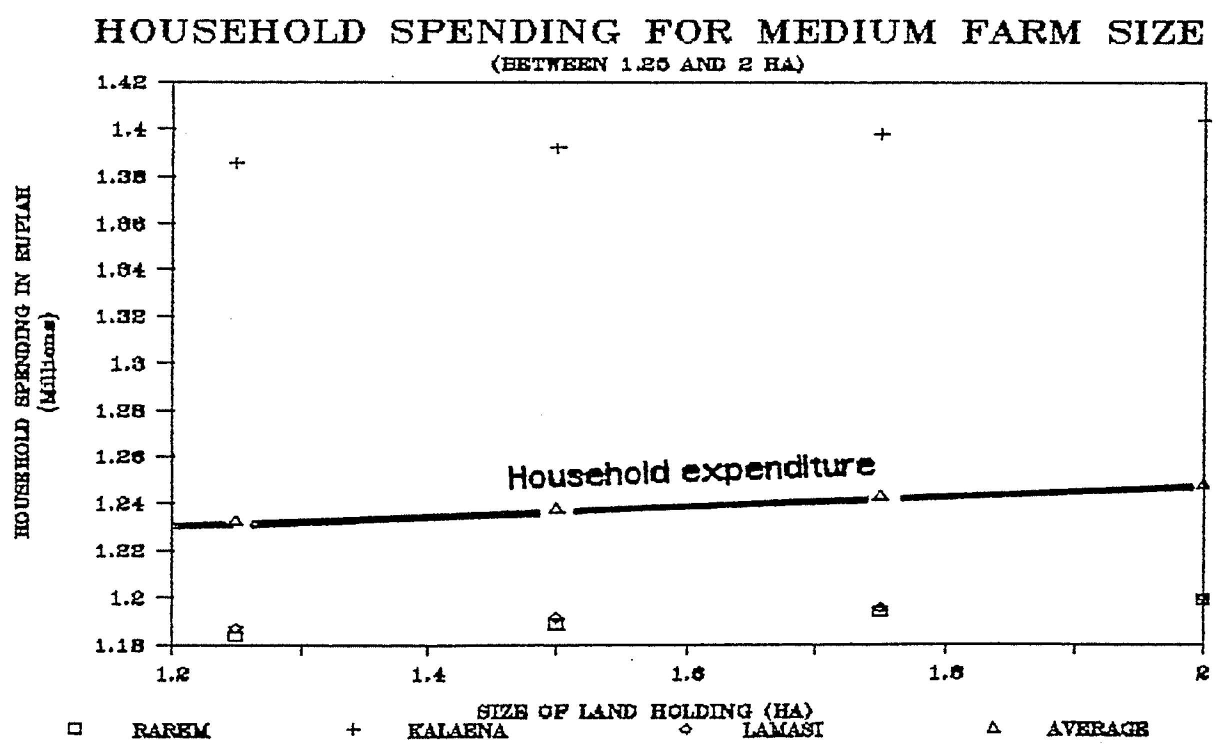

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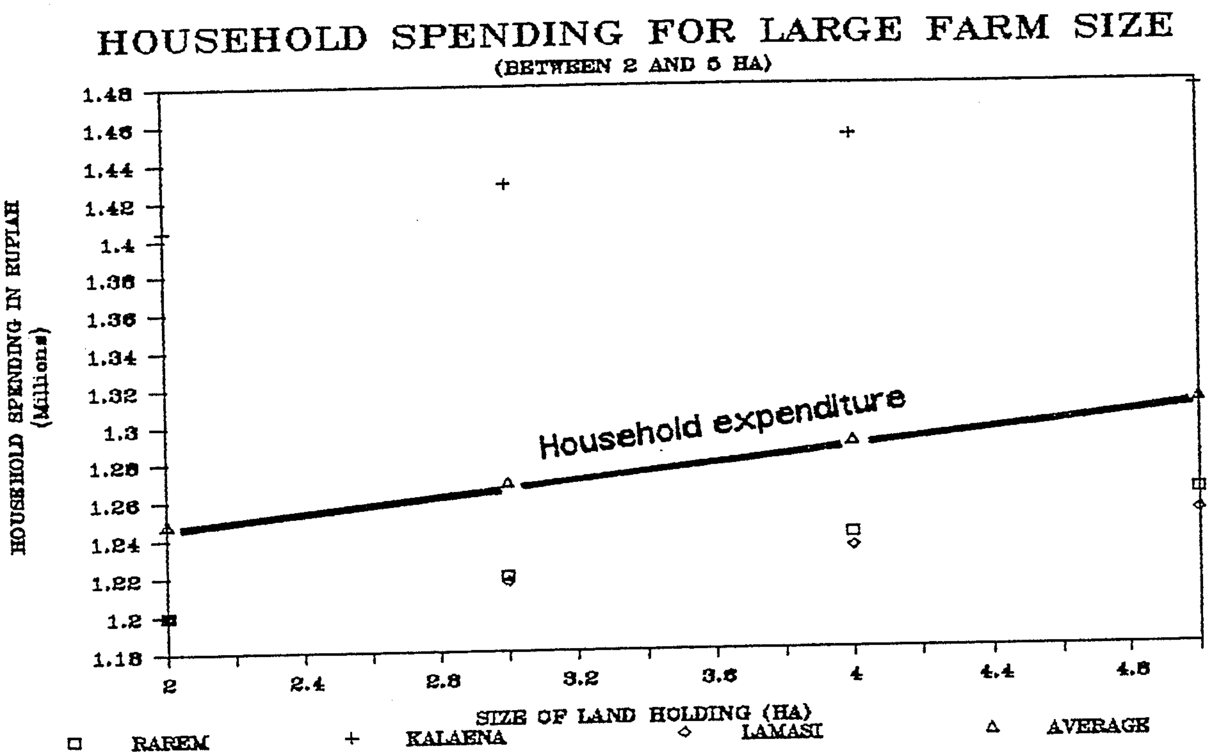

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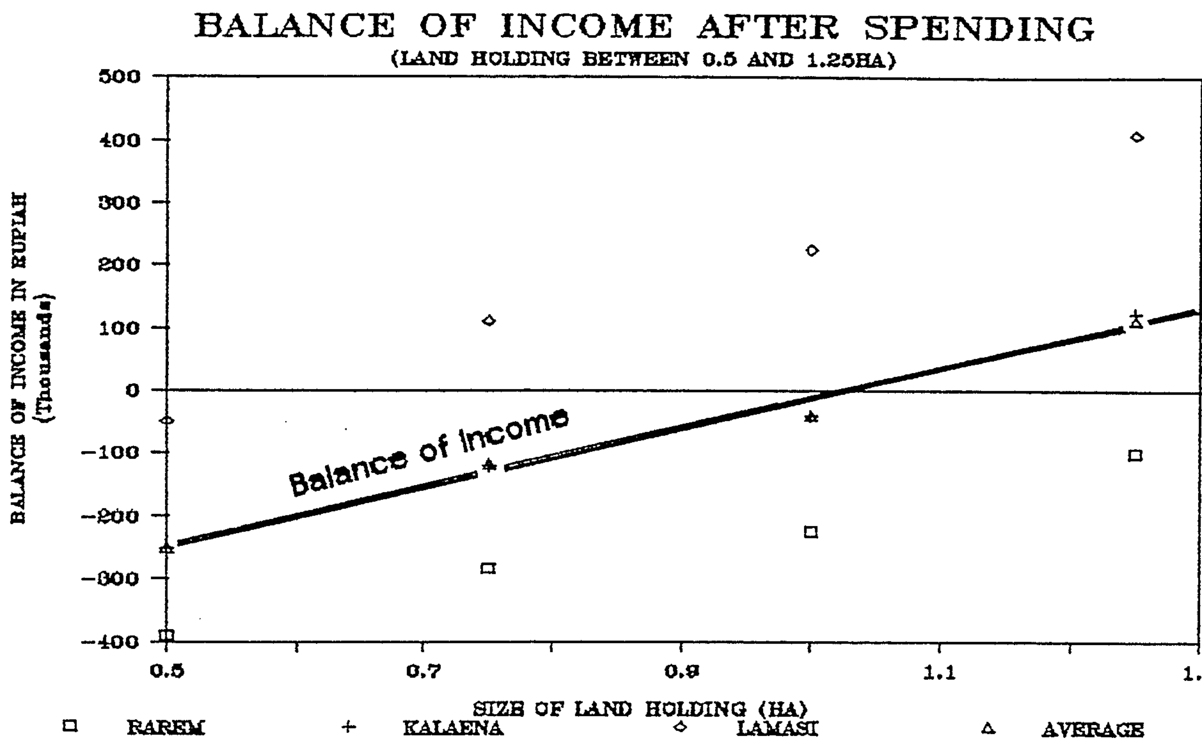

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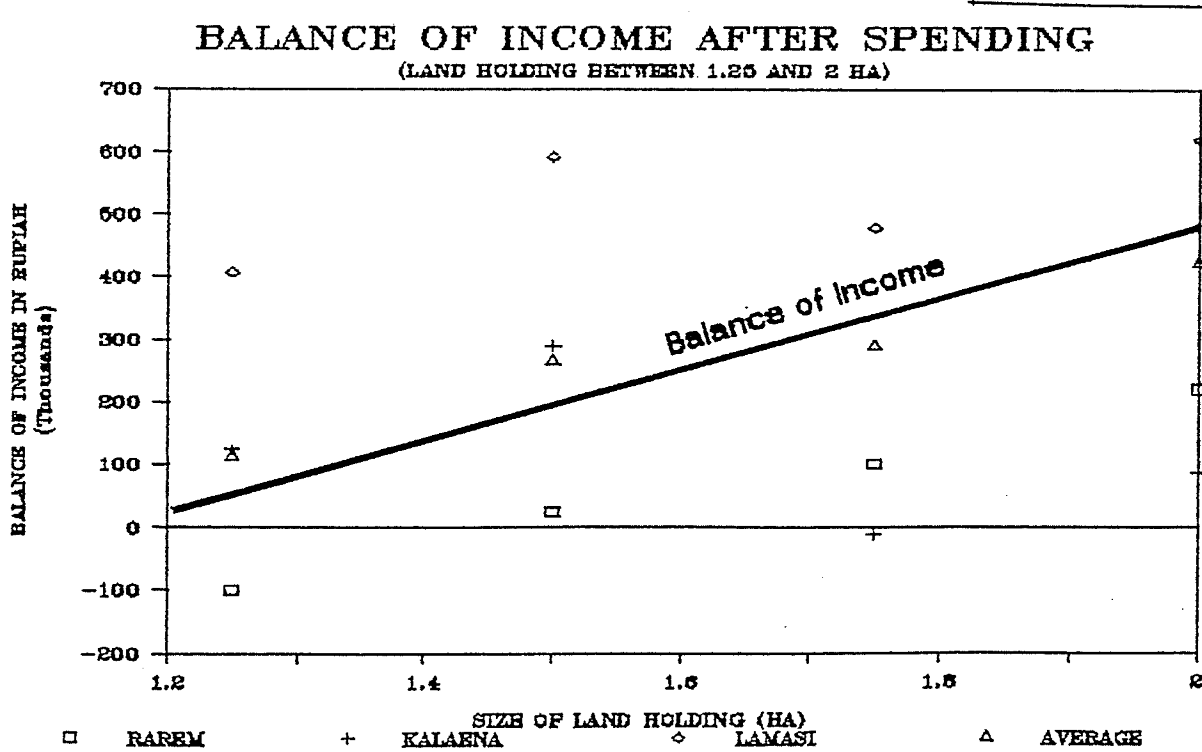
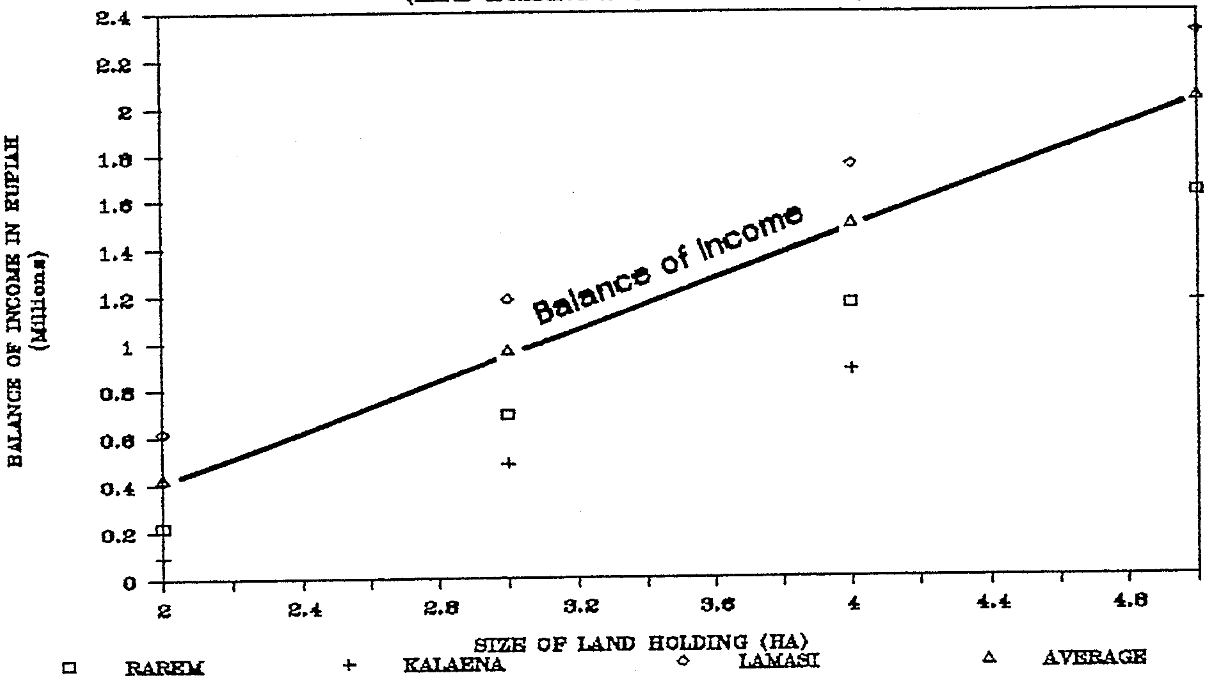


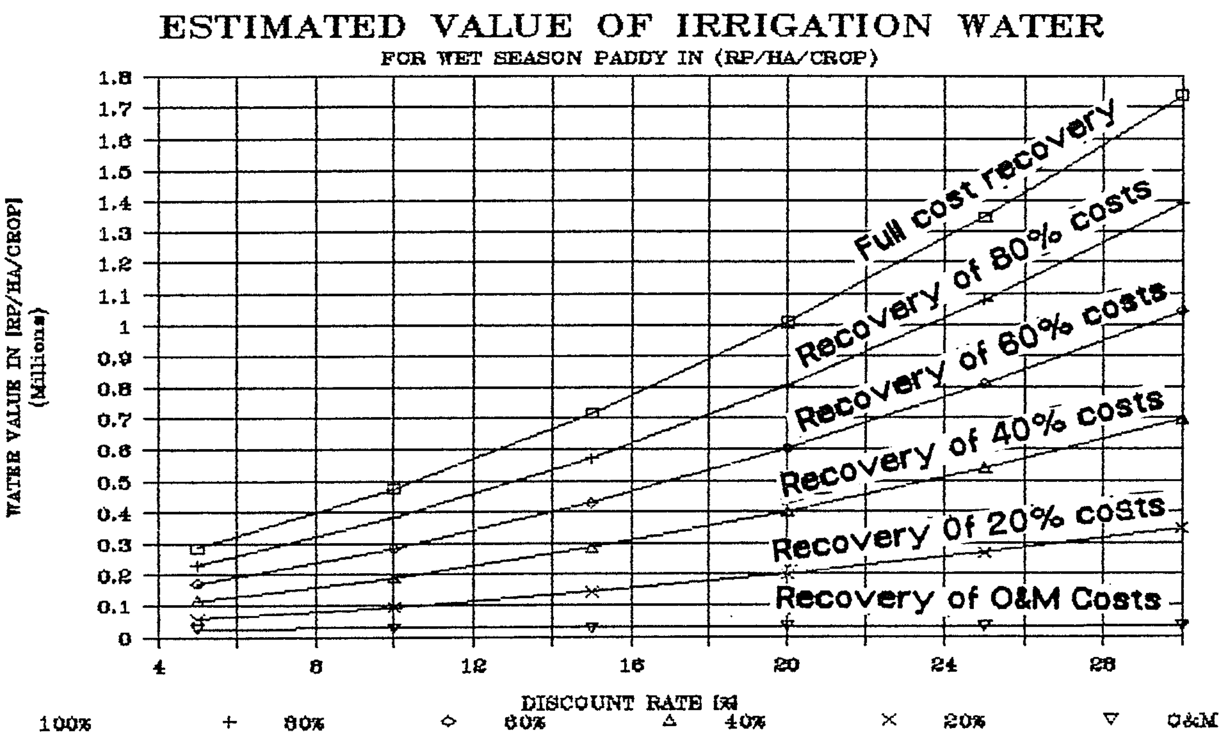
APPENDIX 7-8C

BALANCE OF INCOME AFTER SPENDING

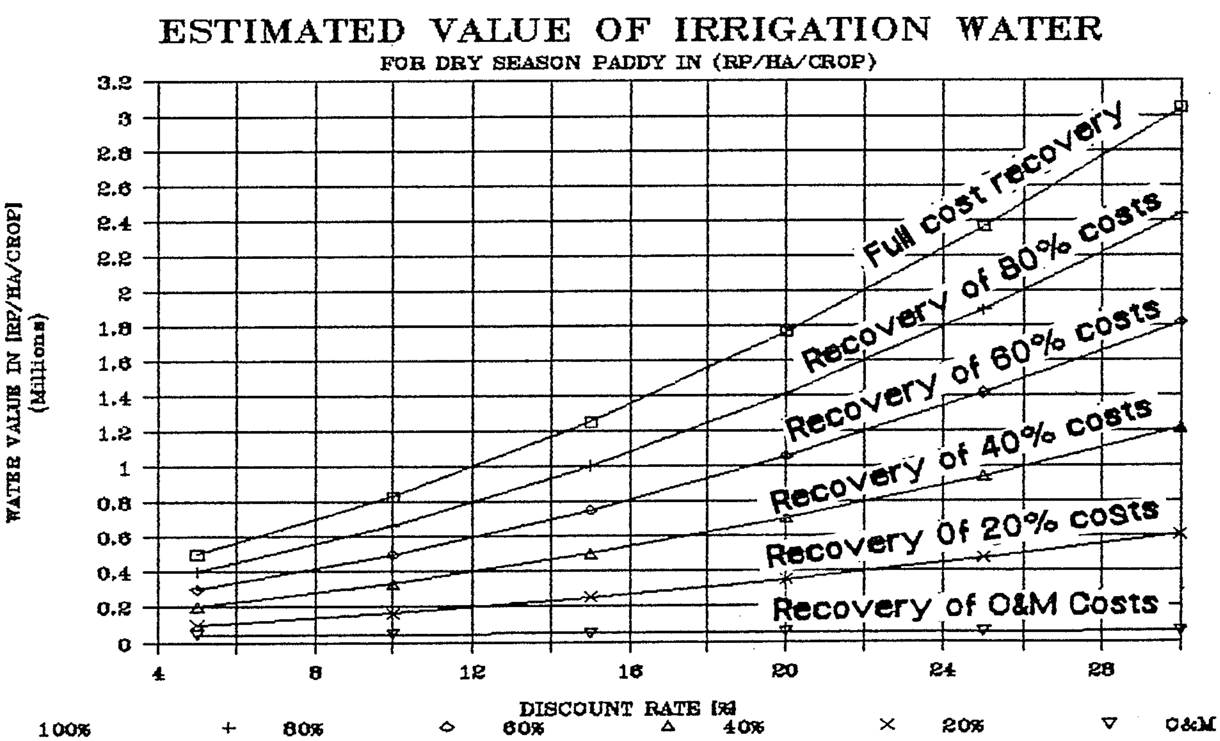
(LAND HOLDING BETWEEN 2 AND 5 HA)



APPENDIX 7-9A



APPENDIX 7-9B



APPENDIX 8-1

GENERAL SUMMARY OF THE DATA COLLECTED DURING THE FIELD SURVEY

NO.	ITEM	UNIT	THE SCHEMES ALL-TOGETHER: NUMBER OF RESPONDENT: HOUSEHOLD HEAD (N)	PERCENT WITHIN THE SCHEME (%)	PERCENT FROM TOTAL (%)	BASIC STATISTICAL FIGURES: MEAN	MAXIMUM	MINIMUM	STD-DEVIAT.
(1)	(2)	(3)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
A.	GENERAL ASPECTS OF THE HOUSEHOLD HEAD RESPONDENT	QUEST-01							
01-01	AGE:	YEAR	253		100	47	78	26	10.32
					0				
	GENDER:								
01-02	-MALE	NOS	247		97.628458				
01-03	-FEMALE	NOS	6		2.3715415				
					0				
	MARITAL STATUS:				0				
01-04	-MARRIED	NOS	240		94.861660				
01-05	-SINGLE	NOS	4		1.5810276				
01-06	-WIDOW	NOS	9		3.5573122				
	ETHNICITY:								
01-07	-JAVANESE	NOS	187		73.913043				
01-08	-SUNDANESE	NOS	5		1.9762845				
01-09	-BALINESE	NOS	14		5.5335968				
01-10	-LOMBOKNESE	NOS	3		1.1857707				
01-11	-BUGISNESE	NOS	18		7.1146245				
01-12	-TORAJANESE	NOS	26		10.276679				
	RELIGION:								
01-13	-MOSLEM	NOS	204		80.632411				
01-14	-PROTESTANT	NOS	29		11.462450				
01-15	-CATHOLIC	NOS	6		2.3715415				
01-16	-HIDUISM	NOS	14		5.5335968				
	EDUCATION:								
01-17	-ILLITERATE	NOS	36		14.229249				
01-18	-PRIMARY SCHOOL	NOS	166		65.612648				
01-19	-SECOND. SCHOOL	NOS	31		12.252964				
01-20	-HIGH SCHOOL	NOS	20		7.9051383				
01-21	NUMBER OF CHILDREN:	PERSON	247		97.628453	4	11	0	2.19
01-22	NUMBER OF DEPENDANTS:	PERSON	240		94.861660	2	9	0	1.65
01-23	PERSON PER HOUSEHOLD:	PERSON	253		100	6.74	17	2	3.75
01-24	MIGRATION YEAR:	YEAR	253		100	1970	1990	1935	11.65
	TRANSMIGRATION STATUS:								
01-25	-COLONIZATION	NOS	22		8.6956521				
01-26	-GENERAL	NOS	58		22.924901				
01-27	-SPONTANEOUS TRANSMIGRANT	NOS	91		35.968379				
01-28	-LOCAL	NOS	26		10.276679				
01-29	-RESETTLEMENT	NOS	12		4.7430830				
01-30	-INTEGRATED	NOS	2		0.7905158				
01-31	-SELF INITIATIVE/SWAKARSA	NOS	17		6.7193675				
01-32	-NATURAL DISASTER	NOS	12		4.7430830				
01-33	-SOCIAL PROGRAM	NOS	10		3.9525691				
01-34	-CRUSH PROGRAM/"INPRES"	NOS	3		1.1857707				
	PROVINCE OF ORIGIN:								
01-35	-LAMPUNG	NOS	3		1.1857707				
01-36	-WEST JAVA	NOS	8		3.1620553				

01-37	-CENTRAL JAVA	NOS	108		42.687747				
01-38	-EAST JAVA	NOS	60		23.715415				
01-39	-BALI	NOS	14		5.5335968				
01-40	-NTB (LOMBOK)	NOS	3		1.1857707				
01-41	-SOUTH SULAWESI	NOS	57		22.529644				
B.	AGRICULTURAL AND LAND USE ASPECTS:	QUEST-02							
02-01	IRRIGATION EXPERINCE:	YEAR	94		37.154150	2	30	2	4.64
	AMOUNT OF LAND OWNED:								
02-02	-IRRIGATED LAND	HA	249		98.418972	1.29	3.5	0.15	0.89
02-03	-UPLAND (NON IRRIGATED)	HA	71		28.063241	0.87	5	0.2	0.87
02-04	-HOUSE YARD	HA	253		100	0.29	0.75	0.04	0.13
02-05	-OTHERS	HA	12		4.7430830	0.53	1	0.12	0.24
	LAND TITLE:								
02-06	-AVAILABLE (?)	YES	194		76.679841				
02-07	-UNAVAILABLE	NO	59		23.320158				
	THE SIGNIFICANCE OF LAND TITLE:								
02-08	-IMPORTANT (?)	YES	253		100				
02-09	-NOT IMPORTANT	NO	0		0				
02-10	LAND LOCATION SEPARATED ?:	YES	239		94.466403				
02-11	LAND NOT SEPARATED:	NO	14		5.5335968				
02-12	LAND IN THE VILLAGE ?:	YES	229		90.513833				
02-13	LAND NOT IN THE VILLAGE:	NO	24		9.4861660				
02-14	LAND DISTANCE:	KM	245		96.837944	1.23	7	0.01	1.03
	LAND OWNERSHIP STATUS:								
02-15	-LEGAL OWNERSHIP	NOS	198		78.260869				
02-16	-RIGHT TO CULTIVATE	NOS	3		1.1857707				
02-17	-TEMPORARY OWNERSHIP	NOS	52		20.553359				
	THE PRESENT LAND USE:								
02-18	-IRRIGATED PADDY FIELD	HA	243		96.047430	1.06	3.5	0.15	0.67
02-19	-UPLAND CROPS	HA	71		28.063241	0.78	3	0.2	0.59
02-20	-HOUSE YARD	HA	253		100	0.26	0.75	0.03	0.13
02-21	-FALLOW	HA	11		4.3478260	0.83	3	0.25	0.81
02-22	-OTHERS	HA	9		3.5573122	0.8	2.75	0.35	0.74
	CROPPING INTENCITY:								
02-23	-PADDY	(%)	239		94.466403	145.07	200	25	51.86
02-24	-UPLAND	(%)	35		13.833992	90.14	100	20	48.33
02-25	-OTHERS	(%)	14		5.5335968	70.41	100	20	28.65
	CROP PRODUCTION:								
02-26	-PADDY	TON/HA	233		92.094861	3.7	10	0.4	1.54
02-27	-UPLAND	TON/HA	37		14.624505	1.45	10	0.25	1.7
02-28	-CORN	TON/HA	25		9.8814229	0.15	5	0.1	1.28
02-29	-OTHERS	TON/HA	18		7.1146245	0.96	3	0.1	0.8
	AGRICULTURAL INPUTS:								
02-30	-FERTILIZER	RP/HA	242		95.652173	143714	726000	10000	114099.81
02-31	-SEED	RP/HA	233		92.094861	23412	130000	4500	17886.19
02-32	-INSECTICIDES	RP/HA	239		94.466403	43499	480000	1000	58930.77
02-33	-MECHANIZATION	RP/HA	132		52.173913	113259	487000	8000	93654.45
02-34	-LABOR	RP/HA	152		60.079051	67475	500000	6500	67569.08
02-35	-CATTLE POWER	RP/HA	129		50.988142	62131	380000	1500	59946
C.	FARM LEVEL IRRIGATION ASPECTS:	QUEST-03							
	ON ARRIVAL IRRIGATION:								
03-01	-AVAILABLE	YES	38		15.019762				
03-02	-NOT AVAILABLE	NONE	215		84.980237				
03-03	FIRST YEAR IRRIGATION:	YEAR	246		97.233201	1986	1992	1971	3.54
03-04	IRRIGATION SUFFICIENT (?):	YES	137		54.150197				
03-05	NOT SUFFICIENT:	NO	116		45.849802				
03-06	TIME OF LAND RECLAMATION:	YEAR	225		88.932806	4	16	1	2.35

03-07	CONTINUOUS IRRIGATION (?):	YES	97		38.339920				
03-08	NOT CONTINUOUS:	NO	156		61.660079				
03-09	PAY FOR IRRIGATION FEE?:	YES	193		76.284584				
03-10	NOT PAY ANY FEE:	NO	60		23.715415				
03-11	IRRIGATION FEE PER YEAR:	RP/YEAR	191		75.494071	14197	100000	1000	11725.76
	WATER USER ASSOCIATION:								
03-12	-MEMBER?	YES	236		93.280632				
03-13	-NOT A MEMBER	NO	17		6.7193675				
03-14	-IMPORTANT?	YES	249		98.418972				
03-15	-NOT IMPORTANT	NO	4		1.5810276				
D.	FINANCIAL CONDITION AND HOUSEHOLD EXPENDITURES:	QUEST-04							

04-01	NON-FARM INCOME:								
04-02	-AVAILABLE	YES	155		61.264822				
04-03	-NOT AVAILABLE	NO	98		38.735177				
04-04	OFF-FARM INCOME 1:	RP/YEAR	158		62.450592	449043	4000000	12000	542920.48
04-05	OFF-FARM INCOME 2:	RP/YEAR	98		38.735177	341995	4000000	18000	532300.72
04-06	OFF-FARM INCOME 3:	RP/YEAR	41		16.205533	320220	1300000	30000	279997.72
	HOUSEHOLD EXPENDITURES:								
04-07	-FOOD/MEALS	RP/YEAR	253		100	794872	2472000	288000	346256.5
04-08	-CLOTHING	RP/YEAR	252		99.604743	117408	700000	10000	108748.62
04-09	-CHILDREN'S EDUCATION	RP/YEAR	213		84.189723	128550	2000000	3600	221829.64
04-10	-HEALTH CARE	RP/YEAR	239		94.466403	51925	1200000	5000	92824.67
04-11	-TRANSPORTATION	RP/YEAR	184		72.727272	57145	400000	1000	73589.55
04-12	-TAXES	RP/YEAR	244		96.442687	38132	175000	1000	36852.7
04-13	-SOCIAL RELATED EVENTS	RP/YEAR	241		95.256916	19366	125000	625	21733.63
	RURAL FINANCIAL SERVICES:								
04-14	-RURAL COOPERATIVE UNIT?	YES	112		44.268774				
04-15	-NO RURAL COOPERATIVE	NO	141		55.731225				
04-16	-RURAL BANK AVAILABLE?	YES	37		14.624505				
04-17	-NO RURAL BANK	NO	216		85.375494				
04-18	-RURAL MARKET AVAILABLE?	YES	76		30.039525				
04-19	-NO RURAL MARKET	NO	117		46.245059				
04-20	-PARTICIPATE IN THE UNIT?	YES	100		39.525691				
04-21	-NOT TO PARTICIPATE	NO	153		60.474308				
E.	MOTIVATION, ENVIRONMENT FACILITIES AND ADAPTATION:	QUEST-05							

	ON ARRIVAL FACILITIES:								
05-01	-LAND ALLOCATION	(%)	61		24.110671	63.93	100	20	25.64
05-02	-HOUSING	(%)	84		33.201581	57.99	100	50	23.86
05-03	-LAND CLEARING	(%)	41		16.205533	62.44	100	10	29.73
05-04	-IRRIGATION FACILITIES	(%)	6		2.3715415	83.33	100	50	25.82
05-05	ON ARRIVAL PERCEPTION:								
05-06	-BETTER THAN ANTICIPATED	NOS	111		43.873517				
05-07	-WORSE THAN ANTICIPATED	NOS	142		56.126482				
	PROPERTY LEFT AT HOME:								
05-08	-AVAILABLE	YES	91		35.968379				
05-09	-NOT AVAILABLE	NO	162		64.031620				
05-10	COMMUNICATION WITH HOME?:	YES	191		75.494071				
05-11	NOT COMMUNICATING:	NO	62		24.505928				
	SOCIAL PARTICIPATION:								
05-12	-NEVER	NOS	6		2.3715415				
05-13	-SOMETIME	NOS	45		17.786561				
05-14	-OFTEN	NOS	183		72.332015				
05-15	-REGULARLY	NOS	19		7.5098814				
	MASTERY OF LOCAL LANGUAGE:								
05-16	-NOT AT ALL	NOS	102		40.316205				
05-17	-VERY LITTLE	NOS	61		24.110671				
05-18	-COMMON WORDS ONLY	NOS	43		16.996047				
05-19	-PASSIVELY	NOS	6		2.3715415				
05-20	-ACTIVELY	NOS	41		16.205533				
	OPINION WITH INTERMARRIAGE								

05-21	-STRONGLY DISAGREE	NOS	7		2.7667984				
05-22	-CONDITIONALLY	NOS	146		57.707509				
05-23	-AGREE	NOS	80		31.620553				
05-24	-FULLY AGREE	NOS	18		7.1146245				
	PUBLIC FACILITIES:								
05-25	-RURAL HEALTH AVAILABLE?	YES	228		90.118577				
05-26	-UNAVAILABLE RURAL HEALTH	NO	25		9.8814229				
05-27	-SCHOOL AVAILABLE?	YES	241		95.256916				
05-28	-SCHOOL NOT AVAILABLE	NO	10		3.9525691				
05-29	-AVAILABLE EXTENSION?	YS	240		94.861660				
05-30	-UNAVAILABLE EXTENSION	NO	13		5.1383399				
05-31	-AVAILABLE GUIDANCE?	YES	237		93.675889				
05-32	-UNAVAILABLE GUIDANCE	NO	16		6.3241106				
	ADAPTATION:								
05-33	-BETTER CONDITION	NOS	247		97.628458				
05-34	-WORSE CONDITION	NOS	6		2.3715415				
	HAPPINESS:								
05-35	-HAPPY	NOS	215		84.980237				
05-36	-SLIGHTLY	NOS	35		13.833992				
05-37	-UNHAPPY	NOS	3		1.1857707				
	PREVIOUS LAND OWNERSHIP:								
05-38	-AVAILABLE	YES	105		41.501976				
05-39	-LAND SIZE IF AVAILABLE	HA	102		40.316205	0.53	3	0.02	0.5
05-40	-NOT AVAILABLE	NO	148		58.498023				
	PRESENT HOUSE CONDITION:								
05-41	-NOT YET REBUILT	N	38		15.019762				
05-42	-REBUILT	YES	215		84.980237				
05-43	-YEAR REBUILT	YEAR	220		86.956521	1984	1992	1956	5.75
05-44	-TIME REQUIRED TO BUILD	YEAR	216		85.375494	4	30	1	3.94
05-45	-FUND REQUIRED TO BUILD	RP.	219		86.561264	2169349	10000000	100000	1711128.52
	HOUSE CATEGORY:								
05-46	-I. VERY SIMPLE HOUSE	NOS	61		24.110671				
05-47	-II. SIMPLE HOUSE	NOS	94		37.154150				
05-48	-III. MODERATE HOUSE	NOS	81		32.015810				
05-49	-IV. PERMANENT HOUSE	NOS	14		5.5335968				
05-50	-V. GOOD HOUSE	NOS	5		1.9762845				

APPENDIX 8-2.1

LIST OF SUMMARY OF THE SOURCES OF INFORMATION THE TRANSMIGRANT HEARD ABOUT THE PROGRAM FOR THE FIRST TIME

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED (N) LAMASI (N)	LAMASI (%)	KALAENA (N)	KALAENA (%)	KAREM (N)	KAREM (%)	GENERAL TOTAL (N)	GENERAL TOTAL (%)	GENERAL REMARK
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0	NO RESPONSES OR COMMENTS	0		0		0		0		NO RESPONSES: (%) -LAMASI 0 -KALAENA 0 -KAREM 0 OVERALL-AVERAGED 0
I	PARENT/UNCLE	13	20.634	4	4.9382	1	0.8333	18	6.8181	
II	FRIENDS PREVIOUSLY MIGRATED	2	3.1746	14	17.283	9	7.5	25	9.4696	
III	RELATIVES PREVIOUSLY MIGRATED	14	22.222	10	12.345	1	0.8333	25	9.4696	
IV	NEIGHBOUR PREVIOUSLY MIGRATED	9	14.285	0	0	3	2.5	12	4.5454	
V	LOCAL GOVERNMENT EXTENSION	3	4.7619	18	22.222	4	3.3333	25	9.4696	
VI	SEE DIRECTLY THE LOCATION	1	1.5873	0	0	0	0	1	0.3787	
VII	FROM THE COMMUNITY	2	3.1746	0	0	0	0	2	0.7575	
VIII	LOCAL PEOPLE	1	1.5873	0	0	0	0	1	0.3787	
IX	VILLAGE HEAD	7	11.111	2	2.4691	19	15.833	28	10.606	
X	RURAL EXTENSION STAFF	8	12.698	17	20.987	13	10.833	38	14.393	
XI	TRANSMIGRATION EXTENSION	1	1.5873	16	19.753	68	56.666	85	32.196	
XII	TEACHER	1	1.5873	0	0	0	0	1	0.3787	
XIII	FILM PROPAGANDA	1	1.5873	0	0	0	0	1	0.3787	
XIV	PREVIOUS TRANSMIGRANT	0	0	0	0	2	1.6666	2	0.7575	
	TOTAL	63	100	81	100	120	100	264	100	

APPENDIX 8-2.2

LIST OF SUMMARY OF THE LIVING PROSPECTS THAT THE TRANSMIGRANT HEARD BEFORE JOINING THE PROGRAM

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	12		0		0		12		NO RESPONSES: <%> -LAMASI 19.354 -KALAENA 0 -RAREM 0 OVERALL-AVERAGED 4.7430
I	BETTER LIVING PROSPECT IN THE NEW, VIRGIN, ABUNDANT AND FERTILE LAND ALLOCATION FOR THE TRANSMIGRANT, AS COMPARED TO THE SCARCE LAND RESOURCES IN JAVA <HOME OF ORIGIN>.	17	36.170	28	40.579	33	27.272	78	32.911	
II	PROSPEROUS LIVING WITH A SECURE ENVIRONMENT AWAITING IN THE TRANSMIGRATION AREA, SUPPORTED BY THE GOVERNMENT WITH THE NECESSARY FACILITIES, IRRIGATION AND PUBLIC UTILITIES.	13	27.659	25	36.231	38	31.404	76	32.067	
III	EASY TO MAKE LIFE IN THE TRANSMIGRATION AREA, ALL WE NEED IS TO FARM OUR LAND ALLOCATION.	4	8.5106	2	2.8985	6	4.9586	12	5.0632	
IV	PROMISING AGRICULTURAL LANDS WITH A HIGHLY PRODUCTIVE IRRIGATED SOIL AWAITING FOR THE TRANSMIGRANT TO BE FARMED AND CULTIVATED	5	10.638	8	11.594	12	9.9173	25	10.548	
V	BETTER CHANCE TO IMPROVE THE LIVING CONDITION AS WELL AS TO HAVE A RELIABLE AND CERTAIN INCOME IN THE TRANSMIGRATION AREA.	5	10.638	4	5.7971	21	17.355	30	12.658	
VI	THE PREVIOUS CONDITION IN THE HOME OF ORIGIN IS TOO CROWDED AND UNHEALTHY. BY FOLLOWING THE TRANSMIGRATION PROGRAM THIS SITUATION WILL NEVER HAPPEN AGAIN. <SOLVED>	3	6.3829	2	2.8985	11	9.0909	16	6.7510	
	TOTAL	47	100	69	100	121	100	237	100	

LIST OF SUMMARY OF THE INFORMATION THE TRANSMIGRANT HEARD ABOUT THE FACILITIES TO BE GIVEN WHEN JOINING THE TRANSMIGRATION PROGRAM

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED (N) LAMASI (N)	LAMASI (%)	KALAENA (N)	KALAENA (%)	RAREM (N)	RAREM (%)	GENERAL TOTAL (N)	GENERAL TOTAL (%)	GENERAL REMARK
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0	NO RESPONSES OR COMMENTS	4		1		0		5		NO RESPONSES: (%)
I	AGRICULTURAL LAND AND HOUSE-YARD.	8	15.094	2	2.7027	7	6.1403	17	7.0539	-LAMASI 6.4516 -KALAENA 1.4285 -RAREM 0
II	AGRICULTURAL LAND, HOUSE-YARD AND SIMPLE HOUSE.	12	22.641	12	16.216	10	8.7719	34	14.107	OVERALL-AVERAGED 1.9762
III	AGRICUKTURAL LAND, HOUSE-YARD, HOUSING AND LIVING ALLOWANCE.	14	26.415	33	44.594	73	64.035	120	49.792	
IV	AGRICULTURAL LAND, HOUSE-YARD, HOUSING, TOGETHER WITH AGRICULTURAL FACILITIES AND SIMPLE HOUSEHOLD EQUIPMENT, & CLOTHING.	7	13.207	27	36.486	21	18.421	55	22.821	
V	AGRICULTURAL LAND, HOUSE-YARD AND BUILDING MATERIALS.	1	1.8867	0	0	3	2.6315	4	1.6597	
VI	AGRICULTURAL LAND.	6	11.320	0	0	0	0	6	2.4896	
VII	NONE/SELF EFFORT.	4	7.5471	0	0	0	0	4	1.6597	
VIII	HOUSING AND LIVING ALLOWANCE.	1	1.8867	0	0	0	0	1	0.4149	
	TOTAL	53	100	74	100	114	100	241	100	

APPENDIX 8-2.4

LIST OF SUMMARY OF THE TRANSMIGRANTS' OPINION ABOUT THE DECISION TO PARTICIPATE IN THE TRANSMIGRATION PROGRAM

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	5		0		1		6		NO RESPONSES: <%>
I	TO OBTAIN A BETTER LIFELIHOOD AND IMPROVE THE LIVING CONDITION.	6	8.2191	2	2.7777	38	27.737	46	16.312	-LAMASI 8.0645 -KALAENA 0 -RAREM 0.8264
II	ENCOURAGED BY MY RELATIVES, FRIENDS AND/OR PARENTS.	10	13.698	0	0	0	0	10	3.5460	OVERALL-AVERAGED 2.3715
III	JUST FOLLOW THE MAJORITY DECISION.	1	1.3698	0	0	0	0	1	0.3546	
IV	I TRUSTED MY FRIEND TO DECIDE.	1	1.3698	0	0	0	0	1	0.3546	
V	INTERESTED WITH THE OPPORTUNITY TO HAVE AND TO FARM OWN LAND.	5	6.8493	28	38.888	40	29.197	73	25.886	
VI	SELF MOTIVATION TO IMPROVE MY LIVING CONDITION THROUGH AGRICULTURAL ENDEAVOUR.	7	9.5890	0	0	1	0.7299	8	2.8368	
VII	LAND HAS BECAME MORE AND MORE SCARCE IN JAVA, HARD TO MAINTAIN A RELIABLE LIFELIHOOD.	5	6.8493	2	2.7777	2	1.4598	9	3.1914	
VIII	INTERESTED WITH THE INFORMATION ABOUT THE TRANMIGRATION PROGRAM THAT I HEARD BEFORE.	3	4.1095	6	8.3333	3	2.1897	12	4.2553	
IX	INTERESTED IN THE PROVISION OF THE LIVING ALLOWANCE AND PERMANENT WORKING OPPORTUNITY AS A FARMER.	5	6.8493	0	0	0	0	5	1.7730	
X	INTERESTED WITH THE PROMISING AGRICULTURAL LAND AND FACILITIES THAT I HAD NEVER HAD IN MY HOME TOWN.	24	32.876	28	38.888	42	30.656	94	33.333	
XI	INTERESTED WITH THE ACHIEVEMENT OF MY FRIEND WHO OCCASIONALLY RETURN HOME TO VISIT US.	1	1.3698	2	2.7777	0	0	3	1.0638	
XII	I FELT DESPERATE IN MY HOME OF ORIGIN WITH NO LAND, CROWDED ENVIRONMENT, NO MORE TO RELY FOR LIFE.	5	6.8493	4	5.5555	10	7.2992	19	6.7375	
XIII	NO CHOICE DUE TO VOLCANIC ERUPTION	0	0	0	0	1	0.7299	1	0.3546	
	TOTAL	73	100	72	100	137	100	282	100	

APPENDIX 8-2.5

LIST OF SUMMARY OF THE TRANSMIGRANTS' MEANS OF LIFE PRIOR TO THEIR PARTICIPATION IN THE TRANSMIGRATION PROGRAM

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED (N) LAMASI (N)	LAMASI (%)	KALAENA (N)	KALAENA (%)	RAREM (N)	RAREM (%)	GENERAL TOTAL (N)	GENERAL TOTAL (%)	GENERAL REMARK
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0	NO RESPONSES OR COMMENTS	25		20		8		53		NO RESPONSES: (%) -LAMASI 40.322 -KALAENA 28.571 -RAREM 6.6115 OVERALL-AVERAGED 20.948
I	AGRICULTURAL LABORER.	10	24.390	31	51.666	47	35.074	88	37.446	
II	TO WORK A SHARE-CROPPER UNDER THE UPLAND CROP CULTIVATION.	5	12.195	0	0	4	2.9850	9	3.8297	
III	TO CULTIVATE UPLAND CROPS AND WORK AS A SEASONAL AGRICULTURAL LABORER.	5	12.195	0	0	0	0	5	2.1276	
IV	PART-TIME GOVERNMENT WORKER/RETIREMENT.	1	2.4390	3	5	3	2.2388	7	2.9787	
V	ASSIST MY PARENT TO WORK IN THE AGRICULTURAL ACTIVITIES.	8	19.512	7	11.666	6	4.4776	21	8.9361	
VI	TO WORK AS A DAILY LABORER/CONSTRUCTION WORKER.	5	12.195	14	23.333	56	41.791	75	31.914	
VII	TO MANAGE OUR KIOSK/FOOD STALL.	2	4.8780	1	1.6666	6	4.4776	9	3.8297	
VIII	SHIFTING CULTIVATOR.	4	9.7560	0	0	0	0	4	1.7021	
IX	FISHING, SAGO/WOOD HUNTER.	1	2.4390	0	0	1	0.7462	2	0.8510	
X	MASON/BRICK LAYER/CARPENTER.	0	0	1	1.6666	4	2.9850	5	2.1276	
XI	ANIMAL/CATTLE TRADER.	0	0	1	1.6666	1	0.7462	2	0.8510	
XII	BUY AND SELL GOODS (LOCAL TRADER), WHOLE SALER AND/OR GROCER.	0	0	1	1.6666	5	3.7313	6	2.5531	
XIII	TRICYCLE PULLER/BARBER.	0	0	0	0	1	0.7462	1	0.4255	
XIV	POULTRY CULTIVATOR.	0	0	1	1.6666	0	0	1	0.4255	
	TOTAL	41	100	60	100	134	100	235	100	

APPENDIX 8-3.1

LIST OF SUMMARY OF THE THE TRANSMIGRANTS' REASONS WHY THE LAND TITLE IS IMPORTANT FOR THEM

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		KAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
I	TO ASSURE THE LEGAL LAND OWNERSHIP STATUS	30	31.914	35	27.777	62	42.758	127	34.794	ALL RESPONDENTS ARE GIVING RESPONCES.
II	TO HAVE A LEGAL PROTECTION	5	5.3191	23	18.253	27	18.620	55	15.068	
III	TO PREVENT THE LAND FROM ANY POSSIBLE CLAIM	6	6.3829	17	13.492	19	13.103	42	11.506	
IV	TO FEEL SECURE IN FARMING THE LAND	0	0	0	0	10	6.8965	10	2.7397	
V	TO BE ABLE TO RESERVE THE LAND AS A CREDIT MORTGAGE WHEN NECESSITY AROUSES	21	22.340	23	18.253	1	0.6896	45	12.328	
VI	TO ASSURE THE PROVISION OF LAND COMPENSATION IN CASE OF DEVELOPMENT PROJECT	4	4.2553	0	0	0	0	4	1.0958	
VII	TO JUSTIFY THE ACTUAL SIZE AND LOCATION OF THE LAND <EVIDENCE>	3	3.1914	26	20.634	22	15.172	51	13.972	
VIII	TO HAVE A BETTER VALUE AND MARKET PROSPECT OF THE LAND	21	22.340	0	0	1	0.6896	22	6.0273	
IX	TO HAVE GOVERNMENT ACCREDITATION	4	4.2553	2	1.5873	3	2.0689	9	2.4657	
		94	100	126	100	145	100	365	100	

APPENDIX 8-3.2

LIST OF SUMMARY OF THE PROBLEMS AND OPINION THE TRANSMIGRANT ABOUT THE LAND-USE ASPECTS THEY HAD

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED (N)								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
I	-NO COMMENTS AND /OR RESPONSES	26		28		13		67		NO RESPONSES (%) -LAMASI 41.93 -KALAENA 40 -RAREM 10.74 OVERALL-AVERAGED 26.48
II	-DIFFICULTY IN THE ARRANGEMENT OF A UNIFORM CROPPING SCHEDULE DUE TO IRREGULARITY OF THE LAND DEVELOPMENT STAGES.	25	32.051	15	17.241	20	10.416	60	16.806	
III	-LACK OF SKILL AND EXPERIENCE ON AGRICULTURAL TECHNIQUES SO WE NEED MORE AGRICULTURAL EXTENSION.	1	1.2820	10	11.494	22	11.458	33	9.2436	
IV	-EXTREMELY DIFFICULT TO UNDERTAKE THE NEW LAND RECLAMATION UNDER THE DRY LAND CONDITION, OR PRIOR TO IRRIGATION COMMENCEMENT.	5	6.4102	10	11.494	40	20.833	55	15.406	
V	-SUFFERED FROM IRRIGATION WATER SHORTAGE DURING THE PROCESS OF THE NEW LAND RECLAMATION.	1	1.2820	4	4.5977	26	13.541	31	8.6834	
VI	-LOW CROPPING INTENCITY AND IRREGULAR PLANTING PATTRN BECAUSE THE WATER SHOULD BE ROTATED DUE TO THE CURRENT UNSTABLE LAND CONDITION.	2	2.5641	0	0	7	3.6458	9	2.5210	
VII	-LACK OF AGRICULTURAL LABORER AND/OR MECHANIZATION DURING THE LAND PREPARATION AND PLANTING SEASON.	0	0	4	4.5977	2	1.0416	6	1.6806	
VIII	-SUFFERED FRON IRRIGATION WATER SHORTAGE FOR LAND PREPARATION AND DURING THE CROP MAINTENANCE.	15	19.230	1	1.1494	21	10.937	37	10.364	
IX	-THE STATUS OF LAND ALLOCATION IS STILL UNCERTAIN, UNDER DISPUTE AND INSECURE TO CULTIVATE.	0	0	0	0	3	1.5625	3	0.8403	
X	-WE DO ENJOY A STABLE AND GOOD CROPS AS WELL AS IRRIGATION SERVICES.	7	8.9743	7	8.0459	3	1.5625	17	4.7619	
XI	-IRRIGATION ROTATION HAS CREATED A NUMBER OF CONSTRAINTS FOR THE CURRENT AGRICULTURAL IMPLEMENTATION.	0	0	0	0	10	5.2083	10	2.8011	
XII	-SUFFERED FROM PEST ATTACK DUE TO THE NON UNIFORMITY OF PLANTATION, MUCH OF THE VICINITY LANDS ARE STILL UNCULTIVATED/WILD VEGETATION.	7	8.9743	15	17.241	8	4.1666	30	8.4033	
XIII	-LACK OF CAPITAL FOR PERFORMING AGRICULTURAL WORKS, AND DIFFICULT TO OBTAIN AGRICULTURAL CREDIT FROM THE RURAL BANK.	0	0	1	1.1494	0	0	1	0.2801	
XIV	-THE LAND ALLOCATION IS NOT SUITABLE FOR IRRIGATED PADDY, POOR SOIL AND TOPOGRAPHICAL CONDITIONS.	5	6.4102	1	1.1494	3	1.5625	9	2.5210	
XV	-LOW AND UNSTABLE CROP PRODUCTION.	0	0	0	0	4	2.0833	4	1.1204	
XVI	-THE NEW LAND RECLAMATION NEEDS AN EXCESSIVELY HIGH WATER CONSUMPTION AND OCCURED FOR SEVERAL YEARS.	0	0	4	4.5977	9	4.6875	13	3.6414	
XVII	-POOR AND INUFFICIENT AGRICULTURAL EXTENSION SERVICES. (LESS GUIDANCE HAS BEEN PERFORMED)	4	5.1282	4	4.5977	10	5.2083	18	5.0420	
XVIII	-WE APPRECIATE THE EFFORT TO PROVIDE IRRIGATION FOR OUR LAND.	0	0	0	0	4	2.0833	4	1.1204	
XIX	-LACK OF FARMERS' INTEGRATION AND POOR COOPERATIVE SPIRIT TO CONDUCT AGRICULTURAL ACTIVITIES. (WE NEED ORGANNIZATIONAL COORDINATION)	4	5.1282	11	12.643	0	0	15	4.2016	
XX	-INCONSISTENT PROVISION OF AGRICULTURAL INPUTS.	2	2.5641	0	0	0	0	2	0.5602	
	TOTAL	78	100	87	100	192	100	357	100	

APPENDIX 8-4.1

LIST OF SUMMARY OF THE TRANSMIGRANTS' WAY OF LIFE PRIOR TO THE PROVISION OF IRRIGATION INFRASTRUCTURES

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED (N)								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0	NO RESPONSES OR COMMENTS	8		5		0		13		NO RESPONSES: (%) -LAMASI 12.903 -KALAENA 7.1428 -RAREM 0 OVERALL-AVERAGED 5.1383
I	TO CULTIVATE UPLAND CROPS SUCH AS CASSAVA, UPLAND PADDY, CORN, BEANS, ROOT-CROPS AND OTHER MIXED CROPS.	43	59.722	58	75.324	114	76.510	215	72.147	
II	TO WORK AS AN AGRICULTURAL LABORER.	2	2.7777	8	10.389	10	6.7114	20	6.7114	
III	TO WORK AT THE FACTORY, SAWMILL AND TIMBER PROCESSOR IN THE NEAR BY.	0	0	2	2.5974	9	6.0402	11	3.6912	
IV	TO WORK AS FOOD GROCER OR RETAILER	0	0	1	1.2987	3	2.0134	4	1.3422	
V	TO WORK AS A CARPENTER/CONSTRUCTION LABORER.	2	2.7777	1	1.2987	4	2.6845	7	2.3489	
VI	AS A REASONAL LABORER IN ANY WORKS.	0	0	0	0	1	0.6711	1	0.3355	
VII	BUYING AND SELLING CATTLES.	0	0	1	1.2987	1	0.6711	2	0.6711	
VIII	TO CULTIVATE RAINFED OR SWAMP PADDY	1	1.3888	3	3.8961	1	0.6711	5	1.6778	
IX	RETIRED GOVERNMENT WORKER.	1	1.3888	2	2.5974	0	0	3	1.0067	
X	TO WORK AS A SHARE CROPPER.	6	8.3333	0	0	0	0	6	2.0134	
XI	TO CULTIVATE LOWLAND PADDY THROUGH OWN EFFORT TO PROVIDE SIMPLE IRRIGATION FACILITIES.	12	16.666	1	1.2987	2	1.3422	15	5.0335	
XII	TO WORK AS WOOD HUNTER OR FISHING.	4	5.5555	0	0	2	1.3422	6	2.0134	
XIII	TO CULTIVATE FRUIT TREES.	1	1.3888	0	0	0	0	1	0.3355	
XIV	TO MAKE BAMBOO OR PALM LEAF HANDY CRAFT.	0	0	0	0	2	1.3422	2	0.6711	
	TOTAL	72	100	77	100	149	100	298	100	

APPENDIX 8-4.2

LIST OF SUMMARY OF THE TRANSMIGRANTS' OPINIONS AND REASONS ABOUT THE IMPORTANCE OF WATER USERS' ASSOCIATION

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREN		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	26		0		0		26		NO RESPONSES: <%>
I	TO FACILITATE A PROPER WATER MANAGEMENT AT THE FARM LEVEL BY MEANS OF ORGANIZED GROUP ARRANGEMENT.	26	24.074	46	55.421	64	57.657	136	62.100	-LAMASI 41.935 -KALAENA 0 -RAREN 0 OVERALL-AVERAGED 10.276
II	TO FACILITATE A SIGNIFICANT INCREASE IN THE CROPPING INTENCITY BY WAY OF MUTUAL COOPERATION.	0	0	1	1.2048	2	1.8018	3	1.3698	
III	TO WORK TOGETHER CONSISTENTLY FOR SOLVING OUR PROBLEMS OR SETTLING DISPUTES CONCERNING THE WATER DISTRIBUTION.	2	1.8518	2	2.4096	0	0	10	4.5662	
IV	TO ALLOW AN EASY MOBILIZATION OF WORKING GROUPS FOR PERFORMING THE NECESSARY MAINTENANCE OF IRRIGATION FACILITIES AT THE FARM LEVEL.	26	24.074	19	22.891	13	11.711	10	4.5662	
V	TO MAINTAIN A CONSTANT AND FAIR WATER DISTRIBUTION THROUGH THE ORGANIZED WORKING COOPERATION.	21	19.444	12	14.457	16	14.414	10	4.5662	
VI	TO MAINTAIN A UNIFORM CROPPING PRACTICES.	1	0.9259	1	1.2048	0	0	10	4.5662	
VII	TO ENCOURAGE THE IMPLEMENTATION OF EFFICIENT IRRIGATED AGRICULTURE.	1	0.9259	2	2.4096	9	8.1081	10	4.5662	
VIII	AS A RELIABLE MEASURE TO EDUCATE THE FARMER BY WAY OF MUTUAL EXCHANGE OF EXPERIENCE IN THE WATER MANAGEMENT AND OTHER AGRICULTURAL TECHNIQUES.	2	1.8518	0	0	1	0.9009	10	4.5662	
IX	TO ESTABLISH A RELIABLE MEAN OF COMMUNICATING THE AGRICULTURAL AND IRRIGATION INFORMATION AMONG THE MEMBERS, AND TO ALLOW AN EFFICIENT DISSIMINATION OF INFORMATION.	7	6.4814	0	0	5	4.5045	10	4.5662	
X	TO ALLOW A PROPER REPRESENTATION OF THE GROUP FOR DEALING WITH OTHER RELATED INSTITUTIONS. <FOR INSTANCE, APPLICATION OF WATER, AGRICULTURAL INPUTS TO THE GOVERNMENT.>	22	20.370	0	0	1	0.9009	10	4.5662	
	TOTAL	108	100	83	100	111	100	219	100	

APPENDIX 8-5.1

LIST OF SUMMARY OF THE TRANSMIGRANTS' OPINIONS AND COMMENTS ABOUT THE RURAL FINANCIAL INSTITUTIONS

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N> LAMASI <N>	LAMASI <%>	KALAENA <N>	KALAENA <%>	KAREM <N>	KAREM <%>	GENERAL TOTAL <N>	GENERAL TOTAL <%>	GENERAL REMARK
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	11		12		33		56		NO RESPONSES: <%>
I	WE HAVE NO RURAL FINANCIAL INSTITUTION TO SUPPORT THE LOCAL ECONOMY.	23	34.848	16	19.277	49	51.578	88	36.065	-LAMASI 17.741 -KALAENA 17.142 -KAREM 27.272
II	WE HAVE VILLLAGE COOPERATIVE UNIT BUT NOT EFFECTIVE DUE TO LACK OF CAPITAL AND QUALIFIED PERSONNELS.	1	1.5151	25	30.120	21	22.105	47	19.262	OVERALL-AVERAGED 22.134
III	WE COULD ONLY ACCESS CREDIT FROM LOCAL MONEY LENDER WITH HIGH INTEREST RATE, WE TAKE IT THOUGH FOR NO OTHER ALTERNATIVES.	1	1.5151	0	0	6	6.3157	7	2.8688	
IV	WE URGENTLY NEED IN OUR VILLAGE THE RURAL FINANCIAL INSTITUTIONS THAT COULD PROVIDE AGRICULTURAL CREDIT FACILITIES TIMELY AND WITHOUT TOO HIGH INTEREST RATE.	17	25.757	17	20.481	17	17.894	51	20.901	
V	WE COULD GET ACCESS TO THE LOCAL MARKET IN THE NEAR BY VILLAGE, BUT PRICES FOR AGRICULTURAL PRODUCTS ARE NOT STABLE AND OFTEN TOO LOW COMPARED TO OTHER GOODS WE NEED.	8	12.121	4	4.8192	0	0	12	4.9180	
VI	WE URGRNTLY NEED A STABLE MARKET WITH REASONABLE PRICES, AT LEAST COMPARABLE TO OTHER GOODS.	9	13.636	16	19.277	2	2.1052	27	11.065	
VII	WE PROPOSE A BETTER RURAL TRANSPORTATION FACILITIES TO ALLOW US TO BRING OUR PRODUCTS TO THE RELIABLE AND COMPETITIVE MARKET.	7	10.606	5	6.0240	0	0	12	4.9180	
	TOTAL	66	100	83	100	95	100	244	100	

APPENDIX 8-5.2

LIST OF SUMMARY OF THE WAY THE TRANSMIGRANTS PARTICIPATE IN THE ACTIVITIES OF THE RURAL FINANCIAL INSTITUTIONS

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED (N)								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0	NO RESPONSES OR COMMENTS	22		21		23		66		NO RESPONSES: (%)
I	SINCE NO MARKET IN THE VILLAGE, WE ARE RESORTED TO SELL OUR PRODUCTS IN THE REMOTE MARKET WITH UNCERTAIN PRICE AND HIGH TRANSPORTATION COSTS	7	18.918	20	32.786	39	41.052	66	34.196	-LAMASI 35.483 -KALAENA 30 -RAREM 19.008 OVERALL-AVERAGED 26.086
II	WE SELL OUR AGRICULTURAL PRODUCTS TO THE BUYERS WHO SERVE THE VILLAGERS ON DOOR-TO-DOOR BASIS.	1	2.7027	0	0	12	12.631	13	6.7357	
III	WE SELL OUR PRODUCT ON OWN STALL BECAUSE MARKET IS SO REMOTE	0	0	2	3.2786	5	5.2631	7	3.6269	
IV	WE SELL OUR PRODUCTS THROUGH A SYSTEM CALLED "TEBAS", THAT IS TO SELL THE PRODUCT AT THE FARM, IMMEDIATELY BEFORE/AFTER HARVESTING.	14	37.837	0	0	1	1.0526	15	7.7720	
V	THE VILLAGE COOPERATIVE UNIT CANNOT PROVIDE A GOOD BUY AND AGRICULTURAL CREDIT, SO WE SELL OUR CROP AND BUY OUR DAILY NEEDS AT AN UNCERTAIN PRICE. ALSO, OBTAIN CREDIT FROM THE LOCAL MONEY LENDER.	6	16.216	1	1.6393	4	4.2105	11	5.6994	
VI	WE TAKE THE ADVANTAGE OF THE VILLAGE COOPERATIVE UNIT TO OBTAIN CREDIT AND AGRICULTURAL INPUTS THAT COULD BE PAID BACK AFTER THE HARVESTING TIME.	2	5.4054	14	22.950	17	17.894	33	17.098	
VII	WE BECOME A GOOD MEMBER OF THE VILLAGE COOPERATIVE UNIT, SO WE COULD ACCESS TO CREDIT AND SAVING FACILITIES.	7	18.918	8	13.114	7	7.3684	22	11.398	
VIII	WE TAKE THE ADVANTAGE OF OF VILLAGE MARKET FACILITY AT OUR VILLAGE BUT PRICES OFTEN FLUCTUATED AND UNREALISTICALLY LOW.	0	0	16	26.229	10	10.526	26	13.471	
	TOTAL	37	100	61	100	95	100	193	100	

APPENDIX 8-6.1

LIST OF SUMMARY OF THE TRANSMIGRANTS' PLANS THE PROPERTY THEY STILL HAVE AT THEIR PLACE OF ORIGIN

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	33		49		76		158		NO RESPONSES: <%>
I	I GAVE IT TO MY RELATIVE/BROTHER TO CULTIVATE FOR ADDITIONAL INCOME.	13	52	11	52.380	13	28.260	37	40.217	-LAMASI 53.225 -KALAENA 70 -RAREM 62.809 OVERALL-AVERAGED 62.450
II	I AUTHORIZE MY RELATIVE TO CULTIVATE FOR ADDITIONAL INCOME BUT KEEP THE OWNESHIP STATUS FOR UNEXPECTED URGENCIES IN THE FUTURE.	4	16	8	38.095	17	36.956	29	31.521	
III	I SOLD THE LAND FOR BUYING A NEW LAND ADJACENT TO MY RESETTLEMENT AREA AND USING THE REST FOR ADDITIONAL WORKING CAPITAL IN THE AGRICULTURAL IMPLEMENTATION.	2	8	1	4.7619	3	6.5217	6	6.5217	
IV	I LENT IT TEMPORARILY TO MY RELATIVE FOR ADDITIONAL INCOME TILL I NEED THE LAND SOME TIME.	1	4	1	4.7619	0	0	2	2.1739	
V	I KEEP IT AS A MORTGAGE FOR SOME FINANCIAL LOAN FROM MY NEIGHBOUR.	1	4	0	0	0	0	1	1.0869	
VI	I SOLD THE LAND FOR IMPROVING/REBUILDING MY HOUSE AND KEEP SOME FOR BUYING MORE LAND	2	8	0	0	0	0	2	2.1739	
VII	I LET THE SHARE-CROPPER TO CULTIVATE FOR ADDITIONAL INCOME.	2	8	0	0	1	2.1739	3	3.2608	
VIII	I KEEP THE LAND FOR FUTURE RESERVATION OF MY CHILDREN TO PURSUE HIGH EDUCATION/GAVE THEM LATER.	0	0	0	0	12	26.086	12	13.043	
	TOTAL	25	100	21	100	46	100	92	100	

APPENDIX 8-6.2

LIST OF SUMMARY OF THE TRANSMIGRANTS' OPINIONS AND COMMENTS ABOUT THE SETTLERS ADAPTATION TO THE TRANSMIGRATION SCHEMES

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N> LAMASI <N>	LAMASI <%>	KALAENA <N>	KALAENA <%>	RAREM <N>	RAREM <%>	GENERAL TOTAL <N>	GENERAL TOTAL <%>	GENERAL REMARK
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	-NO RESPONSES OR COMMENTS	22		29		18		69		NO RESPONSES: <%> -LAMASI 35.483 -KALAENA 41.428 -RAREM 14.876 OVERALL-AVERAGED 27.272
I	-OUR VILLAGE STILL HAMPERED BY SOME PROBLEM ABOUT SECURITY DUE TO OCCASIONAL THEFTS AND ALSO POOR ENVIRONMENTAL CONDITION.	13	27.659	20	44.444	69	61.061	102	49.756	
II	-WE ENJOY A BETTER AND SECURE RURAL ENVIRONMENT WITH A REALIABLE MUTUAL GUIDING SYSTEM AMONG THE COMMUNITY MEMBERS.	8	17.021	0	0	18	15.929	26	12.682	
III	-OFTEN SUFFERED FROM VANDALISM AND YOUTH DELINQUENCY	7	14.893	0	0	0	0	7	3.4146	
IV	-IT IS URGENT TO ENCOURAGE COOPERATIVE WORKING SPIRIT AND INTEGRATED EFFORTS TO SOLVE OUR PROBLEMS SUCH AS; POOR WATER DELIVERY VANDALISM, THEFTS, MUTUAL AIDS IMPLEMENTATION, NEW LAND RECLAMATION AND SO ON.	3	6.3829	0	0	6	5.3097	9	4.3902	
V	-WE NEED MORE AGRICULTURAL TECHNIQUE EQUIPMENT AND FACILITIES ESPECIALLY FOR UNDERTAKING THE NEW LAND RECLAMATION AND OTHER AGRICULTURAL WORKS	5	10.638	3	6.6666	1	0.8849	9	4.3902	
VI	-MORE EXTENSION NEEDED FOR STRENGTHENING THE TRANSMIGRANTS' AWARENESS ON THEIR RIGHT, OBLIGATION AND RESPONSIBILITIES	1	2.1276	0	0	2	1.7699	3	1.4634	
VII	-WE ARE HAPPY TO LIVE IN A PEACEFUL AND SECURE ENVIRONMENT, AS WELL AS BETTER BROTHERHOOD RELATIONSHIP.	4	8.5106	0	0	3	2.6548	7	3.4146	
VIII	-SPECIAL ATTENTION IS NEEDED ON THE PROVISION OF A RELIABLE AND EFFECTIVE SERVICE OF THE RURAL FINANCIAL ONSTITUTIONS. WE CURRENTLY LACK OF MARKETING, CAPITAL AND INPUTS FOR AGRICULTURE.	1	2.1276	5	11.111	2	1.7699	8	3.9024	
IX	-WE NEED MORE TECHNICAL GUIDANCE AND AGRICULTURAL EXTENSION FROM BOTH IRRIGATION AND AGRICULTURAL EXTENSION OFFICIALS THROUGH SOME KIND OF INTEGRATED APPROACH.	1	2.1276	5	11.111	2	1.7699	8	3.9024	
X	-POOR VILLAGE LEADERSHIP TO BE ABLE TO GUIDE AND TO MOTIVATE VILLAGERS.	1	2.1276	4	8.8888	0	0	5	2.4390	
XI	-COSTLY AGRICULTURAL INPUTS AND HIGH LIVING COSTS, BUT WE HAVE LOW PRODUCTIVITY AND UNREALISTIC PRICE OF AGRICULTURAL PRODUCTS, SO IT DOES NOR PAY OFF.	0	0	1	2.2222	1	0.8849	2	0.9756	
XII	-UNCERTAINTY OF LAND OWNERSHIP DUE TO OCCASIONAL CLAIMS, WITH NO LAND CERTIFICATE IN HAND.	0	0	0	0	1	0.8849	1	0.4878	
XIII	-LACK OF SOCIAL PARTICIPATION AND COOPERATIVE WORKING SPIRIT AMONG THE COMMUNITY MEMBERS WITH POOR ORGANIZATIONAL ARRANGEMENT.	3	6.3829	3	6.6666	1	0.8849	7	3.4146	
IX	-VERY LIMITED PUBLIC UTILITIES, SUCH AS HEALTH SERVICES, SCHOOLL, TRANSPORTATION DRINKING WATER AND RURAL ELECTRIFICATION.	0	0	4	8.8888	7	6.1946	11	5.3658	
	TOTAL	47	100	45	100	113	100	205	100	

APPENDIX 8-6.3

LIST OF SUMMARY OF THE NON-AGRICULTURAL INCOME OF THE TRANSMIGRANT

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N> LAMASI <N>	LAMASI <%>	KALAENA <N>	KALAENA <%>	RAREM <N>	RAREM <%>	GENERAL TOTAL <N>	GENERAL TOTAL <%>	GENERAL REMARK
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	18		27		47		92		NO RESPONSES: <%>
I	RICE MILLING	5	5.6818	2	2.8169	0	0	7	2.4054	-LAMASI 29.032 -KALAENA 38.571 -RAREM 38.842
II	DAILY LABORER/CONSTRUCTION WORKER	5	5.6818	8	11.267	20	15.151	33	11.340	OVERALL-AVERAGED 36.363
III	SHARE CROPPER	3	3.4090	0	0	0	0	3	1.0309	
IV	PART-TIME GOVERNMENT WORKER	4	4.5454	2	2.8169	1	0.7575	7	2.4054	
V	FOOD KIOSK/STALL/RETAILER/GROCER	13	14.772	12	16.901	33	25	58	19.931	
VI	COCOA/COCONUT TRADER	8	9.0909	8	11.267	0	0	16	5.4982	
VII	SELL AND BUY ANIMAL	19	21.590	2	2.8169	0	0	21	7.2164	
VIII	TRICYCLE PULLER	3	3.4090	0	0	0	0	3	1.0309	
IX	HOUSE YARD/FRUIT TREES	15	17.045	12	16.901	41	31.060	68	23.367	
X	POULTRY	1	1.1363	5	7.0422	1	0.7575	7	2.4054	
XI	BAMBOO BRAIDING/HANDY CRAFT	0	0	5	7.0422	0	0	5	1.7182	
XII	MAKE COCONUT OIL/CRACKER	1	1.1363	5	7.0422	1	0.7575	7	2.4054	
XIII	AGRICULTURAL LABORER	8	9.0909	7	9.8591	21	15.909	36	12.371	
XIV	RETIREMENT/SEASONAL WORKER	0	0	1	1.4084	0	0	1	0.3436	
XV	WOOD HUNTING	0	0	1	1.4084	2	1.5151	3	1.0309	
XVI	FACTORY WORKER	0	0	0	0	4	3.0303	4	1.3745	
XVII	MASON/CARPENTER/BRICK LAYER	1	1.1363	0	0	2	1.5151	3	1.0309	
XVIII	TAILOR/BARBER	0	0	0	0	1	0.7575	1	0.3436	
XIX	GOODS TRADER	0	0	0	0	4	3.0303	4	1.3745	
XX	FURNITURE MAKER	0	0	0	0	1	0.7575	1	0.3436	
XXI	MECHANICS	1	1.1363	1	1.4084	0	0	2	0.6872	
XXII	FISHING	1	1.1363	0	0	0	0	1	0.3436	
	TOTAL	88	100	71	100	132	100	291	100	

APPENDIX 8-6.4

LIST OF SUMMARY OF THE HOUSING CONDITION OF THE TRANSMIGRANTS

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	2		0		2		4		NO RESPONCES: <%>
I	PERMANENT HOUSE WITH MASONRY FOUNDATION, BRICK WALL, TILE ROOFING, PLASTERED FLOOR, GLASS WINDOW AND FULLY PAINTED.	2	3.3333	1	1.4285	4	3.3613	7	2.8112	-LAMASI 3.2258 -KALAENA 0 -RAREM 1.6528 OVERALL-AVERAGED 1.5810
II	PERMANENT HOUSE WITH BRICK FOUNDATION, BRICK WALL, TILE ROOFING, PLASTERED FLOOR AND FULLY PAINTED.	2	3.3333	7	10	8	6.7226	17	6.8273	
III	PERMANENT HOUSE WITH MASONRY FOUNDATION, CORRUGATED METAL ROOFING, BRICK WALL, PLASTERED AND FULLY PAINTED	8	13.333	10	14.285	19	15.966	37	14.859	
IV	MASONRY FOUNDATION WITH BRICK WALL PLASTERED FLOOR, CORRUGATED METAL ROOFING, PARTLY PAINTED.	6	10	12	17.142	10	8.4033	28	11.244	
V	SEMI PERMANENT HOUSE, BRICK FOUNDATION, PARTLY BRICK AND PARTLY PLANK WALL, TILE ROOFING AND UNPLASTERED FLOOR.	7	11.666	13	18.571	20	16.806	40	16.064	
VI	WOODEN HOUSE, CORRUGATED METAL ROOFING, PLANK WALL, NO FOUNDATION AND UNPLASTERED FLOOR, GLASS WINDOW.	11	18.333	3	4.2857	25	21.008	39	15.662	
VII	WOODEN HOUSE, HIGH POST, CORRUGATED METAL ROOFING, GLASS WINDOW, PLANK WALL AND FLOOR, NO FOUNDATION.	18	30	1	1.4285	9	7.5630	28	11.244	
VIII	SIMPLE WOODEN HOUSE <AS MOST HOUSE FOR TRANSMIGRANT AT THE FIRST ARRIVAL> PLANK WALL, NO FOUNDATION UNPLASTERED FLOOR AND CORRUGATED METAL ROOFING.	3	5	7	10	8	6.7226	18	7.2289	
IX	SIMPLE WOODEN HOUSE, PALM-LEAF ROOFING, PLANK WALL, NO FOUNDATION AND UNPLASTERED FLOOR.	2	3.3333	12	17.142	12	10.084	26	10.441	
X	VERY SIMPLE WOODEN HOUSE, PALM-LEAF ROOFING, BAMBOO WALL, NO FOUNDATION AND UNPLASTERED FLOOR <BARE SOIL>.	1	1.6666	4	5.7142	4	3.3613	9	3.6144	
	TOTAL	60	100	70	100	119	100	249	100	

APPENDIX 8-7.1

LIST OF SUMMARY OF THE FIRST THREE MOST SIGNIFICANT PROBLEMS THE TRANSMIGRANT CURRENTLY HAVE

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	17		4		10		31		NO RESPONSES: <%> -LAMASI 27.419 -KALAENA 5.7142 -RAREM 8.2644 OVERALL-AVERAGED 12.252
	PROBLEM A. <THE FIRST THREE MOST SIGNIFICANT PROBLEMS>									
I	POOR CROPPING SCHEDULE	0	0	9	13.636	0	0	9	4.1474	
II	POOR FARM LEVEL IRRIGATION	2	4.8780	1	1.5151	1	0.9090	4	1.8433	
III	COSTLY AGRICULTURAL INPUTS	1	2.4390	1	1.5151	1	0.9090	3	1.3824	
IV	IRRIGATION WATER SHORTAGE	4	9.7560	3	4.5454	54	49.090	61	28.110	
V	TOO LOW PRICES OF PADDY/OTHER CROPS	9	21.951	17	25.757	13	11.818	39	17.972	
VI	INSECURE/SEVERE VILLAGE SECURITY	3	7.3170	6	9.0909	20	18.181	29	13.364	
VII	JUVENILE DELINQUENCY/VANDALISM	6	14.634	0	0	0	0	6	2.7649	
VIII	POOR COOPERATIVE SPIRIT	7	17.073	0	0	0	0	7	3.2258	
IX	POOR WATER USERS' ASSOCIATION	1	2.4390	0	0	0	0	1	0.4608	
X	POOR/NO IRRIGATION MAINTENANCE	1	2.4390	6	9.0909	10	9.0909	17	7.8341	
XI	SEVERE PEST ATTACKS	1	2.4390	0	0	0	0	1	0.4608	
XII	NO RURAL ELECTRICITY	2	4.8780	0	0	1	0.9090	3	1.3824	
XIII	NO MARKET FACILITY	1	2.4390	1	1.5151	0	0	2	0.9216	
XIV	POOR PUBLIC TRANSPORTATION	2	4.8780	1	1.5151	3	2.7272	6	2.7649	
XV	POOR/NO VILLAGE COOPERTAIVE UNIT	0	0	17	25.757	0	0	17	7.8341	
XVI	POOR TAXES ARRANGEMENT	0	0	1	1.5151	0	0	1	0.4608	
XVII	NO SECONDARY SCHOOL	0	0	1	1.5151	0	0	1	0.4608	
XVIII	PROBLEM ON LAND RECLAMATION	1	2.4390	0	0	1	0.9090	2	0.9216	
XIX	POOR RURAL GOVERNMENT MANAGEMENT	0	0	1	1.5151	0	0	1	0.4608	
XX	NO RURAL HEALTH	0	0	1	1.5151	0	0	1	0.4608	
XXI	UNSOLVED LAND DISPUTES	0	0	0	0	2	1.8181	2	0.9216	
XXII	LOW PRODUCTIVITY	0	0	0	0	3	2.7272	3	1.3824	
XXIII	LACK OF LABOR DURING THE HARVESTING	0	0	0	0	1	0.9090	1	0.4608	
	TOTAL	41	100	66	100	110	100	217	100	

APPENDIX 8-7.2

LIST OF SUMMARY OF THE SECOND THREE MOST SIGNIFICANT PROBLEMS THE TRANSMIGRANTS CURRENTLY HAVE

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		KAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	33		2		16		51		NO RESPONSES: <%>
	PROBLEM B. <THE SECOND THREE MOST SIGNIFICANT PROBLEMS>									-LAMASI 53.225 -KALAENA 2.8571 -KAREM 13.223
I	POOR AGRICULTURAL SCHEDULE	0	0	1	1.4705	0	0	1	0.4950	OVERALL-AVERAGED 20.158
II	POOR IRRIGATION FACILITIES	2	6.8965	4	5.8823	0	0	6	2.9702	
III	COSTLY AGRICULTURAL INPUTS	1	3.4482	13	19.117	10	9.5238	24	11.881	
IV	IRRIGATION WATER SHORTAGE	2	6.8965	0	0	18	17.142	20	9.9009	
V	TOO LOW PRICES OF PADDY/OTHER CROPS	1	3.4482	13	19.117	20	19.047	34	16.831	
VI	INSECURE/SEVERE VILLAGE SECURITY	2	6.8965	7	10.294	35	33.333	44	21.782	
VII	JUVENILE DELINQUENCY/VANDALISM	1	3.4482	0	0	0	0	1	0.4950	
VIII	POOR SOCIAL PARTICIPATION	3	10.344	0	0	0	0	3	1.4851	
IX	LOW AGRICULTURAL PRODUCTIVITY	1	3.4482	0	0	9	8.5714	10	4.9504	
X	POOR/NO VILLAGE COOPERATIVE UNIT	1	3.4482	9	13.235	0	0	10	4.9504	
XI	SEVERE PEST ATTACKS	0	0	1	1.4705	0	0	1	0.4950	
XII	NO RURAL ELECTRICITY	1	3.4482	1	1.4705	0	0	2	0.9900	
XIII	NO MARKET FACILITY	8	27.586	4	5.8823	0	0	12	5.9405	
XIV	POOR PUBLIC TRANSPORTATION	0	0	2	2.9411	2	1.9047	4	1.9801	
XV	LACK OF AGRICULTURAL EXTENSION	2	6.8965	1	1.4705	3	2.8571	6	2.9702	
XVI	UNHEALTHY ENVIRONMENT	1	3.4482	0	0	0	0	1	0.4950	
XVII	NO SECONDARY SCHOOL	1	3.4482	1	1.4705	0	0	2	0.9900	
XVIII	PROBLEM ON LAND RECLAMATION	0	0	2	2.9411	0	0	2	0.9900	
XIX	COSTLY GOODS/LIVING EXPENSES	1	3.4482	6	8.8235	3	2.8571	10	4.9504	
XX	NO RURAL HEALTH SERVICES	0	0	2	2.9411	1	0.9523	3	1.4851	
XXI	UNSOLVED LAND DISPUTES	0	0	0	0	2	1.9047	2	0.9900	
XXII	NO CAPITAL FOR LAND RECLAMATION	0	0	1	1.4705	1	0.9523	2	0.9900	
XXIII	LACK OF LABOR DURING THE HARVESTING	1	3.4482	0	0	1	0.9523	2	0.9900	
	TOTAL	29	100	68	100	105	100	202	100	

APPENDIX 8-7.3

LIST OF SUMMARY OF THE THIRD THREE MOST SIGNIFICANT PROBLEMS THE TRANSMIGRANTS CURRENTLY HAVE

NO.	GROUPING OF THE TYPICAL ANSWERS OF THE RESPONDENTS	NUMBER OF CASES RECORDED <N>								GENERAL REMARK
		LAMASI		KALAENA		RAREM		GENERAL TOTAL		
		<N>	<%>	<N>	<%>	<N>	<%>	<N>	<%>	
<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>	<11>
0	NO RESPONSES OR COMMENTS	50		21		76		147		NO RESPONSES: <%>
	PROBLEM C. <THE THIRD THREE MOST SIGNIFICANT PROBLEMS>									-LAMASI 80.645 -KALAENA 30 -RAREM 62.809
I	POOR AGRICULTURAL SCHEDULE	0	0	1	2.0408	0	0	1	0.9433	OVERALL-AVERAGED 58.102
II	POOR IRRIGATION SERVICES/FACILITY	1	8.3333	5	10.204	8	17.777	14	13.207	
III	COSTLY AGRICULTURAL INPUTS	0	0	7	14.285	10	22.222	17	16.037	
V	TOO LOW PRICES OF PADDY/OTHER CROPS	0	0	3	6.1224	0	0	3	2.8301	
VI	INSECURE/SEVERE VILLAGE SECURITY	3	25	4	8.1632	2	4.4444	9	8.4905	
VII	POOR SOCIAL PARTICIPATION	1	8.3333	0	0	0	0	1	0.9433	
VIII	LOW AGRICULTURAL PRODUCTIVITY	1	8.3333	1	2.0408	7	15.555	9	8.4905	
IX	POOR/NO VILLAGE COOPERATIVE UNIT	0	0	9	18.367	2	4.4444	11	10.377	
X	NO RURAL ELECTRICITY	3	25	0	0	0	0	3	2.8301	
XI	NO MARKET FACILITY	0	0	5	10.204	0	0	5	4.7169	
XII	POOR PUBLIC SERVICES	1	8.3333	2	4.0816	0	0	3	2.8301	
XIII	LACK OF AGRICULTURAL EXTENSION	0	0	2	4.0816	1	2.2222	3	2.8301	
XIV	HIGH TAXATION	0	0	1	2.0408	1	2.2222	2	1.8867	
XV	NO SECONDARY SCHOOL	1	8.3333	1	2.0408	0	0	2	1.8867	
XVI	COSTLY MECHANIZATION/EQUIPMENT	0	0	3	6.1224	1	2.2222	4	3.7735	
XVII	COSTLY GOODS/LIVING EXPENSES	0	0	2	4.0816	3	6.6666	5	4.7169	
XVIII	NO RURAL HEALTH SERVICES	0	0	2	4.0816	1	2.2222	3	2.8301	
XIX	UNSOLVED LAND DISPUTES	0	0	0	0	6	13.333	6	5.6603	
XX	POOR ECONOMIC CONDITION	0	0	1	2.0408	1	2.2222	2	1.8867	
XXI	LACK OF CAPITAL	1	8.3333	0	0	2	4.4444	3	2.8301	
	TOTAL	12	100	49	100	45	100	106	100	