

KIRINDI OYA

IRRIGATION AND SETTLEMENT PROJECT

PROJECT IMPACT EVALUATION STUDY

Draft Final Report

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Executive Summary

The KOISP Project Impact Evaluation Study was a collaborative research effort between the International Irrigation Management Institute (IIMI) and the Agrarian Research and Training Institute (ARTI) with the former having the overall responsibility. The two institutes shared the responsibility of hiring and fielding the research team. Consultants from Ruhunu University have also been engaged by IIMI through a research contract.

The broad objective of the project was to attempt to assess the overall effects of the interventions as implemented under the KOISP. More specifically, the objectives of the study were to i) identify and measure KOISP outputs and trends; (ii) to measure the project benefits and evaluate the impacts of the project and (iii) to conduct a cost-benefit analysis of the KOISP. The overall objectives of this study are reviewed in Chapter 1, jointly with an account of the settlement policy of the Government of Sri Lanka. In addition, general lessons were to be derived from the conclusions of this study, which should contribute to improvements in future irrigation development and land settlement projects and to improved policies in these areas.

This project impact evaluation study has covered a wide range of topics for detailed impact assessment. It should be recognized however that it is virtually impossible to measure all (final) project benefits and impacts through this study. Among the areas for detailed examination are crop and livestock production, project management, irrigation, socio-economic conditions, forestry and environment. Other aspects such as sanitation and water supply, education, health etc, are also covered by the study, but at a lower level of detail.

The distinctive stages of the study consisted of literature review, planning for and collection of appropriate data, data analysis and the preparation of the reports. To collect data, different research methodologies were used such as sample surveys in the old and new area, special studies on nutrition and health, rapid appraisals and observations in the project area, and interviews with officers from various departments. The analysis of existing information made up an important part of the literature review. The ARTI baseline survey of 1983, the mid-term project evaluation of 1986, IIMI's studies of Irrigation Management and Crop Diversification (ADB Technical Assistance Study, Phase I and II) were important sources of data.

This present draft final report contains two segments. Part I comprises the major findings and conclusions of the project impact evaluation study. In this section abstracts of all research components are presented, providing the reader with a relatively compact overview of the scope of the research activities. Part II includes the full and detailed versions of the research components of this study, and provides an in-depth evaluation of the conditions prevailing in the KOISP.

Irrigation System Development, Operation and Maintenance as described in Chapter 2, concentrates on different aspects of the irrigation component of the KOISP. An assessment of the water resources potential in the Kirindi Oya basin made clear that the estimated average inflow has decreased considerably. The decline is about 25 percent of ADB's 1976 estimated inflow due to a perceptible drop in the rainfall at the Kirindi Oya basin. The average annual release from the Lunugamvehera reservoir is 40 percent below the projected release. As a result it was only possible to irrigate 71 percent of the irrigable area during the last six years. The average duty for the new area works out to 8.5 acft/acre while for the old area it is only 2.4 acft/acre. The overall efficiency of irrigation over a six year period is 47.3 percent against a simulated value of 44.5 percent for an inflow of 177.6 mcm. This indicates that the system has performed very well.

A comparison has been made between the proposed and actual irrigation water requirements during land preparation and the time taken for land soaking, land preparation and sowing. These parameters as actually used in the field are very much different from what has been assumed in the design and operation guidelines.

The field canals in KOISP are designed for a typical design discharge of one cusec and the turnout areas are sized to serve the peak water requirements for rice. Most of the field canals are able to meet their requirements, but some turnouts serving 20-24 ha. have operational difficulties.

Most of the distributaries in the Kirindi Oya system have design discharges which are less than the aggregate sum of the design discharges of all field canals served by them. This imposes a potential capacity constraint (particularly during the land preparation period) when all field canals are operated simultaneously with continuous flow.

Financial allocations for maintenance in the Kirindi Oya system are low (in 1992: Rs. 54/= for O&M). An analysis of the breakdown of O&M costs between administrative and O&M costs shows a trend to spend a greater part of the funds on administration. This has a negative effect on maintenance.

The study of farmers' perception about the construction quality of the irrigation system revealed that more than 50 percent of the farmers felt that the construction of the various irrigation structures is normal, except for the farm turnouts. In this case, 38 percent perceived the construction as normal while 35 percent said it was poor.

Chapter 3 on **Land Development and Settlement** deals with the settlement program of the KOISP aimed at providing user rights to the landless people in order to increase the productivity of land resources in the project area. The objectives were to improve the socio-economic conditions of the peasants already living in the area by ensuring irrigation facilities to their lands, to establish necessary irrigation infrastructure and cultivable lands to the landless migrants from the densely populated areas surrounding the project and to evolve a self-reliant peasant community in the project through the equitable distribution of land and water. The development activities began simultaneously with the settlement of people. This is known as "advanced alienation" which was also meant to curb the encroachment problems and to obtain settlers participation in the project development activities.

The project planners followed two approaches to select suitable persons to allocate land: a) provision of alternative lands to the households that lost their original lands due to the project development (*alternative settlers*) and b) provision of lands to landless families in the surrounding districts (*open settlers*). Open settlers were the largest segment of the allottees in Phase I, while more land has been allotted for alternative settlers under Phase II. In the new area about half of the respondents identified themselves as alternative settlers. Of the open settlers about 50 percent reported to have been allocated land not only because they were landless, but also because of their political affiliations. The open settlers in the sample said that they were provided land mainly because of the loss of their lands to the project.

A prescribed range of assistance was provided to the new settlers to establish themselves in their allotment and communities. The agricultural assistance consisted of free seed materials, a cash subsidy, free agricultural implements and instructions for cultivation. This agricultural assistance program and the development of agricultural related organizations had a considerable impact on the settlers, they have been encouraged to venture in agricultural related activities. However, the old area farmers have benefitted more than the new area farmers, and income disparities have tended to increase. From the housing program the settlers received grants for temporary shelters and semi-permanent houses and an interest free loan to start a venture. These loans have not been repaid by the settlers. In general, the housing program has not been sufficient to assist the settlers in building houses as only the higher income groups have constructed a permanent house. The World Food Program (WFP) provided dry food rations initially for 18 months, but this period was exceeded because of the delayed irrigation facilities. The first phase settlers received food rations up to 1986. During the later stages of the project food assistance was reduced to promote domestic productivity. But the haphazard manner of this scheme negated settlers' anticipations and consequently forced them to seek alternatives.

At present, settlers in KOISP face several operational problems. Boundary disputes due to alienation in a vague manner using only temporary land marks is one example. 37 percent of the settlers state their boundaries are not clear, most of them having

undersized plots. Other problems are the migration of settlers and non-resident allottees (which has caused cancellation of allocated plots), reallocation of plots due to salinity of soils and cattle problems.

Infrastructure Development (Chapter 4) deals with support to settlers which included facilities for health care, education, transport, water supply and food. Also training courses on irrigated agriculture, marketing assistance and agricultural research were formulated in the project proposals.

Most of the originally designed construction as well as the delivery targets with regard to the infrastructure services of the KOISP have been achieved. Changes have occurred due to the subsequent revisions of the plans based on experience and problems prevailing in the project area (e.g. 23 hamlets and 4 village centers instead of 28 and 5 respectively).

The project has established 20 primary schools in hamlets and 4 junior and senior secondary schools in new towns. All of these are operational except one at the Left Bank where the people are not yet settled. This has vastly improved the type, volume and facilities of the educational infrastructure in the area. The educational status in the KOISP has gradually improved during the project period. The project literacy rate increased to 96 percent and school participation rates in all age, sex and income categories in the old and new area have gone up. The current problems with project schools relate to the difficulties of many schools to maintain a sufficient number of students as many settlers have sent their children to schools outside of the project area.

The health facilities in the area improved due to the construction of a rural hospital at Lunugamvehera and the provision of professional medical care to two dispensaries on clinic days. Malaria has declined drastically due to the spraying program of the government. Infant mortality rates in the area are low. Suicide rates appeared to be high (16 percent).

Malnutrition as a result of chronic and acute undernutrition (stunting and wasting) was found with respectively 36 and 46 percent of the children in the area. The former coincides with the national average but the latter is much higher.

The length of the road network constructed by the project increased from 175 km. to 435 km. In addition, homestead roads (200 km.) and linking feeder roads (60 km.) have been constructed. 96 percent of the houses in the new area are now accessible by a vehicle. Bus services in the new and old areas have a prominent place in the public transport system, but seem to be inadequate (early morning, night) and do not adhere to a proper time table. Farmers' participation to maintain field channel roads is high in the new area. Project roads suffer from pot-holes, inadequate drainage and poor maintenance.

Presently, 17 of the 25 constructed cooperative shops are open, but the open markets sometimes offer better quality products at lower prices. Many cooperatives do not make profits. Most of the settlers depend on the cooperatives to buy foodstuff and other household items. Hence, settlers appreciate the services of the cooperatives as retail shops. Only 2 produce stores (to store inputs such as fertilizer and outputs such as paddy) were opened for the intended purposes.

The drinking water supply in KOISP is now guaranteed by the piped water system at a rate of Rs. 11/= per month per family. Women's time spent to collect water has been reduced considerably. Most of the alternative farmers stated that the tap water supply was the greatest achievement they had experienced so far from the KOISP. Problems however relate to the excessive numbers of families allocated for one tap and the restricted time of water supply.

Other services which have been provided by the project are sub-post offices, community centers, agricultural service centers, a police station, an agricultural research station, an extension unit, staff quarters and a farmer training center. All these services add to the overall impact of the project infrastructure facilities. The availability of accessible infrastructure facilities within shorter distance for the majority of the households is an important achievement of the KOISP.

Participation in construction activities is estimated at 7.2 million person days for the period 1980 - 1985, which is one million more than projected at the appraisal stage. About 56 percent of the households in the new area and 13 percent in the old area participated in the project's construction work.

In Chapter 5 the benefits and impacts of the KOISP on the overall **socio-economic conditions** in the project area are evaluated. The findings are mainly based on the information gathered through a large-scale sample survey and special (sub-)studies on health and nutrition.

The average family size for the KOISP area is 5.5, which is only marginally higher than the national figure of 5 persons per family. During the pre-project period the average family size was 5.7. This declining trend is similar to the national pattern. The literacy rate, being a key achievement indicator, increased considerably during the project period. The literacy rate for men increased from 90 (1981) to 97 (1994) percent. The female literacy rate increased from only 79 to 94 percent. School participation rates appear to be very high.

The housing conditions differ for the old and the new areas. In the old areas the houses are relatively larger (creating less overcrowding) and more permanent. Almost all houses are owner-occupied. The households have a good water supply (80 percent obtain their drinking water from their own well or pipes), and almost all houses had toilet facilities.

The labor force in the project area does not show any major changes during the 1981-1994 period. The economically active population remained stable at around 60 percent. The percentage employed in the new area increased substantially from 32 percent (1986) to 71 percent (1994). Corresponding figures for the old area are 29 and 63 percent respectively. While agricultural related employment opportunities decreased, salaried employment has shown a sharp upward trend in the area.

The average monthly household income was more than Rs. 2,000/= for almost two-thirds of the households in the new area. The majority of the population in the old area (65 percent) received an income of more than Rs. 3,000/=. The lower income groups spend a high proportion of their income on food and non-food items (despite foods stamps and Janasaviya).

Chapter 6 addresses the progress in the area of **Crop Production** which received considerable attention in the project documents. For the maha season 1993-94 the average rice yields in the old and new areas is estimated at 3,706 kg/ha. and 3,649 kg/ha. respectively, which indicates no significant difference. Potential paddy yields in the KOISP are reported to be roughly 4,800 kg/ha., but only a minority of farmers obtain these yield (7 and 13 percent in the new and old area respectively). The OFC program does not show encouraging results, since these crops are hardly grown. The cropping intensity of the lowlands (old area) increased to 163 percent which is a marked achievement. This index for the lowlands in the new area is 98 and 48 percent for the Right and Left Bank respectively. The annual projected paddy production for KOISP was set at 44,000 mt. For 1993 the actual production amounted to 41,000 mt. which is an achievement of 90 percent. However, this figure fluctuates over the years depending on the paddy area in the yala seasons.

Rice production is not very attractive in terms of economic returns. Based on an average yield of 3,605 kg/ha., a farm gate price of Rs. 7.50 per kg and total cost of production of Rs. 23,000/= per ha., the net income from rice production has been calculated at Rs. 4,200/= per ha., or a monthly net income of Rs. 700/= /ha. over a six month period. OFC production has generally yielded a higher net income of Rs. 6,000/= /ha., based on a mixed cropping system.

In terms of technology adoption it appears that almost all KOISP farmers cultivate HYVs. Fertilizers and agro-chemicals are widely applied to their fields, but frequently not according to the recommendations. The agricultural extension and training program did not play a sufficient role in informing farmers, since the majority of the farmers did not receive regular visits from the field staff.

Farmers in KOISP have access to institutional credit but are more inclined towards informal credit sources thus avoiding formal application submission, approval and delays. Institutional loan recovery rates are low during adverse seasons, and the crop insurance scheme could not change this situation due to a low participation level.

Agricultural marketing is almost entirely controlled by private dealers. Prices of paddy and OFCs decrease considerably during the harvesting periods. The absence of floor prices, especially for OFCs has caused significant price fluctuations.

Chapter 7 on **Livestock Development** highlights the fact that although the KOISP area was considered to be one of the predominant cattle and buffalo regions of Sri Lanka, no livestock component was included in the first phase of the project. This study was severely constrained by the lack of background information and published data on the pre-project situation. Animal numbers presented another problem as herdsmen were often reluctant to give actual numbers, so it was felt that the reported numbers are heavily underestimated.

Livestock raising in KOISP does not seem a popular activity: out of the total sample of 479 households less than 10 percent kept livestock. Cattle and buffalo raising is the most important livestock enterprise, while poultry assumes secondary importance. Due to the construction of the KOISP, the traditional cattle and buffalo raising system was modified and today five types of management systems have been adopted by the herdsmen in KOISP: the Village Based System, the Migration System, the Traditional System, the Jungle Based System and the Tethered Grazing System.

Reliable estimations of the animal population in the KOISP area are not at hand. The approximation by this study would be roughly 67,000 (48 percent buffaloes and 52 percent cattle), but according to herdsmen this figure must be a heavy underestimation.

The gross income per livestock unit ranges from Rs. 1,100/= to Rs. 1,900/= per year in all systems except the Village Based System in the new area, where returns per livestock unit are Rs. 689/=, the lowest reported. An average for the total project returns per livestock unit are Rs. 1,423/=.

The Mahaweli Draft Animal and Dairy Development Program (MDADDP) established the Mahaweli farm at the end of 1986 to provide several services to the herdsmen. The cattle and buffalo upgrading program was not very fruitful and the milk collection and marketing activities could not compete with the private dealers to whom most of the herdsmen sell their milk today. The vaccination program however appeared to be one of the most effective services rendered by the MDADDP. The services of the veterinary surgeon's office have been used by a large percentage of the herdsmen.

The establishment of the Cattle Owners Associations should assist in solving the current problems of crop damages by cattle, the rising conflict between herdsmen and cultivators and the need for grazing land.

In sum, the evaluation of the livestock component of the KOISP is not invariably positive. While, for instance, the project planned an incremental production of 4.1 million

liters of milk annually, the total quantity of milk produced in the KOISP area would be roughly around 2.6 million liters.

Chapter 8 reports on the **Social Forestry** component of the KOISP which was launched by the Land Commissioner's Department, with the Forest Department acting as the executing agency. This component included the development of nurseries, woodlots, homelots, live fencing and extension services. In addition, the condition of forests in the project area are described and an assessment is made of the elephant relocation, establishment of medicinal herb gardens and planting of roadside avenues. The fuel efficient cooking stoves component was not implemented.

The targets for the nursery development were not met. Even all the seedlings produced have not been planted by the farmers mainly due to the fact that usufruct rights and long lease agreements were not given to them. The woodlot program showed a relatively good result and provided farmers with fuel wood and other small timber for their needs. The medicinal herb gardens are unfortunately not well maintained, but has become a source of readily available material for Ayurvedic treatment.

The awareness raising activities of the project made settlers realize the value of tree planting and it seems that the illicit cutting of the dwindling forests resources has been reduced. Reforestation to add to the forest cover which is estimated at 1,645 ha. has been carried out on a minor scale only. The replanted lands have been suffering from cattle and elephant damages. Despite the relative success of enclosure of elephants in the National Park, lone elephants continue to damage crops and home gardens in the settlements.

In Chapter 9 four components of **environmental** impacts resulting from the construction of the Lunugamvehera reservoir upstream of the old Ellegala anicut diversion and the development of the new irrigated land and settlement of farmer families on the Right Bank and Left Bank of the KOISP are discussed.

First, the disturbances in the lagoon ecology of the natural lagoon systems which are located in the lower coastal plain resulting from the altered hydrology of inflow from the new irrigation system seem limited of the Bundala lagoon. This is due to the fact that RB tract 3 and 4 have not been developed. The Embilikala and Malala lagoons receive drainage water from the RB and Badagiriya respectively. Embilikala lagoon has been subject to serious negative impacts reducing the lagoon's salinity to sub-optimal levels for prawn production.

Second, the salinity hazards arising from the leaching of soluble salts from the new irrigation system to the old Ellegala system are serious. The Ellegala has to cope with added accretion of soluble salts coming from the drainage waters of the new system. As a result of the inadequate drainage in the Ellegala, it presently acts as a sink for salt

coming from both the upstream new areas and normal cyclic salts and other accretions as well.

Third, the hydrology of the lower floodplains areas and the irrigated command area of the old irrigation system has been modified in several ways, such as no natural scouring of the Kirindi Oya river bed, a new river course carving itself out as an outfall to the sea, no further flooding of the lower flood plain during November and December, and the changed water table and the water quality of the homestead wells.

Finally, the soils in the undulating terrain of the newly irrigated lands are subject to erosion on the sloping lands, but the threats have been minimized because all irrigable land has been terraced for wet paddy cultivation. Monitoring of the first and second order drainage ways revealed very little or no silting, but substantial silting was observed in the higher order drainage ways.

Chapter 10 considers key aspects of the **project management** of KOISP, **institutional development** under the KOISP and **beneficiary participation** in the KOISP. Although many aspects of the KOISP went very well, this chapter has focussed on the problems in an attempt to learn how to improve project management for future projects.

There were a series of controversial decisions and errors that occurred in the planning of the KOISP, among which the dam location (apparently motivated by the need to maximize the area), the overestimation of water availability, the miscalculation about the possible degree of crop diversification, the failure to deal with the displacement of cattle and the lack of groundwater investigations in dug well planning are the most important. These planning problems resulted from the inadequate information for planning purposes.

The KOISP showed severe problems in irrigation system construction, particularly the problems of cost overruns and construction delays. These delays were due to insufficient basic data for planning, problems with contracting and procurement processes, the difficulties the Irrigation Department had keeping some of the contractors on schedule and due to the delays in the construction of the main canals. All these delays were a major cause of the costs increases.

The problems in the management of the settlement process were threefold. First, the advanced alienation strategy provided settlers allotments in the second half of 1983, but some settlers had to wait almost three years before cultivating their allotments. Second, there is the problem of nonresident allottees (who allegedly received their allotments as a consequence of interventions by politicians) who do not participate in Farmer Organizations, do not clean canals etc. Third, the failure to investigate the groundwater resources of the area led to a failure to plan for adequate domestic water supplies.

The project coordination mechanisms were not able to address those problems whose solutions required cooperative planning and effort from two or more agencies (e.g. the cattle problem and the OFC dilemma).

With respect to beneficiary participation it appeared that there was no system to involve local persons in the planning and design of the irrigation systems or settlements. Participation in construction took place on a wide scale, but participation in decision-making was absent.

The development of FOs under the KOISP was necessary to help manage the irrigation system and to represent farmers interests. Almost all farmers know about the FO and their representative, but they are relatively ignorant about many aspects of the functioning of the FO. There seems to be a lack of communication among the FO members. Overall, farmers organizations have taken over maintenance but not operations. Their performance in maintenance seems to be satisfactory and they clearly have helped improve water distribution, at least on the field channels. The great majority of farmers feel that they can do routine maintenance better than the ID can.

The **Cost-Benefit Analysis (CBA)**(Chapter 11) was undertaken to determine whether the project is economically or financially viable under the current circumstances. There were considerable cost as well as time overruns. Water availability was overestimated, while the projected area could not be brought under cultivation. The cropping patterns that were originally conceived for the project never materialized. The environmental or indirect negative/positive impacts of the project were not fully understood at the time of implementation. Therefore an attempt was made to take into account the above factors, wherever possible, in estimating the economic benefits under the existing scenario and on projections based on currently available information.

A formal CBA was undertaken using actual costs as well as direct benefits of the project (actual production, prices and income). Project costs have been recorded in different formats according to the needs of the user. The annual accounts, which appeared to be the most reliable, provided cost data in an accounting format. The next major source of cost data were the quarterly progress reports. Although less reliable than the annual report, there was a greater breakdown of costs. Cost figures however did not match in the two documents. The figures in the progress reports tended to be lower than those in the annual reports. The third source of cost data were the various subject files of the Irrigation Department. Very much more details are available in these files, but they were not available for all the years. It was decided to use the data from the annual accounts for purposes of the CBA, supplemented by data from progress reports.

The Economic Internal Rate of Return has been estimated at 6.3 percent, taking into account the incremental benefits from the old system, and the benefits from paddy production, forestry and livestock in the new area.

An attempt was also made to estimate the indirect impacts of the project, both positive and negative. The positive impacts could come from the general increase in economic activity in the region as a result of the project activities. This would include such activities as, rice milling, transport, small businesses, agricultural processing, inland fisheries, banking activities, service facilities for marketing of agricultural produce and repair of machinery, employment in project construction and maintenance, housing etc. The negative impacts included: losses due to salinity, soil losses, reduction of coastal fisheries due to fresh water inflows to the lagoons, possible higher incidence of health problems due to water borne diseases, pollution of ground water by chemicals, etc. Sub studies have been conducted to determine the impact of some of these factors. These were presented as separate studies and not incorporated in the CBA as an extended CBA, due to the paucity of good data.

Chapter 12 summarizes some of the major conclusions and lessons of this impact evaluation study.

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CHAPTER I

INTRODUCTION

1.1 Land Settlement in Sri Lanka

Land settlement and land development in Sri Lanka dates back to the 19th century. During the 1930s, the Dry Zone became the main focus for government development programs and policies. The most important strategy was the opening up of irrigated settlements to achieve the following objectives:

- increase food production, particularly by opening up irrigable land;
- relieving population pressure of the densely populated wet zone as well as the southern parts of the country by shifting the landless unemployed population to the dry zone areas in which land and irrigation water could be provided;
- provision of employment opportunities to the increasing population;
- protection of the peasant farmers as a class;
- promotion of agricultural development in general.

A review of land settlement policies in developing countries shows that the benefits of settlement schemes are not invariably positive. Land settlements are costly, yielding low rates of return as productivity levels are far below potential. They are administratively top heavy, suffer from internal social problems, very often resulting in a fairly high rate of physical desertion. The Sri Lankan case confirms this general picture (Economic Review, 1986).

It is within this setting that the KOISP impact assessment was undertaken. The study attempts to evaluate the performance of the KOISP Project in terms of the above objectives, and its impact on the beneficiaries as well as on the general economic and social conditions in the project area.

1.2 The Kirindi Oya Irrigation and Settlement Project: Phase I and Phase II

The KOISP is the largest irrigation and settlement scheme in the South of Sri Lanka implemented under the land settlement policy of the Government of Sri Lanka. The broad objectives of the scheme were the same as for other settlement schemes in Sri Lanka and thus consistent with the government's major economic plans.

The scheme is located in the dry zone of the southeast quadrant of Sri Lanka about 260 km from Colombo, and is an expansion of the old Ellegala system, a very old irrigated area. During the 19th century, the Ellegala diversion was constructed in the Kirindi Oya to divert water to five ancient and previously independent tanks: Debarawewa, Tissawewa, Yodawewa, Weerawila Wewa and Pannegamuwa Wewa.

The expansion plans were formulated in the 1970's. The KOISP was funded by three external donors - the Asian Development Bank (ADB), the Kredietanstalt für Wiederaufbau, the International Fund for Agricultural Development (IFAD) - and by the Government of Sri Lanka. The loan was released in 1978 and the project was inaugurated in 1979. Because of substantial cost overruns due to implementation delays and local inflation, the project was reformulated in 1982, when two phases were proposed: Phase I from 1982 to 1987 and Phase II from 1988 to 1993. The total initial funding amounted to US\$ 51.8¹ million, while Phase I included supplementary funding of US\$ 28.0 million. Phase II budgets amounted to US\$ 33.1 million. The revised total project cost were estimated at US\$ 106 million. The objectives of the KOISP will be summarized in the next section (1.3).

During the reformulation of the KOISP, project components were changed and new components were added. At the last appraisal of 1986, the project included the following 9 components: (1) irrigation and drainage works; (2) land settlement; (3) agricultural support services; (4) marketing; (5) support for participating banks; (6) livestock; (7) woodlots and homestead lot planting; (8) environment and (9) project monitoring and benefit evaluation.

The executing agencies of the project were the Irrigation Department (ID) and the Land Commissioner's Department (LCD), both under the Ministry of Lands and Land Development (currently, the Ministry of Forestry, Irrigation and Mahaweli Development). The ID was the principal executing agency responsible for irrigation system construction and settlement infrastructure construction. The LCD's main responsibility was the settler selection and subsidies. Other agencies involved were the Department of Agriculture (DOA) (research, agricultural extension, seed production and training), the Irrigation Management Division (IMD) and other institutes such as the Central Bank of Sri Lanka and the Forestry Department. These institutes were responsible for specific components of the project. The ARTI performed the functions of project monitoring and benefit evaluation from 1982. The management and coordination bodies of the KOISP consisted of the Central Coordinating Committee (CCC), the Project Coordinating Committee (PCC), the Project Director (ID), the Project Manager (Settlement) and the Project Manager (Irrigation). The ID had the overall responsibility for the coordination of the project.

1.3 KOISP - Objectives

The objectives and scope of the KOISP have been described in the three project appraisal documents (1977, 1982 and 1986) and refer on the one hand to broad socio-political and economic objectives, and on the other hand to more specific irrigation, settlement and

¹ ADB:US\$ 20.0 million; KFW/IFAD: US\$ 25.3 and the GSL: US\$6.5 million.

agricultural objectives. The broad socio-political and economic objectives as formulated in 1977 remained valid during the re-appraisal of the project and can be summarized as follows:

Socio-Political and Economic Objectives

- increased food and fiber production (to reach self-sufficiency esp. in rice);
- generation of employment (construction, farm labor);
- foreign exchange savings to improve the balance of payments;
- settlement of landless people (to reduce the population pressure in the wet zone, to exploit the human resources of the peasantry and to improve the position of the peasant cultivator, more equitable land distribution);
- increased income for project beneficiaries through irrigation, improved crop management and livestock development.

The main project components (excl. the consulting services) to accomplish these objectives as formulated in 1977 are summarized below in Table 1.

Table 1. KOISP Project Components (1977)

Component	Description
Irrigation Works	<ul style="list-style-type: none"> ■ Rehabilitation of existing facilities in 3,675 ha. ■ Construction of 5,000 m long and 25 m high dam: storage capacity of 197.8 million cu.m. with spill way and sluices ■ Construction of 61.6 km of main canals ■ 8,409 ha. to be developed as farmland
Land Settlement	<ul style="list-style-type: none"> ■ 1,980 to be prepared for settling 8,320 farm families in 28 hamlets and 5 village centers; construction of 200 km of village roads ■ Provision of health center, branch cooperative, secondary school and sub-post office for each village center and staff quarters; health clinic, cooperative depot and primary school for each hamlet ■ 420 wells for new settlers
Agricultural Development	<ul style="list-style-type: none"> ■ Provision of district training center with mobile van, vehicles for extension workers, reference material for cotton/paddy research ■ Pilot scheme incl. necessary farm facilities and equipment ■ Provision of 45-four wheel tractors and 164 power tillers ■ training in water management

Source: ADB, 1977.

The realization of these activities would lead to an Economic Internal Rate of Return (EIRR) of 17.6 per cent². The projected increase in paddy and cotton production (resulting in a foreign exchange cost saving of approx. US\$ 8.2 million annually), the settlement of mostly landless laborers, the additional employment opportunities, the provision of water supply, public health care and education facilities, the training center and pilot farms, and the improved water management skills of the farmers were all factors which induced the project appraisal mission to conclude that the project was economically viable, technically sound and socially desirable.

In 1982, the EIRR of the KOISP project was estimated at 11.0 per cent, which included only a part of the settlement costs of the project. Expenditures which the GoS would have to incur elsewhere in the absence of the project, were excluded (ADB, 1982). The full costs of the dam and appurtenant structures have been incorporated. The rate of return of Phase I and Phase II was appraised at 13.6 per cent, recognizing however that significant benefits of the settlement component cannot readily be quantified.

Environmental and Public Health Objectives

Aspects of the environment and public health received attention during the appraisal of the project, and are associated with the creation of the reservoir, conversion of secondary forest area to settled irrigated cultivation and with the introduction of new settlers in the area. In 1977 the net environmental and health effects of the project were assumed to be positive and were to be realized by a) watershed management; b) erosion control and c) construction of drainage facilities and the application of rotational irrigation to prevent the appearance of waterborne vector diseases, so that in combination with wells, the morbidity and mortality rates would be reduced.

In the appraisal document of 1982, the environmental and health effects were expected to be neutral or positive, and the report specifically mentions the goal to minimize negative environmental effects (e.g. by the proper use of agrochemicals by the farmers). This statement is reiterated in 1986, and has become one of the explicit objectives of the project (ADB, 1986):

- to prevent further environmental degradation associated with chena cultivation, by proper land use and application of appropriate farming systems.

Settlement and Irrigation Objectives

The general objective of the settlement policy of the Government of Sri Lanka is to raise the economic and social status of rural people, particularly the peasantry: the small

² based on August 1977 constant prices and specific assumptions on economic costs and benefits, see Appraisal Document, Appendix 20 (ADB, 1977).

farmers and the landless. The settlement goals of the KOISP have changed over time, to correspond with the insights into the development of the project and the actual availability of the water for the system.

In 1977, it was planned

- to settle 8,320 farm families in 32 hamlets and villages with the necessary infrastructure (roads, public health, education, rural water supply, cooperative stores, community services;
- to provide irrigation facilities to 8,409 ha. of new land;
- to improve the irrigation facilities for 4,525 ha. of the existing system (Ellegala: 3,734 ha. and Badagiriya: 850 ha).

The revised goals of the project under Phase I and Phase II were as follows:

Phase I (1982)

- to settle approx. 4,200 farm families with the necessary infrastructure;
- to provide 4,191 ha. (Right Bank 2,550 ha. and Left Bank 1,641 ha) with new irrigation facilities (total 8,775 minus 4,584³);
- improved irrigation facilities for 4,584 ha.

The main components of the KOISP in 1982 included:

- (1) irrigation works (dam and appurtenant structures; irrigation systems on the RB and LB and clearing/terracing new farm lands; rehabilitation of Ellegala and Badagiriya);
- (2) land settlement (hamlets and village roads; community buildings; wells; equipment and vehicles);
- (3) agricultural development (district training center and adaptive research station and equipment; vehicles and quarters for extension staff; additional staff and research equipment for regional center);
- (4) consultant services and training (design and construction supervision; (water) management, agronomy; overseas training in on-farm water management and institutional development for water user groups); and
- (5) equipment for O&M (earthmoving, transport and other equipment for O&M of project facilities and standby generators for operation of spillway gates).

Phase II (1986)

- to settle 4,200 farm families with the necessary infrastructure;
- to provide 4,200 ha. with new irrigation facilities.

³ The figures for the old and new area do not correspond for 1977 and 1982.

In 1986, further components were added to the original ones of the first phase of the project. The project as formulated at that moment consisted of 9 components, including for instance forestry and environment:

- (1) irrigation and drainage (extension LB canal; branch distribution and field canals; secondary and field drains; land clearing and land leveling);
- (2) land settlement (rural roads and water supply; hamlets and village center facilities; assistance to settlers; vehicles and equipment);
- (3) DoA: agricultural support services (extension; education and training; seed production);
- (4) marketing (produce stores; market information; specialist marketing officer);
- (5) credit (bank field staff; training; credit facilities);
- (6) livestock (service center; procurement of bulls and heifers; extension service; milk producer societies; sales network);
- (7) forestry (nursery support; tree crop establishment and agro-forestry; seedlings for homelots);
- (8) environment (buffer zone; study of critical areas of concern; relocation of elephants and formation of National park);
- (9) project benefit monitoring and evaluation (series of studies).

Agricultural Objectives

The goals for agricultural development were based on the provision of irrigation to new lands and improvements to the irrigation facilities in the old area, but these changed as the project was being constructed. The initial objectives in 1977 were:

- double cropping of rice in the lowlands;
- non-rice crops on the uplands (cotton, pulses) in the dry season (Yala) and subsidiary (OFC's) crops (pulses, cereals) in the wet season (Maha);
- a cropping intensity of 189 percent ("considered attainable");
- 4.0 mt/ha per season as the average estimated yield of paddy.

Phase I (1982)

- double cropping of rice in the lowlands;
- one rice crop in the wet season on the upland and intermediate soils followed by subsidiary crops (pulses, oils seeds, cereals and vegetables) in the dry season;
- a cropping intensity of 200 percent;
- 3.5 mt/ha for upland paddy; 4.5 mt/ha for lowland paddy in Maha and 4.8 mt/ha for lowland paddy in Yala season.

Phase II (1986)

- lowlands: one rice crop during the wet season and 50 percent paddy and 50 percent subsidiary crops during the dry season;
- intermediate lands: paddy during the wet season and subsidiary crops during the dry season;
- uplands: 80 percent rice and 20 percent subsidiary crops during the wet season and 100 percent subsidiary crops during the dry season;
- a cropping intensity of 170 percent.

1.4 Context and Objectives for the Impact Study

This study of the assessment of the benefits and the evaluation of the impact of the Kirindi Oya Irrigation and Settlement Project (KOISP) was carried out under two Project Impact Evaluation Study Agreements, dated 29 December 1993, between the Director of Irrigation, Department of Irrigation, Colombo for and on behalf of the Government of the Socialist Republic of Sri Lanka⁴ (GSL) and the International Irrigation Management Institute (IIMI), Pelawatte, Colombo.

In para 28 of the Memorandum of Understanding of the KOISP Phase II ADB Review Mission, June 1992, it was agreed to carry out a detailed and comprehensive impact study as an expansion to the originally envisaged post-evaluation study of the KOISP. According to the MOU, the study should assess and quantify the direct and indirect benefits and possible negative effects of the Project. The study should also formulate measures to enhance the benefits of the investments and mitigate or minimize negative effects.

This present Draft Final Report is a product of the International Irrigation Management Institute and is based on the Terms of Reference which were prepared by SLFO-IIMI by the end of 1992. The Project Impact Evaluation Study is a collaborative effort between IIMI and the Agrarian Research and Training Institute (ARTI) with the former having the overall responsibility. The two institutes shared the responsibility of hiring and fielding the experts. Consultants from Ruhunu University have also been engaged by IIMI through a research contract to undertake the crop and livestock component of the study.

This Project Impact Evaluation Study aims to assess the overall effects of the interventions as implemented under the KOISP. More specifically, the objectives of the study are:

⁴ Through Asian Development Bank loan funds under the Technical Assistance Agreement (Loan No. 794-SRI (SF): KOISP (Phase II) Project between the GSL and the ADB.

- to identify and measure KOISP output and trends;
- to measure the project benefits and evaluate the impact of the project; and
- to conduct a benefit-cost analysis of the KOISP.

As a first step, the specific physical outputs as generated by the project (e.g. new settlements, new irrigation infrastructure, woodlots, education and health facilities, transport etc.) are identified and described in the study.

The assessment of the benefits and the evaluation of impacts is being conducted on the basis of the outputs produced by the project. Most attention will be given to three areas, viz. agriculture and livestock, the population in the project area and the environment and natural resources. The population will be differentiated in order to demarcate the impacts of the project on the specific beneficiary groups.

Direct and indirect benefits and costs will be analyzed in the CBA to conduct a with versus without analysis. The study of the KOISP pre-project socio-economic conditions (ARTI, 1983) contains an important part of the baseline data required to carry out this cost-benefit analysis.

In addition, general lessons will be derived from the conclusions of this study, which may contribute to improvements in future irrigation development and land settlement projects and to improved policies in these areas.

1.5 Scope of the Study - Main Components

The KOISP covered a wide range of activities over its life span with impacts on a wide range of fields. This means that it will be virtually impossible to measure all of the resultant benefits and project impacts through this study. Therefore, priority was given to the assessment of selected benefits and evaluation of their impact. Among the areas for detailed study are agricultural (crops and livestock) production, irrigation, employment and household income, and impact on forestry, wildlife and environment. Other aspects such as sanitation and water supply, education, regional development, health, etc. are also covered by the study, but at a lower level of detail.

Water for irrigation from the Lunugamvehera Reservoir has been available for the last eight years; the first water issue to the new areas was made in Yala 1986. However, some components of the project were implemented very recently. The impact of these late interventions cannot be measured as yet. Therefore, the final benefits and impact of the KOISP cannot be determined by this study.

In the next chapters a summary of the main components of the KOISP impact study, which were selected for detailed impact analysis will be presented. These are:

- irrigation system development, operation and maintenance;
- land development and settlement:
- infrastructure (incl. nutrition and health);
- socio-economic conditions;
- crop production;
- livestock development;
- forestry;
- environment;
- institutional development and project management: and
- cost-benefit analysis.

CHAPTER 2

IRRIGATION SYSTEM DEVELOPMENT, OPERATION AND MAINTENANCE

2.1 Introduction

The KOISP planned to augment irrigation water supplies for the existing irrigation systems Ellegala and Badagiriya which cover 4,500 ha. Besides the project intended to provide irrigation facilities through the Right Bank and the Left Bank Main Canals from the newly constructed Lunugamvehera reservoir for an additional area of 8,400 ha. About 8,320 families would be settled on the newly irrigated lands.

Under phase I of the project, the reservoir at Lunugamvehera was commissioned in early 1986. New and improved irrigation facilities were provided for 8,775 ha of which 4,584 ha were already under cultivation. Phase II construction commenced in 1987 and was meant to develop an additional 4,100 ha of new land. The phasing of the project was necessitated by large cost over-runs and time delays.

The climate in the project area is tropical and characterized by nearly constant year-round temperatures of 26 - 28° C. Evaporation is uniform throughout the year with an annual average approximating 2,100 mm. Mean annual rainfall is 1,000 mm with maha rainfall (October to February) three times the yala rainfall (March to August). The soils consist of well drained reddish brown earth in the upland and intermediate zones and poorly drained low humic gley soils in the lowland areas.

2.2 Methodology

Data for this chapter were derived from a variety of sources including direct field measurements, published work, research reports, project design and various reports from the funding agencies. Interviews were held with operating and decision making officials. Minutes of the Central Coordinating Committee and progress reports of the Irrigation Department were consulted as well as the large-scale sample survey of farmers conducted under this consultancy.

Unfortunately, most of the details regarding design, implementation and as-built drawings were destroyed during the 1989 insurgency and thereby restricting the ability to compare between proposals and achievements. Therefore, the operational and procedural aspects of water delivery and performance were collected through field observations, measurements and published reports. For field measurements and analysis a set of sampled distribution systems (representing head, middle and tail as well as representing Right Bank Canals, Left Bank Canals, the Old Ellegala System and the dam proper) was selected. The analysis looked into the following aspects: planning, design, implementation, operation and monitoring of irrigation systems.

2.3 Irrigable Area¹

The KOISP appraisal report proposed to develop a total irrigable area of 12,930 ha. Not more than 71 percent of this acreage (9,170 ha) has been developed due to insufficient water flow to the Lunugamvehera reservoir.

2.4 Water Resources of Kirindi Oya Basin

The water resources potential of the Kirindi Oya basin has been estimated several times during the past years. The estimated average inflow has decreased considerably over the years. The decline is about 25 percent of ADB's 1976 estimated inflow. One of the major causes for the decreased inflow into the Lunugamvehera reservoir must be sought in a perceptible drop in the weighted average rainfall at the Kirindi Oya basin from 1,646 to 1,152 mm (1986 - 1993).

2.5 Lunugamvehera Reservoir Release

The average annual release from the Lunugamvehera reservoir in the period 1986 - 1993 amounts to 177.6 mcm, which is a 60 percent of the projected release. The ADB appraisal reports of 1982 and 1987 estimated reservoir releases of 294 mcm and 297 mcm respectively. As a result of this achievement it has been possible to irrigate 71 percent of the irrigable area with an irrigation intensity of 66 percent during the last six years.²

The average duty for the new area works out to 8.5 acft/acre while for the old area it is only 2.4 acft/acre. This reduced duty is mainly due to additional water received from drainage of new areas and surface run-off from its own catchments. The intensity of irrigation based on the proposed irrigable area is 47.2 percent whereas it is 66.6 percent based on the actually developed irrigable area.

The overall efficiency of irrigation is defined as percentage of irrigable area developed for irrigation multiplied by the percentage of irrigation intensity. The actual observed overall efficiency over a 6 year period is 47.3 percent against a simulated value of 44.5 percent for an inflow of 177.6 mcm. This indicates that the system has performed very well. Two reasons can be attributed to the improved performance. One is the large

¹Irrigable area refers to the actual area developed by the project and not the gross area irrigated.

²Irrigation intensity refers to a season. It can be a maximum up to 100 per cent for a season. On the other hand, the cropping intensity is for a year. For a two season crop, the cropping intensity can be maximum up to 100 per cent.

amount of return flow emanating from the new irrigated area which adds to the total quantum of water utilized in the project area. Another is the procedure adopted by the Irrigation Department to effectively use the rainfall by closing the distributary canal.

2.6 Development of Agro-wells in the Command Area

There has been a rapid development of agro-wells in the command area of the KOISP-project. In 1991 yala only 2 agro-wells were found, irrigating 1.5 ha and used by 2 farmers. In 1993 yala these numbers had increased to 325 wells, 74.5 ha of irrigated land and 266 farmers.

2.7 Reuse of Drainage water

Drainage measurements have been carried out from May to July 1993. The drainage discharge varies from 83 cusecs in May to 32 cusecs in July. It is estimated that drainage discharge during maha will be much higher.

While drainage water moving out from tracts 1 and 2 of the Left Bank and tract 1 and 2 of the Right Bank reaches Ellegala tank systems, drainage from the new area tracts 5, 6 and 7 goes to the sea. Hence, this drainage water is not effectively re-used. At the planning stage of the KOISP the use of dug-wells and the effective use of the drainage return flow to supplement the Lunugamvehera reservoir water were not given due consideration.

2.8 Design Assumptions and their Realization

A comparison has been made of the proposed and actual irrigation water requirements during land preparation and the time taken for land soaking, land preparation and sowing. These parameters as actually used in the field are very much different from what has been assumed in the design and operation guidelines. E.g. the water requirement in D2, yala 1989 was 800 mm while a requirement of only 175 mm was estimated for the design guideline. Likewise, 15 days were planned as design guideline while 38 days were actually observed.

A number of reasons have been attributed to these divergence. The most important among them are: the irrigation system has not yet stabilized, the farmers are not organized well, the support services are poor and the design assumptions need to be updated.

The seepage and percolation values are especially high for upland soils. A figure of 6 mm per day was assumed for the upland new area. In Right Bank tract 5 BC2, 10.9 mm per day was actually measured.

The assumed and realized distributary efficiency in the new area do not differ very much. For distributary canal DC2 in the new area the design guideline mentioned an efficiency of 0.65 while 0.70 has been measured in yala 1988.

The return flow to the Ellegala tank system based on data obtained during maha 1992/1993 has been computed. The results indicate that the actual drainage water including rainfall run-off entering into the Ellegala system tanks (53.5 percent of water supplied to the Right Bank and the Left Bank) is much higher than what is normally assumed (20 percent) for scheduling purposes. This higher inflow of drainage water into the Ellegala system allows to release a lower quantity of water from the Lunugamvehera reservoir, thereby bringing down the duty of water released from Lunugamvehera to the Ellegala system.

2.9 Design Management Interactions

The design of field canals and turnouts in the KOISP embodies a set of technical, operational and institutional assumptions. The field canals are designed for a typical design discharge of 28 l/s (one cusec) and the turnout areas are sized to serve the peak irrigation water requirements for rice, depending on the total percentage of well-drained and poorly drained allotment areas served by the field canal. Most of the field canals are able to meet their requirements. However, some turnouts serving 20 - 24 ha with predominantly well-drained soils have operational difficulties as the design discharge in the field canal can not meet the irrigation needs of all the farmers within the typical irrigation interval of seven days, if rotation is implemented.

Most of the distributaries in the Kirindi Oya system have design discharges which are less than the aggregate sum of the design discharges of all field canals served by them. This imposes a potential capacity constraint particularly during the land preparation period when all the field canals are operated simultaneously with continuous flow. If such a distributary has excessive conveyance losses above the assumed values, the distributary canal capacity becomes a constraint in ensuring an adequate and equitable supply to the farmers.

In Kirindi Oya the "variable discharge - fixed period" mode of water distribution was adopted. It was however observed that the farmers rarely followed the intended internal rotations and instead resorted to various informal ways of water sharing throughout the season. This compelled the turnout attendants to deviate from strict adherence to the schedules prepared by the Irrigation Department for rotations among the field canals and to respond to the needs of each individual field canal in an ad hoc manner.

2.10 Design Construction Conformity

The conformity between the design and the construction of distributary canals could not be verified as most of the as-built drawings and files were destroyed during the

insurgency in 1989. For a typical distributary canal in Left Bank tract 3 the conformity has been assessed and there is no significant deviation found between the design bed level and the constructed bed level.

2.11 Post-Construction Data Collection Program in KOISP

Data such as sluice discharges variation, tank water level, wind speed and spill tunnel pressure is being collected routinely at the Lunugamvehera Dam and maintained in a register. There is however no evidence that these data are analyzed and that any corrective measures are taken.

2.12 Maintenance Management

Financial allocations for maintenance in the Kirindi Oya area are low. Within the Hambantota region maintenance allocations range from Rs. 53/= to Rs. 87/= per acre. Old systems like Tissa get the higher allocations to cover its overhead costs. In 1992 the KOISP new area received Rs. 54/= per acre for operation and maintenance. An analysis of the breakdown of operation and maintenance (O&M) costs between administration and O&M shows that the ratio of administrative expenditure to O&M expenditure is 4.21 in 1991 compared to 2.10 and 0.80 in previous years. There seems to be a trend to spend a greater part of available funds on administration with a corresponding detrimental effect on maintenance. Administrative overhead costs are even covered by using the funds provided for physical work. To overcome this situation and to minimize fixed expenditure the Irrigation Department should reorganize its operation and maintenance division by bringing in more command area under each division.

2.13 Irrigation Performance

The area cultivated in the KOISP from maha 1987/1988 to yala 1993 shows the following percentages.

Table 1
Area cultivated (percentage) in KOISP maha 1987/88 to yala 1993

	maha 87/88	yala 88	maha 88/89	yala 89	maha 89/90	yala 90	maha 90/91	yala 91	maha 91/92	yala 92	maha 92/93	yala 93
new area	80	45	80	35	45	0	80	45	92	0	80	0
old area	100	100	100	100	100	100	100	100	100	20	100	40

2.14 Farmers' Perception about Construction of Irrigation Systems

In a large scale sample survey farmers were requested to respond to the construction quality of the main canal, the branch canal, field canal, regulators, gates and farm turnouts. More than 50 percent of the farmers felt that the construction of the various components of irrigation structures is normal except for the branch canal and the farm turnouts. As far as the branch canal is concerned, the response can not be considered as valid since just a few farmers using the only branch canal in the whole system were included in the sample. With regard to farm turnout 38 percent perceived the construction as normal while 35 percent said that it was poor.

2.15 Farmers' Perception about Irrigation Problems

The sample survey extracted the following information.

1. 75 percent of the farmers think that water received in the reservoir is used efficiently.
2. 67 percent expressed that during the cultivation period their field canals receive enough irrigation water.
3. Approximately 40 percent of the farmers reported to get an adequate water supply during maha while the same percentage of farmers said that they were unable to receive sufficient irrigation water from the field canal during yala.
4. About 80 percent of Ellegala farmers said to have water problems only during the early stages of crop growth in yala. In contrast, 90 percent of the new area farmers indicated that they have problems in getting enough water during all stages of crop growth in yala.
5. 65 percent of the farmers stated to participate both in field and distributary canal maintenance works.
6. 70 percent feel that they can do routine maintenance better than what the Irrigation Department is presently doing.
7. The money allocated for maintenance is not adequate according to 50 percent of the farmers.
8. The money allocated for distributary canal maintenance is used efficiently by FO on a contract basis according 45 percent of the farmers.
9. Approximately 50 percent feel that FO would be able to handle successfully the

operation and maintenance responsibilities turned over from the Irrigation Department.

10. The rehabilitation completed just after the Lunugamvehera reservoir construction failed due to the poor construction quality. The structures collapsed in a short period. This is reported by 65 percent of the farmers in the Ellegala system.
11. According to 45 percent of the farmers the Irrigation Department rectified the difficulties pointed out by the farmers after walk-through surveys.
12. Approximately 40 percent of the farmers feel that the OEIS tanks are to be operated by ID officials while another 40 percent feel that it should be operated by farmers and ID officials both in collaboration.

As one would expect diversion of water from other basins and efficient use of available water are the two major solutions to overcome water deficiency in the Lunugamvehera reservoir as identified by farmers.

2.16 Lessons Learned

1. Detailed hydrological analysis together with an integrated approach of using surface water together with drainage return flow and groundwater are very essential to plan an efficient project especially in water short areas such as the Kirindi Oya basin.
2. Water rights for old and new settlers are to be decided very clearly before the start of the project for efficient operation of the project.
3. The present procedure of aligning field channels traversing well-drained, imperfectly-drained and poorly-drained soils is not conducive for efficient operation when other field crops are to be raised during the dry yala season. Separate provision of parallel field channels for well-drained and poorly-drained soils would facilitate a better system operation when other field crops are raised, it will effectively intercept the drainage flow and it will increase the on-farm water use efficiency.
4. Better maintenance, improved monitoring and evaluation of the system performance and incentives for the operating personnel are necessary for further improving system performance.

CHAPTER 3

LAND DEVELOPMENT AND SETTLEMENT

3.1 Methodology

This chapter aims to assess the immediate benefits of land development and settlement under the KOISP on the population in the newly irrigated area and in the old irrigated area in particular and on the people of Sri Lanka in general.

The principle data collection technique for this chapter was the large-scale sample survey with involved almost 500 farm families in both the new and the old area. In addition, the survey included qualitative information gathering techniques such as discussions with field level officers, farmers and selected individuals. Secondary data and information was also reviewed extensively. Unfortunately, several limitations restricted the survey output: lack of primary data related to land demarcation and land allocation to families, inconsistency and contradictions of available data gathered by different agencies and lack of beneficiary perception on project benefits and services.

3.2 Pre-Project Status

Irrigation Infrastructure

Available reports suggest that prior to the commencement of the KOISP people had settled under an extensive animal-agro-forestry farming system. Paddy was widely cultivated under five major tanks, while smaller areas were cultivated under minor tanks and under rainfed conditions.

The old irrigation infrastructure consisted of two independent irrigation systems. The Ellegala system which was constructed in 1872-1977, served an area of 3,734 ha and the Badagiriya system serving an area of 850 ha. It is acknowledged that in ancient times the whole South East Dry Zone, including the Kirindi Oya basin formed a unique agricultural and settlement entity. The striking feature of this system is that the traditional cascade type of small and medium scale tanks could store the whole of the surface run-off from the watersheds of the streams and rivulets.

Land Use Pattern

The following five types of land use pattern were common:

1. Forest, forest reserves and uncultivated shrub lands.
2. Water spread areas (irrigation and paddy lands).

3. Home gardens and highlands.
4. Chena plots on jungle patches.
5. Land for residential, commercial and recreational purposes.

In addition land was used extensively for the free grazing of cattle. The absence of a policy to alienate lands for livestock grazing considered in relation to the carrying capacity and the herd population has been one of the major deterrents of the land development and settlement process of the as Kirindi Oya area.

Approximately 75 percent of the total irrigated paddy lands in this area were located in the settlements under the Ellegala Anicut. Nearly 17 percent was located in the unirrigated region.

Associated land use in the traditional villages of the area showed that the wet lands were cultivated with rice and the higher dry lands occupied by homesteads cultivated with tree crops, pulses or vegetables. The forest shrub lands and fallow lands were used for livestock grazing or animal agro-forestry. The paddy tracts stretched along the river banks, mainly along the lower part of the Kirindi Oya and the catchment of the major reservoir.

Population Distribution

The population was predominantly rural with an average density below 100 per square kilometer. The rural population increased with 52 percent in the period 1971 to 1981. The Census of Ceylon in 1971 recorded the population of this area, Magama Pattu to be around 3,651. From 1921, large scale migration to Magama Pattu took place mainly from the Matara district. Between 1936 and 1946 the population of this area, more than doubled due to migration consequent on the availability of irrigable lands. Two colonization schemes Badagiriya and Bogahapalessa, also brought an increase of population.

Pattern of Employment and Unemployment

According to employment records in the period prior to the project, 30 percent of the population was employed while 5.4 percent was unemployed. Housewives were 18 percent, students 25 percent, discouraged workers 1 percent and others 20 percent. Employed is understood as paid and unpaid family workers. The unemployed include those without gainful employment, for at least 15 days within three months prior to the survey. The discouraged workers are those not looking for employment and others include retired, disabled, too young or too old to work.

Two-thirds of the employed in the sample were engaged in agricultural activities. There was no significant difference in the proportions between the irrigated and unirrigated

areas. 37 percent of the households received their entire income from agriculture based activities.

78 percent of the female employees fell into the categories of farm helpers, agricultural and non-agricultural laborers and domestic servants. Only 46 percent of the employed men fell into these categories.

3.3 Project Plan

The project plan focussed on three development criteria: economic growth, resource equality and sustainability. The project anticipated the settlement of 8,400 farm families in 32 hamlets to be created under the project. Twenty hamlets in the Right Bank and twelve in the Left Bank. In addition to the settlement of farm families the project also expected the in-migration of considerable non-farming populations, through the development of basic infrastructure, roads, village and urban centers, marketing and other agricultural support services.

3.4 Land Settlement

The settlement program of the KOISP aimed at providing user rights to the landless people in order to increase the productivity of land resources in the project area. The program has formulated the following objectives at the beginning of the project:

1. To improve the socio-economic conditions of the peasants already living in the area by ensuring irrigation facilities to their lands.
2. To establish necessary irrigation infrastructure and cultivable lands to the landless migrant people from the densely populated areas surrounding the project.
3. To evolve a self-reliant peasant community in the project through the equitable distribution of land and water.

Unlike other settlement projects, implementation of project development activities began simultaneously with the settlement of people. This is popularly known as "advanced alienation" which also meant to curb the encroachment problem and to obtain the settler participation in the project development activities.

3.4.1 Settler Selection Scheme

Based on the surveys conducted in 1979 and 1980, the project planners have followed two approaches selecting suitable persons to allocate land:

1. Provision of alternative lands to the households that lost their original lands due to the project development. Those who have obtained land under these schemes is known as *alternative settlers*. These are people whose land was taken to the project or those who had government permits for chena cultivation, prior to the project.
2. Provision of land to the landless families in the surrounding districts. Mainly Hambantota, Matara, some parts of Moneragala, Galle and Ratnapura Districts. These settlers are known as *open settlers*.

The main reason for the selection of allottees under an open selection scheme was to reduce the social unrest among young families due to unemployment, low income and landlessness in the South-East region. The selection criteria for alternative settlers put more emphasis on youth and persons who had experience in agriculture.

Although it was planned to settle 8,400 families in two phases, only 5,000 families have been settled so far. This is mainly due to continued water shortages for cultivation and delays in the infrastructure development activities, specially in phase two.

Open settlers were the largest segment of allottees in phase one, while more land has been allotted for alternative settlers under phase two. In the new area about half of the respondents identified themselves as alternative settlers.

50 percent of the open settlers reported to have been allocated land not only because they were landless, but also because of their political affiliations. Although most of the open selectees received land due to landlessness in their places of origin they admitted that the political affiliations with the members of parliament in their original electorate, also helped them to get lands under the project. On the other hand, almost all the alternative settler respondents in the sample said that they were provided land mainly because of the loss of their lands to the project.

Two criticisms raised by different agencies and individuals must be mentioned here. First is the claim that the selection of farmer families from outside the project area led to the disappointment and displacement of bona-fide farmer families who had been in the project area prior to the project, but were not selected as settlers. Second is the irrigation difficulties experienced during the initial project period which also exacerbated the frustration among settlers in sharing the project benefits.

3.5 Assistance to the Settlers

A prescribed range of assistance was provided to new settlers to establish themselves early in their allotments and communities. These included food aid, drinking water, assistance in constructing shelter, fencing and the provision of free planting materials

along with some agricultural implements. Also a subsidy scheme was implemented with a package of various items. The assistance to settlers can be categorized as follows: agricultural assistance, housing and sanitation facilities, food and drinking water and organization and community assistance. For this section only the assessment of the agricultural, housing and food program is relevant.

3.5.1 Agricultural Assistance

Growth of agricultural production was one of the main objectives of the project. Settlers were provided with:

1. Free seed materials for the harvested and irrigable allotments.
- 2.. Cash subsidy of Rs. 300/= and ridging of the irrigable allotment.
3. Free agricultural implements along with interest free loans to start the cultivation practices.
4. Instructions from agricultural and agrarian services with regard to cultivation.

Further, the KOISP settlers could utilize the Agricultural Research Station which was established in Weerawila new town. Also an Agricultural Extension Unit and a Farmer Training Center were established.

It should be noted that the failure to introduce irrigation technology suitable for other field crops has contributed to the non-adoption of OFCs among settlers and a seasonal transformation from rice fields to rice and non-rice farms in both the old and the new area.

The agricultural assistance program and the development of agricultural related organizations had a considerable impact on the settlers, they have been encouraged to venture in agricultural related activities. However, old area farmers have benefitted more than new area farmers. As anticipated in theories of economic development, in this case essentially based on agriculture, with the higher gains in productivity and income in the old area, income disparities among the new area settlers have tended to increase. Hence, carefully designed further assistance is required until the disparities are eliminated.

3.5.2 Housing Program

During the pre- and mid-project period the settlers found it difficult to construct a house according to the specifications given without materials being supplied by the project at concessionary prices. Therefore, the subsidy scheme was later revised to cash subsidies as interest free loans. This proved to be a temporary help for the settlers.

At the beginning of the project the settlers received Rs. 500/= to build a temporary shelter. Once this was completed, they received another Rs. 1,500/= to purchase construction materials for a semi-permanent house. In addition they were given interest

free loans of Rs. 11,500/= to start a venture. These loans have not been repaid by the settlers, which has led to a hesitation from the side of the government to provide more loan schemes. The housing program has not been sufficient to assist the settlers building permanent houses as only the higher income groups have constructed a permanent house.

More than 95 percent of the houses are provided with toilet facilities. However, water seal toilets were mostly built by old area farmers as a result of their better living conditions, while the new area settlers still have toilets with concrete slabs.

3.5.3 Food Program

At the beginning of the project settlers who were brought into the then non-irrigated areas received food subsidies until they settled down. Dry food rations were provided for a period of 18 months for all the family members. The World Food Program (WFP) further assisted by providing adequate quantities of food to all settlers. In fact the WFP supplied food rations to most of the families for a period exceeding 18 months to overcome the initial difficulties caused by the delayed irrigation facilities. The first phase settlers received food rations from 1982 to 1986.

In spite of this food subsidy program the monthly expenditure on food among the low income groups (below Rs. 2,000/=), is nearly conterminous with their income or even above it. The overall household expenditure rises to 150 to 200 percent of their income when expenses on non-food items is also taken into account. Even when the value of food stamps and other food subsidies were deducted from the total household expenditure, the latter still remains above 100 percent.

During the later stages of the project food assistance was reduced to promote domestic productivity. But the haphazard manner of this scheme negated the settlers' anticipations and consequently forced them to seek alternatives. Hence, the current program of food assistance to the settlers should be revived.

3.6 Operational Problems of Settlements

3.6.1 Boundary Disputes

According to the pre-project socio-economic survey of 1983, a population of 2,897 families was living in the catchment, command and tank areas of the KOISP. With the commencement of the project, the number of encroachers had increased the population speculating on the future legal access to land. Advanced settling was started in 1984 to obtain settler participation in the project work and to reduce encroachment. Thus alienation was done amidst the construction of headworks and prior to the issue of water for cultivation. It was done in a vague manner using only temporary land marks. The fact that land was uncleared at the time of alienation, added further confusion to

the boundary demarcation. The land clearing started almost after one year and at that time most of the land marks were not found in their original positions. The settlers had to mark their land boundaries as they remembered it one year ago. This has resulted in lowland plot sizes from one to four acres. When the actual land survey was conducted, instances were found where either distributary channels or field channels were running in the middle of the land, thus fragmenting the plot. However, the earlier boundaries did not change, creating numerous boundary disputes.

Although the majority of the respondents in the new area reported their land boundaries to be clear, one cannot overlook the fact that some of them have oversized plots and do not want to admit it fearing to lose the excess land. 37 percent stated that their boundaries are not clear, most of them having undersized plots. The boundary problem appeared to exist only in the lowlands. Highland settlers expressed to be satisfied with the demarcation of their plots.

3.6.2 Settler Migration and Non-Resident Allotees

Initially a significant number of open settlers was reluctant to stay in the project area. The main reason was uncertainty of receiving irrigation water. Water issuing was done in a rotatory system as an answer to the water shortage. Most of the open settlers, who had land in their native villages or who had relatives elsewhere, migrated to these places during the seasons when their respective zone did not have priority for water issue. Approximately 10 percent of the respondents could be seen as migrating farmers. They are found more often at the Right Bank as compared to the Left Bank.

The non-residency problem has caused a cancellation of the allocated plots in 5 percent of the cases. Another 7 percent are yet to be canceled.

Some settlers could not adapt to the barren conditions of the project area and abandoned their lands. These plots were later reallocated, but the majority of these settlers leased their land to traders in either the project area or in nearby towns.

3.6.3 Reallocation of Land

Due to various reasons several originally allocated plots were abandoned and the settlers received new land elsewhere. The most important reason for abandoning the plots has been salinity of soils. 138 plots (3 percent) have been reallocated due to salinity. Another 115 plots will be reallocated for the same reason. Salinity of soils is mostly found at the Right Bank, especially hamlets 10, 11, 18, 19 and 20 are badly affected.

3.6.4 Other Problems

The conflict between cattle owners and paddy farmers has become one of the major operational problems of the project, threatening its sustainability (refer chapter 7). This

problem is most intense in hamlets 4, 5 and 6 of the Left Bank. Although this problem has been reduced to some extent by the joint actions of the Cattle Owner Farmer Organizations and the Project Farmer Organizations, it remains unsolved.

The problem of land fragmentation was found to be acute in the old area. Land fragmentation has not been reported in the new area.

CHAPTER 4

INFRASTRUCTURE DEVELOPMENT

4.1 Introduction

The KOISP intended to support the settlers in the new area by providing the basic public infrastructure including facilities for health care, education, transport, water supply and food. Also training courses on irrigated agriculture, marketing assistance and agricultural research were formulated in the project proposals.

It was planned to establish five village centers consisting of 28 hamlets. Each hamlet would have one health center, a cooperative and a primary school. Each village center would have a health center with a maternity home and dispensary, a cooperative bank branch, paddy stores, sales center, a post office, a junior and senior secondary school and quarters for the officers. In addition in total a 200 km of roads would be constructed and 420 dug wells which implied one well for 20 families. The establishment of a district research, extension and training center for the area was also included in the original plan.

Most of the originally designed construction as well as delivery targets with regard to the infrastructure services of the KOISP have been achieved. Changes have occurred due to subsequent revisions of the plans based on the experience and problems prevailing in the project area.

The area which was planned to be developed under the KOISP was reduced as a result of the shortage of water in the Lunugamvehera reservoir. This reduced the number of families to be settled and consequently a reduction of the number of hamlets.

Accordingly, not more than 23 hamlets and 4 village centers were established. The village centers Beralihela and Veligatta are new, Lunugamvehera and Weerawila are upgraded village centers.

4.2 Education

The KOISP has established 20 primary schools in hamlets and 4 junior and senior secondary schools in new towns. All of these are operational except for one at the Left Bank where the people are not yet settled. The construction of 22 schools and the upgrading of the existing 2 schools by the KOISP has drastically improved the type and volume of the educational infrastructure in the project area as there were only 28 schools in different categories before the project started. This number now increased to 50. Also the school facilities changed positively. Although the project did not give attention to the

educational facilities in the old area, as an indirect result of the project activities these have developed there too. The attraction of a large population consisting of various categories of society required advanced educational facilities. The government and other organizations have responded well to this.

It was envisaged to construct one school for 274 settler families in the new area. Since the number of families actually settling turned out to be lower than expected, there is now one school for every 246 families.

4.2.1 Educational Status

The educational status in the KOISP area has gradually been improved during the project period. This is reflected by literacy rates and school participation of boys and girls in the old area. At national level the literacy rate increased from 87 percent in 1981 to 89 percent in 1993. In the project area the literacy rate increased during the same period from 85 to 96 percent. Women are still more frequently illiterate, but the big gap between the male and female educational levels has been reduced.

It is important to note that the literacy rates of both men and women in the new area have grown much faster than in the old area. Apart from a better school attendance, the higher educational level of the selected settlers have contributed to the growth of the literacy.

School participation rates in all age, sex and income categories in both areas have gradually and satisfactorily gone up during the project period. Participation of girls has become equal to boys in all age categories, which was not the case in the pre-project period. There is no relationship observed between income level and school participation in both areas. This is even true for the age group of 15 to 19 years. Only families earning less than Rs. 1,000/= per month in the new area, appeared to withdraw boys more often from school.

The major reasons given today for school avoidance by children in the compulsory school age have changed as compared to the pre-project period. Earlier economic reasons were most frequently mentioned, while nowadays simple lack of interest is most often reported. The absence of schools which was a reason for 20 percent of the truants in the new area has stopped being a argument.

4.2.2 Problems with Project Schools

The failure of the project to provide permanent residential places to settlers has created various educational problems. Many schools have difficulties to maintain a sufficient number of students because settlers often stay only temporarily in the settlements or change residences frequently. Those who have not settled permanently, did not bring

their children along. The frequent change of schools by one and the same student is caused by his/her parents mobility and has become another problem in the operation of schools. To solve these problems alternative income generation opportunities during droughts should be sought.

Moreover, 26 percent of the households in the new area and 6 percent of the households in the old area have sent their children to schools outside the project area. The majority of these settlers reported to do this because they considered the school facilities in their original areas to be of a better quality. Secondly, the low income they are deriving in the settlement has encouraged them to keep their children with relatives.

Households who send their children to school in the project area have indicated several shortcomings. The most important issue was the shortage of teachers, especially in the new area. The shortage of teachers in specific subject matters is even more acute. Secondly, the inadequacy of school buildings due to excessive pressure of the student population was mentioned as important problem. Some schools were found to utilize produce stores to hold classes as a temporary solution. Thirdly, in the overpopulated schools the classroom equipment was not longer sufficient. This could temporarily be solved by using under-utilized equipment from other schools.

4.2.3 Benefits of Project Schools

The farmers who originally lived in the area before the project started have benefitted most from the establishment of new schools. In the pre-project period only a limited number of schools was available at remote places. Poor access roads and low incomes discouraged the children's school participation. Older children were kept home to look after their younger siblings, while their parents went out to work. The provided road network and schools closer to hamlets have removed the problems of accessibility. The World Food and the Janasaviya Program as well as the mid-day meal program contributed to remove the latter constraints.

The second group who benefitted most are children from neighboring traditional villages. Also they now have schools within a shorter distance and better roads available. The KOISP school facilities have been more beneficial for girls because they have contributed most to the increased school participation.

Finally, it should be noted that the new schools provided the opportunity for a large number of people to engage themselves as teachers or school staff. A total number of 260 persons is working as teaching staff at the schools. 26 percent of them comes from the new area, 28 from the old area, while the remaining 46 percent comes from other areas. As far as 61 percent of the teaching staff is female, demonstrating that women have been benefitting most.

4.3 Health

The KOISP project documents focussed to some extent on improving health facilities. The objectives formulated were as follows:

1. Each village center would have a maternity home and a dispensary.
2. Each hamlet would have one health clinic.
3. Malaria should be eradicated with the help of anti-malaria agencies.

4.3.1 Health Facilities in the Pre-Project Period

Before the project started there were three district hospitals. One in Tissamaharama, one in Hambantota and one in Debarawewa with limited facilities. In addition there were two dispensaries, two mobile dispensaries and two Ayurvedic dispensaries. Further four midwives and five public clinics providing prenatal, post-natal and immunization services were available in the project area.

Public health clinics were held at specific places on a particular day of the week. Due to poor roads and transportation problems, these clinics and the mobile dispensaries too failed to function according to schedule. Therefore most of the people were compelled to travel to the district hospitals. These hospitals did not have adequate facilities to cater to the needs of the population.

4.3.2 Health Facilities during and after the KOISP

The KOISP Mid-Project Evaluation Study stated that the health services in the area were managed by the Department of Health, which installed basic facilities. The old area had relatively better health facilities than the new area according to this study. The project constructed a rural hospital at Lunugamvehera with three wards, including a maternity ward. Further professional medical care was provided at two dispensaries on the clinic day.

This study surveyed the public opinion about the services provided by the clinics. Nearly 44 percent of the respondents considered the services to be good, while 37 percent felt they were average. In the new area 26 percent said that drugs were not available at village level, to get medicines they had to travel nearly 5.5 km. In the old area this distance was claimed to be 7.3 km. At that time anti-malaria spraying and distribution of drugs had been initiated by the project in the new area.

The facilities available at the Debarawewa and the Lunugamvehera hospital in 1987 and 1994 have been compared. Data reveal that in this period of time facilities have not changed much. The total number of beds, nurses and attendants remained almost the same. However, the number of doctors and dental surgeons increased from 3 to 7 in total. Nevertheless, the facilities seemed not to be sufficient to serve the total population.

The people in both the new and the old area reported to be more or less satisfied with the mother and child care and midwives services provided. Approximately 70 percent stated to be satisfied with these services, while roughly 10 percent considered the services to be bad. Asked about overall health facilities, 41 percent of the respondents appeared not to be satisfied with the health services in the area. The major reasons for the dissatisfaction were shortage of drugs and medical staff.

4.3.3 Malaria and Water Borne Diseases

In the period 1991 to 1993 the number of patients treated for malaria in the Debarawewa hospital has declined drastically. This may be due to the spraying program of the project. Also the number of patients treated for water borne diseases was much higher in 1992 than in 1993. However, comparable figures from the Lunugamvehera hospital in the period 1988 to 1994 show a fluctuating pattern to such an extent that no valid conclusions can be drawn.

Doctors in this area reported that incidence of malaria is very high directly after the rainy seasons. The diarrheal diseases are higher during the dry months. According to the settlers themselves incidence of malaria in this area is very low.

4.3.4 Other Health Indicators

The data collected in the sample survey revealed that infant mortality in the project area is very low. Out of 335 births only 2 babies died directly after birth. The figure is the same for maternal mortality.

Suicide rate appeared to be high. 16 percent of the people who died, had committed suicide, mostly using agro-chemicals.

4.3.5 Recommendations

In order to improve the health conditions of the people in the KOISP area the following recommendations have been formulated:

- The hospitals in the area are to be equipped with adequate personnel and materials.
- Transportation facilities, especially outstation, have to be developed.
- Training programs on hygienic measures must be conducted at school level, household level and staff level.

- Family planning methods must be introduced.
- Research work to develop a proper health program is needed.

4.4 Nutrition

Malnutrition undermines development in many ways: undernourished people lack the strength and energy to actively take part in development projects, a lack of a balanced diet also causes health problems, which can in turn have serious effects on the family income.

Since pre-school children and pregnant and lactating mothers are the most vulnerable groups in terms of nutritional status, attention is focussed on these groups.

Stunting is malnutrition as a result of chronic undernutrition. This becomes visible through a deficit in height for age. Data obtained through an anthropometric survey conducted in July 1994 revealed that in the KOISP area 36 percent of the children had signs of chronic undernutrition, which is almost equal to the national average. However, there appeared to be a significant difference of stunting between the old and the new area: 46 and 33 percent respectively. This dissimilarity may be explained by the fact that in the old area many landless families and families having a permanent income came to the survey.

Wasting is a sign of acute undernutrition, indicated by a deficit in weight for height. The percentage of acute undernutrition appeared to be very high in the project area. 46 percent of the children had signs of wasting, whereas the national figure is only 18 percent. Again a significant difference between the old and the new area is observed, showing an opposite picture as compared to stunting. Wasting was found among 49 percent of the children in the new area and among 30 percent in the old area. Moreover, for the children above 12 months wasting appeared to gradually increase with the age.

Concurrent chronic and acute undernutrition (concurrent stunting and wasting) is an effect of long term protein calorie undernutrition. When the observed height of a child is less than 90 percent of the reference median for its age and the observed weight is less than 80 percent of the reference median for its height, concurrent stunting and wasting is diagnosed. The incidence of concurrent chronic and acute undernutrition does not show significant dissimilarities in the old and the new area. The percentages are highest for the age groups of 12 to 23 months and 48 to 59 months.

A child born with a low birth weight (under 2.5 kg) is more likely to die within the first months of life. The incidence of low birth weight was reportedly high in the KOISP area, 43 percent for the new area babies, 26 percent for the old area babies.

4.5 Road Network

In the pre-project period the total length of roads amounted to 175 km. The project's construction work increased this to 435 km. Homestead roads for access to households and service centers have been constructed stretching over 200 km. Furthermore, linking feeder roads were constructed connecting hamlets with main roads and towns. These came to a total length of 60 km.

The project road network serves more than 4,900 families or 27,000 people settled in the new area directly. According to the large-scale-sample survey 96 percent of the houses in the new area is today accessible by a vehicle. In the old area this percentage would be 93 percent. Exact figures from the pre-project period are not available, but people reported that a considerable number of houses could not be reached by vehicle at that time. The predominant means of travelling in the area are by foot or push bike.

4.5.1 Public Transport

The bus services in the new and the old area have a prominent place in the public transport system. There are two kinds of busses: the busses of the Peoples Transport Boards and private busses owned by individuals. The bus services appeared not to be sufficient, in the early morning and at night they do not run at all. During the day they do not adhere to a proper time table. The inadequate bus service in the new area is a constraint for the functioning of the service centers and to attract new settlers into the settlements.

The Peoples Transport Board in Kataragama claimed that the roads constructed by the project are not suitable to operate a proper bus service. The roads are too narrow and in some places no proper culverts have been constructed for long vehicles to be able to pass.

4.5.2 Maintenance of Project Roads

Maintaining the linking roads is the responsibility of the Land Commissioners Department. Channel roads are maintained by the Irrigation Department and field channel roads are maintained with farmers participation. The survey revealed that 94 percent of the farmers in the new area participated to maintain field roads. This percentage for the old area is much lower as there are fewer field roads.

4.5.3 Evaluation of Project Roads

The majority of the settlers have appreciated the construction of project roads and recognized the consequent improved transport facilities. They claimed that the share of costs for transporting their produce has reduced with the changed mode of transport. Faster transport in case of emergencies was mentioned as an other important effect.

Pot-holes, inadequate drainage and poor maintenance are among the statements of dissatisfaction.

The project road network has reduced the problems of access to various service stations and also the time required to reach there. Although the settlements are now connected with the major towns by better roads, the distances are often very long. It should be considered to construct cross roads between hamlets and major towns to solve this problem.

4.6 Cooperative Shops

Constructing cooperative shop buildings for every hamlet and new town has been a major goal of the project's infrastructure program. The operation of the 25 constructed shop buildings has been handed over to the Cooperative Department. At present only 17 shops are open, 16 in hamlets and one in Lunugamvehera new town.

Under the prevailing liberalized economic system there are alternative places to purchase goods, sometimes the open market offers better quality at lower prices. The cooperatives have not always been able to buy the produce from the farmers at attractive prices. Therefore many cooperatives are making a loss. Only shops can be run viably in places where there is a sufficient number of permanent settlers and where there is a large number of food stamp holders. Problems in protecting the cooperative shops from thieves was another important reason for closing shops in hamlets.

Most of the settlers are depending on the cooperatives to buy foodstuff and other household items. Hence, settlers appreciate the services of cooperatives as retail shops.

The second purpose of the cooperative shops is to purchase the farmers' products. The farmers' production is not always of the required quality, but the cooperatives do not have the flexibility of private traders to change the purchasing prices accordingly. This has limited the cooperatives' purchasing opportunities.

4.7 Produce Stores

23 buildings in hamlets and new towns were allocated to be used as produce stores. 10 of these have been constructed earlier as World Food Program stores, the others have directly been constructed as produce stores. The main purpose of the produce stores was to facilitate the storing of inputs such as fertilizer and outputs such as paddy.

Field observations revealed that only two produce stores were opened recently for the intended purpose. Some of the produce stores are used to hold classes of overcrowded schools. The stores could be utilized more effectively by farmers organizations to

purchase and stock paddy and other products when their prices have considerably dropped.

4.8 Drinking Water

The project plan to provide drinking water to the new area by constructing one dug well for every 20 families has been unsuccessful due to the high rock table, salinity and severe drought in the area. Only 37 dug wells have been constructed.

As an alternative the project has supplied bowser water to each household and service center. This was continued until every family was given piped water.

The piped water system issues 3,000 cubic meters of water per day to be used only for drinking. Water is released during a limited daily period only to avoid blockage of filters. A flat rate of Rs. 11/= per month is charged per family. Water consumers organizations formed for each stamp post are providing support.

The bowser water as well as the piped water scheme has changed the source of drinking water of the households. According to the large scale sample survey as much as 76 percent of the households in the new area and 17 percent in the old area are now using water from road pipes. The percentage of households using either well water or piped water has gradually increased during the project period; from 80 percent in 1991 to 96 percent in 1994 in the old area. In the new area the percentage raised during the same period from 64 to 81 percent.

As a result of the project's water supply the time spent especially by women to collect water has drastically reduced. In the pre-project period the vast majority of the households (90 percent) in the new area depended on nearby wells or tanks and rivers and the housewives had to spend around 30 minutes to collect water. Now this time has been reduced to 5 - 15 minutes.

4.8.1 Settlers' Opinions and Problems

The majority of the settlers expressed their dissatisfaction with the bowser water distribution. Most of them felt that the amount of water supplied was not sufficient. A considerable number of settlers mentioned malpractices of the officers involved in water distribution (giving more water to people with whom they had a close relationship) and also irregularities in distribution.

Most of the alternative farmers stated that the tap water supply was the greatest achievement they had experienced so far from the KOISP. Only 23 percent of the respondents expressed dissatisfaction with the piped water scheme. Reasons given were amongst others the restricted time of water supply and the excessive number of families allocated for one tap. In fact, the limitation of water release to certain hours of the day

has resulted in the high number of consumers at stamp posts at the same time. Construction of more stamp posts or small tanks near stamp posts in places where the situation is worst, would allow a number of people to obtain water simultaneously.

According to the management of the tap water scheme the operational costs of the scheme can not be covered by the charges paid by the consumers at present. The present charges are very small and could easily be increased. Furthermore, the reported misuse of water should be controlled. Consumers are not allowed to use water for cultivation purposes neither for bathing at the stamp post itself. But there is no control over the usage of water which is taken away from the post. It is recommended to strengthen the water users societies and to give them the power to control the use as well as the misuse of water. This may minimize the operational costs of the scheme.

4.9 Other Services

Sub-Post Offices

In all four new towns sub-post offices have been established. These offices are operating with unequal facilities and several constraints. Nevertheless, it is a great service for the people in the new settlement and the old area close to Lunugamvehera and Weerawila.

Community Centers

In the new area a total of 22 community centers have been established, one in each hamlet. Almost all of the centers are presently used for various purposes such as family clinics, farmers organizations, community meetings and village festivals. In every community center a nursery school is voluntarily conducted by one or two young women from the same hamlet.

Agrarian Service Centers

The project has also constructed 3 Agrarian Service Centers to assist settlers obtaining input requirements. At present two centers are operational. As nowadays inputs are available in the open market as well, the importance of the Agrarian Service Centers as places of input supply has been reduced. In isolated areas such as Beralihela the center is still beneficial.

Police Station

The project has established one police station in the Lunugamvehera township. This station provides a service to the area which earlier could not be provided by the Tissa police which had a larger area to cover. The new police station and the new road network of the project strengthened the supervision by the police in villages resulting

in a reduction of illegal activities in the area. The number of offenses in the period 1986 to 1993 gives an erratic picture, but the number of offenses solved by the police has increased in recent years.

Agricultural Research Station

To enhance the agricultural research on area specific issues, the KOISP has established an agricultural research station in Weerawila new town. Only one research officer is available although two more officers were initially planned. Recently the station was involved in a research to identify suitable crops for the area maximizing productivity and income from the land under the existing condition of water shortage.

The Research Station provides advises and solutions for salinity problems of farmers in the project area. According to the statistics of the station 500 to 1,000 farmers a year had their soil tested. In addition the water and the soil in the area and the reservoirs are continuously tested by the station.

Extension Unit

To provide extension service to the project area, an extension unit has been set up, linking in with the normal extension system of the Agricultural Department. However, the Department abolished the post of agricultural extension officer, thereby breaking up the total extension system. At the time that these extension officers were still working at village level, around 40 demonstration plots and even more training programs were organized. But today more than 15 of these plots are deserted. Some of recent useful demonstrations included the cultivation of maize and ground nuts, upgrading land with a combination of chemical fertilizer and paddy straw, use of pure fertilizer by mixing and the successful cultivation of saline land.

Staff Quarters

Two types of staff quarters were constructed to enable service staff to stay in the project area. The first type of quarters are constructed at the sites of various service centers such as schools and hospitals. Generally, these are well-used. The second type is constructed in each hamlet for Field Inspectors, Colony Officers etc. In the initial phases of the project these quarters were frequently used by the relevant officers. Presently, the cadre of hamlet officers has been reduced as their services are less required. Consequently, the hamlet level quarters are less used by these officers, but staff involved in other services are now using the same quarters.

Farmer Training Center

The District Farmer Training Center constructed by the KOISP has a capacity of 150 farmers. This center conducts programs for various groups such as farmers, Janasaviya

beneficiaries and school children. The subjects covered include selection of suitable crops, methods of cultivation, application of fertilizer and agro-chemicals, ways to improve productivity etc. People in both the old and the new area have benefitted from the training programs.

4.10 Overall Impact of the Project Infrastructure Facilities

The availability of accessible infrastructure facilities within shorter distance for the majority of households is an important achievement of the KOISP. For example, today around 90 percent of the households have a primary school, secondary school, cooperative and a temple within 3 km from their homes.

Many people in the project area, the Hambantota District and the country have benefitted from the infrastructure construction activities as they were involved as designers, administrators, supervisors, contractors and skilled and unskilled workers on permanent and temporary contracts. It has been estimated that the number of person days employed during the period 1980 - 1985 by the four government agencies reached 7.2 million. That is one million more than the person days projected at the appraisal stage. The ratio of professional, skilled and unskilled laborers has been 1:3:13 indicating a higher demand for seasonal employees on a casual basis. However, people from outside the project area have benefitted most the employment generated. 100 percent of the professional and clerical grades, 88 percent of the skilled laborers and 73 percent of the unskilled laborers came from outside.

According the large-scale sample survey 56 percent of the households in the new area and 13 percent in the old area participated in the project's construction work either as hired laborers or on Shramadana basis or under the World Food Program. From these households 90 percent in the new area and 54 percent in the old area worked a hired laborer. 29 percent in the new area participated under the World Food Program as well. Almost all respondents claimed to have spent their income from this construction work on day-to-day consumption. The percentage of households which reportedly invested in profitable ventures has been negligible.

The project's infrastructure has created a number of permanent and temporary employment opportunities of various kind in the schools, hospitals, drinking water supply scheme, cooperative shops etc.

An estimated 400 permanent employment positions have been created in the new service institutions of which 30 percent has been occupied by new area employees, 27 percent by old area employees and 43 percent by people from elsewhere. 46 percent of the employees are female.

CHAPTER 5

SOCIO-ECONOMIC CONDITIONS

5.1 Methodology

In this chapter the benefits and impact of the KOISP-project on the overall socio-economic conditions in the project area are evaluated. The effects of the project on the following categories are investigated:

1. Settler families, women and youth in the new area.
2. Farmer families in the old area.
3. Employees of implementing state agencies.
4. Employees in the private sector.
5. The people of Sri Lanka.

The study has given special attention to women and the second generation of the settler families.

The study is based on information gathered from 479 households in the KOISP area. A sample survey has been carried out during March and April 1994. The sample design was a stratified two stage simple random sample with hamlet units as the prime sample units. The total farm families in the project area are distributed as follows: Left Bank 3,237 households, Right Bank 1,757 households, old area 2,985 households. Hence, the sample represented 6 percent of the total number of households. A structured questionnaire has been administered to each selected household. Additional information was collected from several secondary sources such as the Department of Census, Central Bank of Sri Lanka, Government officials in the project and other relevant studies published by ARTI, IIMI, the Land Commissioner and others.

Limitations

Benefit assessment and impact evaluation in the KOISP is a complex exercise because the effects are not only due to project activities but also to some micro-economic and social policies which are introduced by the government. Therefore, the study analyses have been done within the macro level socio-economic framework instead of limiting the analysis to the framework of the KOISP.

Furthermore, since some data and information regarding expenditure and income particularly with regard to credit marketing transactions and household expenditure were not available, the findings reflect only the general trend.

5.2 Demographic Characteristics

The estimated farm population in the project area is 52,124, which represented 10 percent of the district population in 1993. The estimated population during the pre-project situation in 1980 also represented 10 percent of the total district population which was 438,000.

The settlers can be grouped into two major ethnic categories: Sinhalese and Muslims. The Sinhalese population is evenly distributed over the area. The Muslims as a small minority are living only in hamlet 8 in the Right Bank. The very few Tamils in the area were not included in the sample.

The average family size for the KOISP area is 5.5, which is only marginally higher than the national average of 5 persons per family. During the pre-project period the family size came to 5.7. The declining trend is similar to the national pattern. Two additional reasons specifically applicable in the KOISP area should be noted. Firstly, the health and education facilities in the area gradually improved during the last 15 years. Secondly, some settlers in the higher income groups did not bring all their family members to the project area because of a lack of educational, residential and infrastructure facilities. These factors are responsible for reducing the family size as well.

The percentage distribution of the male and female composition in the KOISP area is 51 percent for men and 49 percent for women, which is slightly different compared with the national figure (50.6 and 49.4 percent respectively).

Literacy rate is considered to be a key achievement indicator in the context of the socio-economic development in the KOISP. In the old and new area both, the literacy rate increased considerably during the project period. The literacy percentage for men increased from 90 in 1981 to 97 in 1994. The female literacy rate in 1981 was only 79, which raised to 94 in 1994.

The age-specific school participation rate is another important indicator which illustrates the level of education and accessibility of education facilities. The general trend of school participation appeared to be very high. This was due to the greater availability of schools, especially in the new area where construction of new schools was part of the main infrastructure facilities provided for the new settlers. On the other hand, the general upgrading of schools throughout the island is also a factor responsible for higher school participation. The number of children avoiding schools has decreased over the given time frame.

5.3 Housing and Sanitation

5.3.1 Type and Size of Houses

Of the sample households in the old area 62 percent had a permanent house, 38 percent a semi-permanent. In the new area only 14 percent of the surveyed houses appeared to be a permanent construction. The vast majority of the houses are small: in the new area 84 percent has a floor area of less than 500 square feet, in the old area 50 percent of the houses fall into this category. Compared to 1981 only in the old area the size of the houses has increased: 84 percent of the houses in the old area had a floor area of less than 500 square feet at that time, 88 percent of the houses in the new area.

In the pre-KOISP period nearly 88 percent of the houses were owner-occupied. This has increased now to about 99 percent of the houses, mainly due to legal activities and the alienation process undertaken by the KOISP authorities.

The extent of overcrowding in the houses has been estimated in two different ways. On the basis of "minimum floor area per person" 34 percent of the houses in the project area are overcrowded. On the basis of "three persons or more per room" only 12 percent of the houses appeared to be overcrowded. It was observed that houses in the new area are more overcrowded than those in the old area. Comparing 1981 and 1994, overcrowding declined faster in the old area than in the new area in terms of three or more persons per room. Minimum floor space per person decreased in the old area from 33 to 23 percent, while it increased slightly in the new area from 39 to 40 percent of the houses.

5.3.2 Water and Sanitation

Water availability is an essential infrastructure facility for better living conditions of the people. Nearly 80 percent of the households in the new as well as the old areas obtained their drinking water from their own wells or pipes. In 1981 only 10 percent of the households in the new area received their water from these sources, and 40 percent in the old area. Hence, it can be concluded that the water supply in the project area has been relatively good.

Lavatory facilities are an important method for better sanitation and is also an indicator of the standard of living. Approximately 95 percent of the households were found having toilet facilities. In 1981 the figures for the old and the new area were respectively 75 and 49 percent.

The type of toilets available can be seen as an indicator of the general status of health of the people. In the old area 70 percent of the households owned a water seal, 15 percent of pit with concrete slab. In the new area on the contrary, only 22 percent had a water seal, while 56 percent used a pit with concrete slab.

5.4 Household Durables

Availability of specific household durables and other valuable items can be taken as a crude indicator of the economic status of a household. The study revealed that the old area farmers are relatively wealthier than the new area farmers.

However, estimation of the level of prosperity or poverty in the KOISP area on the basis of household durables is a difficult and complicated task. Yet, it was obvious that there are some positive changes in the socio-economic conditions of the people who were settled in the schemes. This is not only the result of project activities, but also of micro and macro level socio-economic policies which are implemented by the government.

While comparing the data and the project evaluation studies of 1981, 1985 and 1994 a declining trend of poverty in relative terms and an increasing trend of prosperity is revealed. This has been due to increased income levels and production, development of infrastructure facilities and some other benefits which are provided by the project as well as the central government. Nevertheless, it is important to note that there are no significant data available to estimate poverty in absolute terms.

5.5 Employment

5.5.1 Characteristics of Labor Force

The different characteristics of the labor force are explored in order to identify the educational level, the economically active population and the employment and unemployment level of the population of the KOISP area. The labor force is defined to include all those in the age group of 15 to 64 years.

The labor force in the project area did not show any major changes during the 1981-1994 period. The economically active population increased from 59 percent in 1981 to 64 percent in 1986, declining again to 62 percent in 1994. Low birth rate and out-migration are important factors contributing to this trend. The old area continued to record a higher percentage of labor force than the new area. A considerable increase in the employed population of the new area must be noted. The percentage employed in the labor force in the new area increased from 32 percent in 1986 to 71 percent in 1994. Corresponding figures for the old area are 29 and 63 percent respectively. This expansion is mainly due to employment opportunities provided upon completion of the project. This becomes clear while comparing the mid project evaluation data of 1986 and the final evaluation data of 1994. Both areas continued to maintain a high economically active ratio but the new area registered an increasing trend over the period 1981-1994 whereas the old area registered a downward trend in this sector.

The percentage of discouraged workers raised from 2 percent (1981) to 12 percent in the

old area and from 1 to 6 percent in the new area. This increase is unavoidable but constitutes a serious threat to the development process.

5.5.2 Type of Employment

During the time span of 8 years from 1986 to 1994 agricultural related employment opportunities have decreased from 79 to 74 percent in the old area and from 83 to 82 percent in the new area. This reduction is attributed to the persisting drought and the consequent inadequate water supply during that period.

Salaried employment including the private sector and the state sector have reported a sharp upward trend in the same period. Self-employment was found more frequently in the old area showing an upward trend, whereas skilled employment showed a downward trend in both old and new areas.

Female dominance is found in farm helping, while males were dominant in agricultural operations. This was true in both areas. Women are more involved in the government and private sector in the old area as compared to the new area. The old area experienced less female participation in agricultural related activities.

Nearly 93 percent of the heads of the households in the new area are engaged in an occupation connected with agricultural activities. In 1986 this was 83 percent. For the old area, this percentage increased from 80 percent in 1986 to 91 percent in 1994.

5.6 Income and Assets

Both old area farmers and new area settlers have experienced a growth in their income patterns, although this increase is only marginal. The increase is not proportional to the current cost of living and expenditure patterns.

Settlers in the new area

Almost two-thirds of the households in the new area received more than Rs. 2,000/= as average monthly income. An average monthly income of more than Rs. 4,000/= has been received by 24 percent of the sample households. Since the greatest part of the income is from agricultural related activities, the release of adequate water at the right time would have further increased their income.

Almost 38 percent of the income is obtained from paddy and other agricultural activities. Yet, the income from agriculture is much lower than had been expected due to the problems in water release. The income from livestock and other field crops gradually decreased because the contributions from paddy and salaried employment increased.

Also the number of animals reared and the lands brought under OFC cultivation reduced.

The second major sources of income are salaried employment and self-employment. Also government subsidies and food stamps have contributed considerably to the income level. This was particularly true for the new area settlers.

Examining the housing patterns in relation to income class distribution, a clear association of improved housing conditions and facilities with increasing income is noted.

Farmers in the old area

The majority of the population in the old area (65 percent) received an income of more than Rs. 3,000/=. Better infrastructure facilities and related education facilities further encouraged and strengthened the possibilities in seeking employment other than agriculture, which however still remains the major source of income. Compared to the new area settlers, the farmers in the old area are better off in most of the domestic departments.

Paddy remained the most important source of income in the old area. Cultivation of other field crops contributed very little and the livestock sector showed a declining trend. The decrease could be due to the growing influence of other salaried employment, both government and private sector, and to the income from paddy as these activities remained the major income sources. Another reason could be the decrease in number of animals reared and in the lands brought under OFC cultivation.

Also agricultural subsidies constituted a major source of income. Therefore removal of these subsidies would have an effect. Dependence on food stamps, school stamps and Janasaviya was almost nil. Further, Middle-East employments started its headway to the old area since 4.5 percent of the monthly income has come from this source.

Hiring out agricultural implements contributed almost 6 percent to the income which is nearly ten times higher than in the new area.

A positive association of improved housing conditions and basic facilities with increasing income is observed.

Due to better infrastructure facilities in the old area, this area reported a high percentage of households owning assets. In both areas bicycles are found to be the best mode of transportation. Motorized vehicles for transportation and tractors, both 2 and 4 wheels are more common in the new area than in the old area.

5.7 Household Expenditure

Farmers in the old area appeared to enjoy a better intake of food as their expenditure on food items is higher than that of the new area settlers.

Settlers in the new area

The study revealed that expenditure on food items as a percentage of household income decreased along with increasing income in the new area. This is also observed with regard to non-food items and with regard to income from food stamps and Janasaviya. Among the lower income groups (below Rs. 1,500/=) the monthly expenditure on food is nearly conterminous with their income or even above it.

Looking at the expenditure for house construction, it appeared that for the majority of the households the farmers' own savings and government subsidies together covered the expenses incurred.

Farmers in the old area

Also in the old area expenditure on food as percentage of household income decreased along with increasing income. The lower income groups spend exorbitant proportions on food and non-food items despite the food stamp program and Janasaviya. The monthly expenditures in all income classes in the old area are almost double that as found in the new area.

In contrast to what prevailed in the new area, the housing construction costs were mostly met by the farmers themselves. Government subsidies were not utilized. Most of the farmers used earnings after 1986 and formal loans.

CHAPTER 6

CROP PRODUCTION

6.1 Introduction

The project documents of the KOISP granted much attention to the development of the agricultural sector in the area. The main agricultural objectives formulated were as under.

1. Increase the cropping intensity in the new area from 20 percent to 170 percent.
2. Improvement of the irrigation systems in 4,300 ha of the existing old system.
3. Increase the cropping intensity in the old area from 140 percent to 170 percent.
4. Increase the production of paddy and other field crops (OFC) by 44,000 mt and 11,400 mt respectively.
5. Generation of agricultural employment.
6. Providing agricultural support services such as input supply, extension, training, research, credit, marketing and processing.

6.2 Methodology

This study utilized the ARTI large sample as sample frame out of which initially 150 farmers were randomly drawn. The final sample consisted of 32 farmers of the Left Bank, 62 farmers of the Right Bank and 54 of the old area, adding up to a total of 148 farmers. The farmers have been interviewed using a structured questionnaire during the months June, July and August 1994.

6.3 Crop Production prior to the Project

6.3.1 Land Use Pattern

The project area was regarded as one of the most important centers of agricultural production in the island. A well established tank irrigation system supplied water to the area. Nearly one-half of the households received a greater part of the family income through farming. The traditional land use pattern consisted of five types:

1. Forest and uncultivated land.
2. Irrigated rice land.

3. Home gardens and highlands.
4. Chena plots.
5. Land for residential, commercial and recreational purposes.

6.3.2 Rice Cultivation

The major crop on irrigated lowlands was rice. Approximately 4,000 ha was confined to this crop which was grown both in the maha and the yala season. The cropping intensity was found to be 121 percent with a marked difference between the irrigated and unirrigated areas, 152 and 65 percent respectively. The average rice yield for the two seasons amounted to 2,500 kg/ha. A significant share of the rice cultivation was confined to the major irrigation systems in the area.

About 44 percent of the lands was utilized for rice as compared to 16 percent for chena cultivation on the unirrigable highlands and the encroached crown lands, 14 percent for homesteads and 25 percent consisted of highlands other than chena.

6.3.3 Farming Systems

The farming systems in the area were determined by the types of land and availability of water. Under irrigated conditions lowland rice cultivation had priority. On the highlands rainfed farming was practised. This farming system can be grouped into two different types: chena cultivation which concentrated on annual crops and secondly the cultivation of perennials and annuals on permanent highland plots and homesteads.

6.3.4 Technology Adoption

As the project area was basically a rice-growing area different institutes took initiatives to introduce innovations to the rice culture during the pre-project period. Most of the farmers cultivated 4-4½ months High Yielding Varieties (HYVs). Agro-chemicals and fertilizers were being used but the quantities appeared to be lower than recommended. Transplanting as a method of plant establishment was not popular in the area.

The farmers' yields ranged between 1,820 kg/ha and 2,860 kg/ha depending on the cultural practices adopted and inputs applied. The higher yields came from the irrigated areas. Yet, the majority of the farmers considered chena cultivation as more dependable than irrigated agriculture.

The technologies preferred by the farmers were HYVs, fertilizer, agro-chemicals and tractors for land preparation. The data demonstrate that adoption rates were higher in the irrigated areas.

6.4 Crop Production - Current Situation

6.4.1 Rice Cultivation

The majority of the farmers in the old area receive an adequate supply of water in both maha and yala which enables them to grow rice in both seasons. Although efforts were made to provide irrigation facilities through a network of canals in the new area, farmers often experience conditions of water shortage. It has been observed that most of the farmers in the new area, both Left and Right Bank, grew their rice crop only in the maha season.

For the maha season 1993-1994 the average yields in the old and new areas is estimated at 3,706 kg/ha and 3,649 kg/ha respectively, which indicates no significant difference. Farmers in the old area have obtained an average paddy yield of over 3,000 kg/ha even during the yala season.

The main cropping systems in the lowlands of the old areas are: (1) maha rice cultivation followed by yala rice cultivation and (2) maha rice cultivation followed by other field crops. The latter cropping system is not prominent.

The predominant lowland cropping system of the new area is maha rice cultivation followed by a yala fallow period. The cultivation of OFCs was introduced in the 1987-1988 maha season as a remedial measure to overcome the water problem, but the sustainability of this solution can not be assessed as yet.

The potential paddy yields in the KOISP area are reported to approximate 4,800 kg/ha. A performance index¹ has been calculated separately for farmers in the new and in the old areas. On average farmers have exploited 75 percent of the yield potential, whereas only 7 percent of the farmers in the new area and 13 percent of the farmers in the old area were able achieve the full yield potential.

6.4.2 Cultivation of Other Field Crops

The KOISP had planned to cultivate rice in poorly drained soils and OFCs in well and moderately drained soils during the maha season. In the yala season OFCs would be introduced to 50 percent of the lowland area. This cropping pattern was suggested to solve the water shortage in the area. The results are however not encouraging. The majority of farmers in the old area limit themselves to rice cultivation in both seasons

¹A farmer performance index was defined as the ratio of farmer yield to the location specific yield potential. This indicates to which extent the farmer has been able to exploit the yield potential. In fact, the farmer performance index is a measure of the farmer's technical efficiency.

(91 percent in maha 1993-1994 and 63 percent in yala 1993), OFCs are hardly grown. About 31 percent of the farmers abandon their rice fields in yala altogether.

On average 65 percent of the farmers in the new area have exclusively grown rice in the maha season 1993-1994 (Right Bank 81 percent, Left Bank 50 percent). Only 11 percent on the Right Bank and 16 percent on the Left Bank have practised the combination of rice and OFCs in the same season. In the yala season the percentage of farmers who were able to cultivate rice as well as OFCs, was negligible. The rice fields were abandoned in yala by 92 percent of the farmers. These data suggest that crop diversification has occurred only in a marginal form, farmers clearly prefer paddy.

6.4.3 Cropping Intensity

At the inception of the KOISP it was expected to increase the cropping intensity in the old area from 140 to 170 percent. Reports reveal that the cropping intensity of the lowlands has increased to 163 percent which is a significant achievement. In contrast, the cropping intensity of the highland area did not exceed 65 percent.

The cropping intensity in the new area was expected to raise from 70 to 170 percent. This objective has not been reached satisfactorily. The lowlands of the Right and Left Banks have recorded cropping intensities of 98 and 48 percent respectively. The estimated cropping intensities in the highlands of the same domains is only 60 and 42 percent.

The above data demonstrate that crops introduced to the highlands, especially OFCs, have not been incorporated well into the farming systems.

6.4.4 Chena Cultivation

Chena cultivation is practised mostly on crown lands. A variety of crops such as maize, chilies, cowpea, gingerly, green gram, kurakkan, onion and vegetables are grown under rainfed conditions. Twenty percent of the farmers reported to use chena cultivation. The majority of them exploit plots in the category of 0.8 - 2.0 ha. The fallow period has now been reduced to 1 - 2 years, while some farmers utilize the same plot continuously converting the shifting cultivation into a permanent farming system. Mostly a mixed cropping system is implemented and external inputs such as fertilizers, insecticides and weedicides are only marginally used. Therefore, the cost of production is not very high. The production in this farming system is rather high, but the farmers often face marketing problems which causes an insufficient farm income. Further, the cultivations are frequently damaged by wild animals. It also seems that institutional services such as credit, research and extension have not been oriented towards chena cultivation.

6.4.5 Total Production

The study has revealed a fluctuating pattern for paddy production in the past seasons. Maha production was higher than yala production in all the years. The KOISP had projected an annual paddy production target of 44,000 mt. The actual production for the year 1993 amounted to 41,000 mt, which is an achievement of 90 percent. The uneven pattern of the annual total production is primary due to the fluctuating paddy area in yala seasons. The cultivated area in the old system was generally constant for both seasons. In contrast, the area under paddy cultivation in the new area showed a marked variation ranging from 0 to 1,616 ha in previous yala seasons. Even in maha seasons the paddy area in the new system varied.

The KOISP expected an annual output of 11,400 mt of OFCs. The actual production of OFCs in 1993 amounted to only 2,800 mt, which satisfies not more than 25 percent of the projected production target.

The cultivated area for OFCs showed a significant variation from 67 ha (yala 1989) to 1,747 ha (maha 1990/1991). Many farmers abandoned their fields in yala due to water shortage. However, during the last three seasons OFCs occupied an area of over 1,000 ha, which indicates a relatively stable situation.

6.5 Farm Budget

6.5.1 Cost of Rice Cultivation

The average cost of rice production in the area is estimated at Rs. 23,000 per ha. Based on the farm gate price of paddy (Rs. 7.50 per kg) and the average yields of the sample (3,605 kg/ha) the net income of rice production has been calculated to come to Rs. 4,200 per ha. This implies a monthly net income of not more than Rs. 700/ha. Hence, it appeared that rice production is not very attractive in terms of economic returns and further, it contributes only marginally to the family budget.

The study revealed that 44 percent of the production costs were spent on labour wages, 39 percent on inputs and 17 percent on machinery and fuel.

6.5.2 Cost of Other Field Crops Cultivation

Among the OFCs grown in the area green gram, cowpea and ground nut are the most important crops. The average yields of these crops were below the potential yield. Cowpea and ground nut cultivation indicated net losses. Green gram on the contrary, has produced a profit of Rs. 24,000 per ha. But since the majority of the farmers practise a mixed cropping system OFCs have generally yielded a net profit of Rs. 6,000 per ha. Factors contributing to the low yields and the low income from OFCs vary from water shortage and diseases to a lack of buyers.

6.6 Technology Adoption

The KOISP made efforts to introduce technologies such as HYVs, fertilizers, agro-chemicals, transplanting, multiple cropping, processing and storage.

HYVs have really gained popularity in the area, almost all the rice farmers cultivate these varieties now. Transplanting has been introduced as a plant establishment method, but it seems that farmers still are inclined to practise broadcasting. The reason should be sought in the high labour involvement in transplanting and in the timing of water issues.

Nearly 70 percent of the farmers have applied fertilizers to their rice fields. Farmers in the new area show relatively lower adoption rates due to the risk associated with the conditions of water shortage. Although the majority of the farmers have utilized fertilizers, it is reported that the recommendations on frequency and dosage were not followed by 35 percent of them.

Pests and diseases were controlled with chemicals only, by almost 75 percent of the farmers. Most of them have nevertheless deviated from the standard recommendations. Weed control too was mostly done with agro-chemicals. Yet, 30 percent of the farmers still practised manual weeding.

An adoption index has been constructed to measure the degree of adoption of given technologies by the farmers in a given domain. It appears that only 9 percent of the farmers belonged to the category of high adopters, which reveals that technology utilization in the project area is not satisfactory.

6.7 Institutional Support

6.7.1 Fertilizers and Agro-Chemicals

The study revealed that fertilizers and agro-chemicals are widely available in the project area. The agro-chemical companies have organized demonstrations and launched advisory services in addition to the supply of inputs. Still, the farmers' knowledge about standard recommendations pertaining to time of application, frequency, mixing ratio, threshold value and precautionary techniques is not satisfactory.

The farmers have mentioned the high price, the low quality, the lack of advisory services and unavailability of inputs as constraints with respect to the use of fertilizers and agro-chemicals. Half of the farmers considers the prices as too high which results in the application of lower quantities than recommended or avoiding to use these inputs altogether. The fact that farmers named lack of advisory services as major constraint could have been anticipated since the extension-farmer contacts were reduced with the removal of the Village Extension Workers.

6.7.2 Agricultural Extension and Training

As the project identified agricultural extension as one of the key elements responsible for the expansion of agricultural production and because this service was required for the crop diversification program, efforts were made to establish an extension network under the supervision of the Department of Agriculture. The concept of a Training & Visit system was introduced with bi-weekly training programs for Agricultural Instructors and Village Extension Workers during two seasons. The knowledge transfer and backward information flow were expected to occur through the visits made to Contact Farmers and through frequent contacts between the Follower Farmers and the Contact Farmers. However, at present the bi-weekly training sessions and the farm visits are not implemented as the Village Extension Workers are not attached to the Department of Agriculture any more. The removal of these grass-root level extension workers from the extension frame work with the introduction of the Provincial Council system has disturbed the extension efforts of the Department of Agriculture severely.

While investigating the frequency of visits made, it became clear that only 4 percent of the farmers have received one visit every month, whereas 45 percent had only one visit per season. The remaining 51 percent had not any extension contact during the last season.

6.7.3 Institutional Credit and Insurance

In principal 76 percent of the farmers have access to institutional credit. But generally, farmers feel that non-institutional credit can be obtained more easily. Although the private money lenders' interest rates were very high, farmers are more inclined towards these sources of credit as they can thus avoid the formal application submission, approvals and delays.

Institutional credit facilities were granted for short-term crops at an interest rate of 9.5 percent per annum and farmers had to repay the full amount at the end of the cropping season. Medium term loans were given for purchasing tractors and other farm equipment. Such loans were granted at 12.5 percent interest per annum and the repayment period was 3 - 5 years. In general, loan recovery rates were satisfactory. However, during adverse seasons farmers were often unable to settle their loans. As farmers experienced many adverse seasons in a series, they were unable to settle their institutional credit. Therefore, non-institutional borrowing increased during the past period.

The crop insurance scheme was introduced by the Agricultural Insurance Board. Agricultural insurance was compulsory in the credit schemes and often the cost of insurance was included in the loan. The insurance payments were pre-determined by the extent of damage with a ceiling of Rs. 5,412 per ha for irrigated paddy and Rs. 1,476 per ha for rainfed crops. The crop insurance scheme has encouraged farmers to adopt new

crops, new agricultural techniques and cropping patterns with greater confidence.

The present study indicates that only 55 percent of the farmers in the project area have contributed to the crop insurance scheme. Factors for non-participation were a too low income, no confidence in the scheme, not having received enough benefits in past seasons and not having obtained adequate information.

6.7.4 Agricultural Marketing

At the inception of the project the Paddy Marketing Board and cooperatives were the main buyers of paddy and OFCs through a guaranteed price scheme for paddy and a floor price scheme for OFCs. As the government has directed its policy towards the private sector these marketing institutions and these price schemes are not operating effectively. In fact, it seems that the marketing is completely controlled by private dealers.

Prices for paddy as well as OFCs decrease considerably during the harvesting periods and this proved to be particularly problematic for the latter crops. The absence of floor prices for OFCs caused significant price fluctuations. In addition to a limited access to market information, these factors adversely affected the crop diversification program as introduced by the project.

CHAPTER 7

LIVESTOCK DEVELOPMENT

7.1 Introduction

Although the KOISP area was considered to be one of the predominant cattle and buffalo raising regions of Sri Lanka, no livestock component was included in the first phase of the project. Only in the second phase of the project (1983 -1986) livestock was incorporated into the mainstream of the development activities of KOISP. The major objectives were:

1. Development of 1,000 ha for livestock (and agro-forestry) enterprises.
2. Incremental production of 4.1 million litres of milk annually and saving of foreign exchange by import substitution.
3. Improved living conditions of the beneficiaries and sustained economic growth.

7.2. Methodology

A recent study (1994) conducted by the ARTI revealed that only a meagre 3 percent of the farmers in the KOISP area show preference for animals other than cattle or buffaloes. Therefore, the study has focussed exclusively on cattle and buffalo raising activities as the single most important livestock husbandry practise in the Kirindi Oya area. The study has been conducted in three stages.

In the first stage the project proposal and secondary data on the pre-project situation were scrutinized. It became clear that the project proponents had not paid any attention to livestock development at the project formulation stage. Further, documentary evidence on the pre-project status of livestock husbandry proved to be scarce.

The objectives of the second stage were to describe the pattern of livestock production today, to examine the various costs and returns associated with these livestock production practices and to depict the present institutional set up providing livestock services.

In the third stage of the study an attempt was made to find out the overall impact of the project on livestock production activities in the KOISP area.

The target population of the study consisted of all herdsmen in the project area. In the absence of a proper population frame the lists of member herdsmen of the three Cattle

Owners Associations in the KOISP region, including both settler and non-settler herdsmen, were taken as the population frame. It should be noted that only 80 percent of the herdsmen in the area have obtained membership in these associations.

A distinction should be made between the Herdsmen-Settlers and Settler-Herdsmen in the KOISP area. The former category consists of the traditional herdsmen in the area who have been traditionally involved in cattle and buffalo raising. They are mainly concentrated in the old area. The Settler-Herdsmen are those settler-cultivators in the new area who have adopted cattle and buffalo raising after they were allocated land in the KOISP project. All the Settler-Herdsmen are concentrated in the new area and they are part-time livestock farmers.

A structured questionnaire was administered with a view to collecting detailed quantitative data on herd characteristics, feeding practices, animal health, costs of production, income, use of extension and other services. In addition case studies and rapid appraisals were used as survey techniques.

The study experienced severe constraints due to a lack of background information and published data on the pre-project situation. This made it hard to compare the present milk production data with those of the past. Animal numbers presented another problem. Herdsmen were often reluctant to give actual numbers as they were hesitant to disclose their wealth position. Also, counting the number of animals owned is supposed to be a socially despised practise and therefore not done. It is felt that the numbers as reported by the herdsmen are heavily underestimated. The Jungle Based System of cattle and buffalo raising made data collection through observation close to impossible.

7.3 Cattle and Buffalo Husbandry in the Pre-KOISP Period

The traditional system of cattle and buffalo husbandry in the Kirindi Oya area was a low technology, low input and extensive system. Purchased inputs formed a negligible part of the variable costs, the major input was manual labour. The outputs of the system were milk and draught. It could be considered as an environmentally friendly crop-stock integrated system because the cropping system benefitted from draught power and organic fertilizer provided by the animals while the animals were fed on stubble left behind in the paddy fields after the cultivation season. As most of the farmers were both herdsmen and cultivators, there was a social harmony between the two categories of farmers.

One of the turning points that affected the pre-KOISP livestock industry was the introduction of tractors in the mid-twentieth century, which reduced the importance of male animals for draught power. With this technology change the sale of male animals for beef to various brokers started.

7.4 The KOISP and Livestock Raising

Out of a total sample of 479 households only 44 kept livestock. Cattle and buffalo raising is the most important livestock enterprise, while poultry assumes a secondary importance. Poultry appeared to have gained popularity in the new area where more than half of the livestock raising households keep poultry. The small sizes of the flocks show that poultry is mainly kept for home consumption. Pigs and goats are not raised in the KOISP area although the latter are supposed to be good dry-zone animals.

Neither the appraisal of the KOISP in 1977 nor the appraisal of the reformulated KOISP in 1982 mention the cattle and buffalo industry in the area. Since the emphasis of the project was on settler-based irrigated crop production, about 1,800 ha of scrub jungles used by herdsmen as grazing lands were cleared and a large number of irrigation tanks that supplied drinking water and wallowing sites for cattle and buffaloes were levelled and developed. These activities had an adverse impact on the cattle and buffalo husbandry practised by herdsmen in the old area, who now lost their traditional grazing grounds which were located in the new area. Moreover, the KOISP facilitated double cropping which drastically reduced the duration of the fallow periods. This prevented the herdsmen from keeping their animals in the fallow fields for extended periods of time. These changes have led to a modification of the traditional cattle and buffalo raising system. Today, five types of management systems have been adopted by the herdsmen in the Kirindi Oya area.

1. *The Village Based System*

The Village Based System of cattle and buffalo raising is mainly practised by part-time farmers whose herds are dominated by cattle. They keep their herds in the village itself. During the nights the animals are enclosed into pen. Close supervision of the animals is essential during the cultivation period, therefore both women and child labour are extensively used.

2. *The Migration System*

Due to the loss of traditional grazing land herdsmen in the new area are forced to take their herds to jungle areas during the cultivation periods. During the fallow period the animals are brought back to the village and are then fed on stubble left behind in the paddy fields. This system depends on hired and family labour both.

3. *The Traditional System*

The traditional system is a modification of the pre-KOISP system of cattle and buffalo raising. As a consequence of the loss of the traditional grazing grounds and the reduced fallow periods, the herdsmen moved to jungles adjacent to their

villages. Unlike the pre-KOISP system, the herdsmen bring the calves and lactating cows to cow pens in the evening. They keep a closer eye on the animals than the old system in which some animals returned to the herdsmen only after a few seasons. The animals are brought back to the fallow paddy fields whenever possible.

4. *The Jungle Based System*

Some herdsmen, both in the old and new areas, have taken their herds to far away jungles in search of food and drinking water. The herds are kept in the jungle over long periods. However, the Jungle Based System can be regarded as a type of Migration System too as the animals are brought back to the villages when sufficient food is available in the paddy fields.

5. *The Tethered Grazing System*

The Tethered Grazing System is adopted by Settler-Herdsman in the new area. The herd size in this system is small and mainly cattle is raised. The purpose of production is principally to meet household consumption needs. The animals are kept in cattle yards and sheds and they are fed with cut grass and straw. The system depends totally on family labor.

In the new area the Village Based and the Migration System are equally important. In total 88 percent of all herdsmen in the new area are engaged in cattle and buffalo raising under these two systems. In the old area almost half of the herdsmen practise the Migration System.

Of the Settler-Herdsman in the new area approximately 57 percent used the Tethered Grazing System, which is not practised at all in the old area.

7.4.1 Buffalo and Cattle Populations

Reliable estimations of the animal population in the KOISP area are not at hand. Based on the available information the total animal population would come to 54,244, which are 26,322 buffaloes and 27,912 cattle. According to knowledgeable herdsmen in the area, these figures must be heavy underestimations.

Data provided by the herdsmen indicate that the number of animals today is slightly above the 1985 level. This is in contrast to the popular belief that animal populations have decreased since the implementation of the KOISP.

7.4.2

Herd Characteristics

The largest herds are maintained by Herdsmen-Settlers in the old area practising the Jungle Based and Migration System. The average herd sizes are 194 and 105 animals respectively. Even in the Village Based System the average herd size is rather high: 50 in the new area and 66 in the old area.

Cattle dominates the herds in all management systems except for the Jungle Based System in the old area.

In the Village Based System cattle is predominant in both the new and old areas. The largest herds are raised under the Migrations System and Traditional System in the old area and also the Traditional System in the new area.

Approximately 25 percent of the animals in both new and old areas are of an improved type (pure breeds and cross breeds). In the Jungle Based System improved animals are mostly found among the buffalo population indicating that the aim of this system is mostly buffalo milk production for curd. In most of the management systems the calf population consists of more improved animals than the cow population which demonstrates an increasing interest among herdsmen in improving their herds.

According to the respondents the calving percentage has increased slightly over the past six years for both buffaloes and cattle in the project area as a whole. The calving percentage is higher in the old area than in the new area.

Information provided by the herdsmen reveals that calf mortality has increased with the implementation of the KOISP. With the veterinary services provided by the project this situation should not have arisen. There may have been a high degree of misreporting by herdsmen who are biased against the KOISP.

7.4.3

Milk Productivity

The average milk yield of an animal in the new area is approximately half that of the animals in the old area which can be attributed to the food shortage in the new area. The herdsmen indicated that the average milk yield has shown a downward trend since the implementation of the KOISP.

Figures on milking percentages show that curd production from buffalo milk is mostly concentrated in the old area. The major reason for not milking the cows appeared to be drought in both old and new areas.

The lactation rate is low in the new area, probably due to insufficient availability of grazing land. The highest lactation yield is reported by herdsmen in the Village Based

System in the old area where more feed is available and animals are raised under closer supervision than in the other systems.

7.5 Profitability of Buffalo and Cattle Raising

The Village Based and the Tethered Grazing System in the new area appeared to bring in negative gross profits indicating that they are not viable in the short run. However, family labor takes a great share of the total labor costs in these systems. If the opportunity cost of family labor is assumed to be close to zero, then both these management systems show positive gross profits.

The long term viability of an enterprise is indicated by positive net profits. Even assuming zero opportunity costs for family labor, the Village Based System of management in the new area is not viable in the long run.

The costs of raising animals is lowest in the Migration System in the old area and highest in the Tethered Grazing System in the new area. If no costs are imputed for family labor, the costs of raising animals in the Tethered Grazing System would be Rs. 299.16 per livestock unit which is the lowest of all systems. For the project as a whole the average cost of raising one livestock unit is around Rs. 788/= a year.

The gross income per livestock unit ranges from Rs. 1,100/= to Rs. 1,900/= per year in all systems except the Village Based System in the new area, where returns per livestock unit are Rs. 689/=, the lowest reported. On average for the total project, returns per livestock unit are Rs. 1,423/=.

The net profit per livestock unit appeared to be negative for the Village Based and Tethered Grazing System in the new area as well as for the Jungle Based System in the old area showing the risk of disappearance of these management systems. For the total project positive net profits of Rs. 59/= per livestock unit per year reveal the long term viability of the cattle and buffalo raising activity.

7.6 Supporting Services

The Mahaweli Draft Animal and Dairy Development Program (MDADDP) established the Mahaweli Farm at the end of 1986 at Jambugaswewa on the Left Bank. It was intended to provide the following services to the herdsmen:

1. To develop a 80 ha Service Center.
2. To import 25 pure-bred Sahiwal and 5 milking buffalo sires.
3. To establish a specialized Extension Service.
4. To purchase and supply to settlers 2,800 local female cows and 400 local buffalo

heifers.

5. To establish a milk collection, processing and sales system.

Due to civil disturbances in the country during the years 1988 and 1989 the livestock development program of the MDADDP could not be carried out according to schedule. Some of the services planned could not be rendered.

7.6.1 The Cattle and Buffalo Upgrading Program

The pure-bred stud bulls expected to be imported at the commencement of the development activities arrived only in 1990. The response of the herdsmen to the 'board and lodging-system' has been poor. This system failed due to the feed problem within the Mahaweli Farm and due to the problem of transporting the animals by the herdsmen. As an alternative stud bulls were also stationed at five stud bull centers on the Left Bank. These bulls were freely reared by selected herdsmen. This produced better results than the 'board and lodging-system'.

The other components of the cattle and buffalo upgrading program have not been very successful either. The failures can be attributed to the following reasons:

- Herdsmen were reluctant to obtain breeding cows from the farm because they were uncertain whether they would get a hybrid calf sometime later.
- Complaints were reported that some cows had problems delivering hybrid calves of large body sizes.
- Some herdsmen stated that the breeding cows had already conceived when they were purchased by the farm. Therefore there was a high risk of obtaining local calves from the purchased breeding animals.
- The feed problem in the farm imposed limits on the number of breeding animals that could be kept on the farm.

7.6.2 Milk Collection and Marketing

Four milk collecting centers have been established. Groups of producer herdsmen were formed as a cooperative around these centers. The milk collection was highest in 1992 and has declined since then. It is evident that the MDADDP has not been able to compete with the private dealers of milk such as Milco and Nestle to whom most of the herdsmen sell their milk today. When the herdsmen sell their milk to the MDADDP they have to take their milk to one of the collecting centers whereas the private dealers have appointed their own local suppliers who operate as small-scale collectors in the villages.

7.6.3 Extension

The vaccination program appeared to be one of the most efficient services rendered by the MDADDP. Vaccinations increased from 1,845 in 1990 to 12,602 in 1993. Further two field trips have been organized. One trip in 1992 with 28 herdsmen and the other trip

in 1993 with 25 herdsmen participating. In view of the training resources available at the farm and the needs of the herdsmen in the area, these extension services can hardly be called adequate.

The production of the mini-dairy of the MDADDP also shows a declining trend since 1992. This can be attributed to the decreasing amount of milk collected.

The major beneficiaries of the services provided by the MDADDP have been the herdsmen in the new area. Milk marketing facilities, stud bulls and veterinary services have been obtained by a quarter of the sample herdsmen (n = 32) in this area. In the old area these services have been obtained by only a tenth of the sample (n = 68).

7.6.4 Veterinary Services

The present program of activities of the veterinary surgeon's office at Tissamaharama includes vaccinations for HS and FM, training classes for cattle farmers, artificial insemination, castration and supply of stud bulls. 90 percent of the herdsmen in the new area and 80 percent in the old area have utilized the services of the veterinary surgeon's office.

7.6.5 Institutional Credit

With the establishment of the Mahaweli Farm loan schemes were designed to help the needy herdsmen to purchase stud bulls or improved heifers from the farm. The center would act as mediator while the state banks would provide the loans. However, there has been hardly any demand for these loans. This does not necessarily mean that institutional credit is not important for livestock development in the area as another factor is that the herdsmen did not have much faith in the improved animals provided by the Mahaweli Farm.

7.6.6 Cattle Owners Associations

The pervasive problem of crop damages by cattle, the rising conflict between herdsmen and cultivators and the strongly felt need for grazing land to feed their large herds was recognized by most of the herdsmen in the KOISP area. During the latter part of 1991 and the early 1992 these herdsmen formed three Cattle Owners Associations (COAs). The main functions performed by the Associations at present are the collection of milk, intervening in the problem of crop damages by animals which usually gives rise to conflicts with cultivators and working towards obtaining suitable grazing lands for the cattle and buffalo populations from the government. The major push for the formation of COAs came from the urgent need to find suitable grassland for the large herds. All the COAs have identified lands to feed their herds and discussions have been carried out at various levels of authority to obtain these lands.

7.7 Problems of Livestock Raising

The most important problems encountered by the herdsmen today are associated with insufficient availability of grazing land, milk marketing problems and inadequate veterinary services .

7.7.1 Insufficient Grazing Land

The KOISP project cleared large extents of forest lands and levelled hundreds of small tanks to develop land for cultivation. The proponents of the project had really underestimated the significance of these forest lands and small irrigation tanks in the sustenance of the traditional livestock raising system in the area. Apart from these project activities, land encroachment by chena cultivators and their land clearing activities have resulted in siltation of tanks. The water holding capacity of most of the tanks has declined and they dry out rapidly during the dry season. The animals have to walk long distances in search of water and along with poor feeding, they loose weight and their milk production drops to less than half a liter per day.

Another problem that emerged with the implementation of the KOISP resulted from the new possibility of cultivation during the yala season. This drastically reduced the fallow period during which the animals used to feed on stubble left in the fields. OFC cultivation was done in unprotected pockets dispersed in tracts. Thus crop damage by grazing animals became a serious problem. To avoid this the herdsmen were forced to move their herds away from the fallow paddy fields where OFCs are cultivated.

With the loss of traditional grazing land animals were often raised close to the cultivated plots of land. This increased the risk of crop damage by the animals which is nowadays considered to be the major cattle problem. It must be noted that fencing of cultivated plots was done even by the traditional Kirindi Oya folk to protect the plots from animals. In fact, the herdsman and the cultivator happened to be the same person in many instances. At present, cultivators and herdsmen are often two categories of people who are in conflict with each other. Now the cultivators seem to expect the herdsmen to keep their animals away instead of putting up fences around their cultivated plots. Costs incurred by herdsmen for crop damages form a considerable portion of the variable costs of cattle and buffalo raising. Some herdsmen in the Migration System in the new area pay crop damages equal to almost 38 percent of their variable costs.

7.7.2 Milk Marketing Problems

The problems associated with milk marketing are price fluctuations during the year and problems of transportation. Very often the herdsmen use motorcycles for daily transporting the milk to the collecting centers. This causes a quality deterioration of the milk if transported over long distances and high costs. This is especially felt during the dry months when the average milk yield drops by about half.

With the termination of the livestock development activities of the MDADDP by the end of 1993 the herdsmen no longer received services such as vaccinations provided by the livestock officers of the Mahaweli Farm. The veterinary surgeon can not handle all the veterinary needs of the herdsmen.

7.8 Conclusions and Recommendations

At its initial stages the project failed to recognize the Kirindi Oya area as an important cattle and buffalo raising area. The significance of the scrub jungles and the countless number of small irrigation tanks in the sustenance of the livestock rearing system was not realized. Most of the problems faced by the herdsmen today are the result of this negligence.

Although it was envisaged to develop 1,000 ha for livestock development and agro-forestry, this reforestation project failed to contribute any notable impetus to the development of the livestock industry. Hardly any management system based on these reforested land was found in the study.

While the project planned an incremental production of 4.1 million liters of milk annually, the total quantity of milk in the KOISP area would be roughly around 2.6 million liters which is far below even the incremental milk yield projected.

With respect to the objective of improving the living conditions of the settlers, the project has been able to help a few settlers (4 percent) to take up livestock raising on a small scale.

Poultry appeared to be a livestock enterprise gaining popularity among settlers. They rear poultry mainly for egg production to meet domestic consumption needs rather than for the market. In view of the nutritional status of households, this is an activity that should receive attention of those concerned about the development of the Kirindi Oya area.

Goat farming is not practised in the Kirindi Oya area although the goat is an animal which is well adapted to dry zone scrub lands as those found in the KOISP area. A well formulated extension program with incentives for innovators and early adopters would be required.

Generally, it can be said that the project has failed to achieve its objectives with respect to the dairy industry.

Of the different types of large scale cattle and buffalo raising systems, the Village Based and Jungle Based Systems of management would disappear in the long run for these

systems enjoy negative net profits. Migration and Traditional Systems would remain but their sustenance depends on the rate of deforestation for other development activities and the rate of encroachment of jungle land by chena cultivators. One of the most important strategies in helping the livestock industry in the KOISP area is to allocate grazing land for the herdsmen in the three Cattle Owners Associations. These associations should be helped with technical support for the reconstruction of tanks and to dig wells.

It is of paramount importance to strengthen the veterinary service and the herd improvement program. A good herd improvement program should be supported by a strong extension service that encompasses farmer training classes focussed not only on a particular practice, but on the livestock production activity as a whole.

Milk marketing has been pointed out as a major problem in the area but is not very significant compared to the problems mentioned above. The market for buffalo milk can be considered as near perfect. The problem is more acute with cow milk where collecting centers are located away from production areas and where exists an oligopsony rather than a perfect market. A solution would be to help the herdsmen setting up more collection centers under the leadership of the Cattle Owner Associations.

CHAPTER 8

FORESTRY

8.1 Introduction

The social forestry component of the KOISP was launched by the Land Commissioner's Department while the Forest Department acted as executing agency. The project documents proposed eight forestry components to be implemented:

1. Nursery Development
2. Woodlot Development
3. Homelot Development
4. Live Fencing
5. Extension Services
6. Fuel Efficient Cooking Stoves
7. Forests in the Project Area
8. Elephant Relocation

The activities started in 1986. However, the introduction of fuel saving stoves has not been carried out while the establishment of medicinal herb gardens and planting of roadside avenues have been added as supplementary activities.

8.2 Methodology

For the assessment of the environmental impact of KOISP activities records of the Forest Department and the Department of Wild Life Conservation have been consulted. Several rounds of discussions were held with officials from various line agencies. Relevant plans and maps of the area were obtained from the Irrigation Engineer Tissa. In addition field work has been carried out visiting woodlots, homelots and the forest and plantation areas. Information from the years 1986 to 1993 has been recorded. However, nursery information for the year 1986 was not available in the Forest Department records at Tanamalwila. The number of plants produced in 1986 was therefore worked out by finding the excess recorded in later years.

8.3 Nursery Development

The target set by the Forest Department (FD) was to raise 500,000 seedlings per annum. Six maha seasons were identified for plant production from 1986/1987 to 1992/1993. Three million plants were to be produced in the FD nurseries. The actual number of plants raised is just slightly over 1 million which is far below the target. This may be

due to the reduced extent of woodlots, homelots and plant distribution during the project period. 1.1 Million plants have been distributed to farmers, the excess originating from outside purchases.

Not all the seedlings have been planted by the farmers. Some farmers lost their motivation because the promise of usufruct rights and long lease agreements (up to 25 years) has not been kept. Although the project document has suggested this procedure, not a single lease agreement has been issued as yet. Another reason for not planting the seedlings can be found in the poor coordination of the plants distribution. Complaints have been reported that plants were supplied to farmers after the rainy season. Due to transport problems the FD failed to supply the plants well in time.

8.4 Woodlot Development

For the development of farmers' woodlots a target was set at 400 ha (1,000 acres) to be distributed among 540 families. The objective was to establish tree crops together with agricultural crops in a Taungya system. The woodlot would be provided on a 5 year lease to be extended to 25 years with usufruct rights. Consequently, the farmers would obtain fuel wood and small woods for their needs.

From 1986 to date, 687 acres have been allocated to 441 farmer families while the area finally planted did not exceed 611 acres. This indicates an achievement of 70 percent of the intended families and 61 percent of the projected area. Reasons for these poor results should be sought in the preference of farmers for cultivation, thereby ignoring the tree planting component in the agro-forestry system. Yet, compared to other plantations raised by the Forest Department in the past, this is a good result. This success is mainly due to the participation of the farmers. Higher outputs would have been achieved if the promised long leases were issued.

Hamlets 5 and 6 - RB tract 2 (1988)

58 acres had been allocated among 29 farmers at a rate of 2 acres per farmer. All farmers had carried out cultivation of arable crops together with planting of trees. These farmers have done a good job and maintained the planted blocks even after the third year when cultivation is not possible any longer due to the shade thrown by the timber species.

The trees planted are: Acacia, Margosa, Eucalyptus, Cashew, Ipil Ipil, Suriyamara, Bulu, Thelambu, Halmilla. Jak was not successful. The survival rate was 75 percent.

The farmers here too had requested the FD to issue them long term agreements for usufruct rights but this was not done.

8.5 Homelot Development

Households (4,180) from both the RB and the LB have been identified for the homelot development activities. It was anticipated to include a larger number of households in the program but about 15 percent of the originally identified households were either absent or uninterested to participate. The foresters supplied the households with the required plant species: Eucalyptus Camaldulensis, E. Tereticornis, Ipil Ipil, Margosa, Teak, Jak, Tamarind, Lime, Pomegranate and Vativer grass.

Location: RB hamlet 5

Name of the owner: Mr. A.A. Gunadasa, lot 216

Land allocated in 1983.

The following fruit trees, five plants each, have been planted in 1986: Lime, Mango and Pomegranate.

Also ten coconut plants and the following timber species have been supplied: Kohomba, Teak, Ipil Ipil, Eucalyptus, Acacia.

Gliricidia sticks were provided for fencing. Today the coconuts are bearing and provide an income to the settler. The timber species provide poles and fuel wood. About 30 trees are available in the home garden today.

Occasional damages by elephants are experienced.

8.6 Medicinal Herb Gardens

In addition to the woodlot and homelot development the Forest Department undertook a program to establish medicinal herb gardens. Commencing at 1986/1987 15 herb gardens comprising of 1 acre blocks have been established. The gardens are located close to schools, government buildings, community centers and residences of Ayurvedic medical men. Eleven different species of trees and herbs are grown. These herb gardens have become a source of readily available material for Ayurvedic treatment, the settlers collect the leaves and bark of the trees whenever they require them. Nevertheless, the gardens are not well maintained, most herb lots are overgrown with weeds.

8.7 Roadside Avenue Planting

While the Forest Department's target for planting at roadside avenues was 36 km, 44 km have been realized in the period from 1986 till 1991. The planting has been carried out on a self-help basis by farmers living at the road side.

The climatic conditions in the area have been ameliorated to a great extent as a result of the planting of these trees. Moreover, the trees provided the much needed shade to roads, homesteads and birds. The lower branches serve as fodder for the livestock and the dry and dead branches provide fuel wood.

8.8 Live Fencing

The objectives of planting live fences were to provide fences to the homelots, to produce fodder for the livestock and to generate fuel wood from the pruning. It was projected to supply:

- 350 cuttings of Gliricidia sticks to each homelot on the Left Bank tracts 3 and 4.
- 250 cuttings of Gliricidia sticks to each homelot on the Right Bank tracts 1 and 2.
- 400 cuttings for each woodlot area.

For the total program an achievement of 450,000 stem cuttings was envisaged. In the period 1990 to 1993 not more than 95,300 sticks have been supplied which implies a result of even less than 25 percent. The survival rate of the cuttings in the field is estimated at 60 percent, the failures being caused by long delays in transportation and untimely supply (e.g. during dry periods).

8.9 Extension Services

The KOISP provided the following constructions to the Forest Department:

- 1 Forest Ranger's Quarters, Lunugamvehera
- 1 Beat Forest Officers Quarters, Lunugamvehera Nursery
- 1 Beat Forest Officers Quarters, Weerawila
- 1 Nursery watchers Quarters
- 1 Pump house for the Lunugamvehera Nursery

To implement the awareness and extension program equipment such as a television set, a video deck, a slides and an overhead projector have been provided too. The extension program of the Hambantota Forest Division is still going on as the Forest Department released funds to continue the program even after the termination of the KOISP.

Many video shows and lectures on conservation, protection and planting of trees have been delivered to participants and school children. As a result the illicit cutting of the dwindling forest resources has been reduced. Settlers have realized the value of tree planting. Planting techniques and the choice of species are known to them.

The establishment of a rest named Thurusevena in the project area served as an excellent spot for awareness education. Unfortunately, these days the rest is not used for this purpose any more. Therefore it is suggested to reorganize the place and to reintroduce the awareness education program.

8.10 Forests in the Project Area

The forests in the project area are of the Dry Mixed Evergreen type. There are strips of riparian lowland forests close to waterways and coastal forests. Most of the area has been logged and partially cleared for chena cultivation. As a result scrub vegetation dominates with a few emergents such as Palu, Kolon, Satin, Thelambu, Veralu and Ingini. These forest types cover an estimated area of 1,645 ha. The people living in the project area continue to extract fuel wood from these forests. In the RB Mahapelessa forest blocks some chena cultivation is still practised but as a result of the irrigation settlements this cultivation technique is reducing. There is no evidence of illegal felling of timber.

Reforestation has been carried out on a minor scale only. The 100 acres which were replanted have been considerably damaged by elephants and cattle.

A total area of 1,988 ha may be considered as lands covered with trees. This includes natural forests, woodlots, medicinal herb gardens and Forest Department Plantations.

8.11 Elephant Relocation

Before the start of the KOISP in 1986 elephants moved freely within the project area. With the opening of the Lunugamvehera National Park an attempt was made to drive the herds from the command area and to enclose them within the National Park. This has been quite successful, but lone elephants and families of three (tumpath rela) continue to raid crops and home gardens in the settlements.

The completion of the boundary survey of the National Park is expected to take another six months. As long as the boundaries are not settled the laws pertaining to the National Park can not be effective. About 300 villagers continue to practise chena cultivation within the proposed Park. The officers of the Department of Wild Life are unable to evict them until the law comes into force.

An estimated 10,000 privately owned buffaloes and 2,000 neat cattle roam about in the Lunugamvehera National Park. These animals threaten the limited stock of fodder grass and drinking water during droughts, creating problems for elephants and other ruminants. Unless the cattle population is provided with alternative lands the wild animals will continue to visit the village farm lots.

The electric fences put up by the Department of Wild Life appeared to be very effective in containing the elephants within the Park area. The settlers support the fencing program, they report if damages occur. Also the elephant relocation program of the Department of Wild Life has contributed to reducing crop damage.

CHAPTER 9

ENVIRONMENT

9.1 Introduction

In this chapter the following four components of environmental impacts of the KOISP project are reported.

1. Disturbances in the lagoon ecology of the natural lagoon systems which are located in the lower coastal plain resulting from the altered hydrology of inflow from the New Irrigation System. This includes the Bundala bird sanctuary component too.
2. Salinity hazards arising from the leaching of soluble salts from the New Irrigation System (NIS) to the command area of the Old Ellegala Irrigation System (OEIS).
3. Modifications in the hydrology of the lower floodplain areas and the irrigated command area of the OEIS.
4. Soil erosion in the undulating terrain of the newly irrigated lands and the silting of the natural drainage water ways located within the NIS.

9.2 Methodology

Disturbances in Lagoon Ecology

In maha 1991 - 1992 and the following yala season four trips were made to three lagoon areas. During these trips field observations using air-photo base maps and recent survey maps were used. Water samples were taken for testing at the Weerawila Agricultural Research Station laboratory for electrical conductivity. More detailed field traverses were made within the Bundala Bird Sanctuary area. These studies continued up to late maha 1993.

Salinity Hazards

In the New Irrigation System three locations were monitored for trends in soil salinity levels. Electrical conductivity measurements were made on 1:5 soil water extracts of soil samples taken. These studies continued from maha 1989 through to yala 1993.

In the Old Ellegala Irrigation System systematic sampling and testing of the quality of irrigation water at fortnightly intervals from the main Lunugamvehera and the four

Ellegala system reservoirs commenced in January 1990. Corresponding soil sampling of salinity affected areas also commenced from this period and continued up to maha 1993-1994. Both pH and conductivity of soil solutions and soil paste 1:1 were measured for each sampling site and date.

Modifications in Hydrology

These studies are based on regular visits from 1991, and field observations made with the aid of air-photos and Irrigation Department layout maps which showed contours of the land. Several interviews were made with farmers in the affected areas in the lower floodplain area. Detailed field inspections were carried out twice a year since 1991 around the area of the outfall of the main river and its recent altered course to the sea.

Soil Erosion and Silting

Six benchmark sites were selected from the first, second and third order drainage maps. Sharpened L iron stakes were driven into the ground in June 1991, and levels of silting noted at bi-monthly intervals. Supporting observations were made in other tracts by rapid field inspections at 3 to 4 monthly intervals for the purpose of comparison and co-relation.

9.3 Disturbances in Lagoon Ecology and the Bundala Bird Sanctuary

9.3.1 The Bundala Lagoon

The Bundala lagoon is located within its own independent catchment and is in no manner influenced or hydrologically connected to any drainage flows from the Weligatta Ara. Had the proposed Right Bank tracts 3 and 4 been developed according to the original development plans, the Bundala lagoon would have received the resulting drainage inflows from the newly irrigated lands.

Other activities than those arising from the KOISP irrigation interventions have caused modifications to the natural hydrology of the lagoon. Firstly, the western portion of the Bundala lagoon (520 ha) has been converted into a saltern which is exploited by the National Salt Corporation. Secondly, an artificial sea outfall has been cut through the sedimentary sandstone barrier (the dune ridge) from the lagoon towards the sea to expel excess water from the lagoon.

A greater part of the area covered by the Bundala lagoon can be regarded as a natural habitat of fish, birds and other wild life. As long as there will be no irrigation development planned for Right Bank tract 3 and part of tract 4, the KOISP is not likely to have negative impacts on the present environmental regime of the Bundala lagoon system, which is now in an acceptable state of a sustainable environmental equilibrium.

9.3.2 The Embilikala and Malala Lagoons

The Embilikala and the Malala lagoons are interconnected by a meandering incised canal. While the Embilikala is an inland lagoon with no direct outfall to the sea, the Malala lagoon has a direct link to the sea at the Malala modera.

The Embilikala lagoon (430 ha) receives a large quantity of drainage water from Right Bank tracts 5 and 6 of the KOISP in addition to the normal run-off from its own catchment. The Malala lagoon (650 ha) receives all the drainage water from the Badagiriya irrigation system (850 ha) in addition to the normal run-off from the Malala Oya catchment.

Inflows into these two lagoons fluctuate depending on the amounts of drainage water received, the water levels vary from +1 msl to +2.2 msl accordingly. High levels of salinity between 14 and 41 ppt occur during the dry months of July to September, low levels of salinity between 7 and 15 ppt are measured during the wet months of November and December.

Field interviews with the villagers around these lagoons reveal that the Embilikala lagoon has been subject to the most serious negative impacts since the development of the KOISP started. Increased flows of fresh water into the lagoons from the KOISP scheme have now reduced the lagoon's salinity to sub-optimal levels for prawn production.

It has not been possible to estimate the degree or levels of agro-chemicals such as fertilizer and pesticides brought in with the drainage water from the irrigated lands in Right Bank tract 5 and 6. However, the non-occurrence of algal blooms and the presence of small fish species that are sensitive to lower threshold levels of pesticides provide an indirect evidence of the absence of a serious threat.

The Irrigation Department recently constructed a canal to discharge excess fresh water from the two lagoons. This canal appeared to be successful in its objectives to maintain the water levels as prescribed and to lead sufficient salt water into the Malala lagoon at high tide in order to obtain the required salinity level for prawn cultivation. The performance of this canal should be properly monitored to assess if adaptations in the management system are to be made.

9.3.3 The Bundala Bird Sanctuary

Due to the shortfall of water supply in the main Lunugamvehera reservoir, the development of the proposed Right Bank tracts 3 and 4 has not taken place. Therefore there has been little or no disturbance in the natural forest cover in the proposed buffer strip located between the Bundala sanctuary and the proposed tracts 3 and 4.

A more environmentally destructive activity which takes place in this area is that of shell mining. Although this is not related to KOISP development activities, it is mentioned here because it is likely to have long term negative impacts on the environment of the Bundala National Park if permitted to expand beyond its present level. Associated with shell mining is the cutting of trees and collection of fuel wood for burning the shells. This results in a depletion of the vegetation cover and in the creation of unofficial access tracks within the sanctuary area. The forests around the lagoon are of critical importance as they protect the soil against excessive surface erosion and consequent soil wash into the lagoons, thereby shortening their life time.

9.4 Salinity Hazards

9.4.1 The New Irrigation System

Initially complaints of soil salinity were reported from the newly developed lands in the new area. The complaints reached a peak in the 1989 maha season but declined progressively since. Currently, salinity is found only in very small areas located adjacent to the natural drainage valleys. This occurs especially where the natural drainage ways are not functioning properly or else have been purposely blocked by unauthorized cultivators who illegally developed the drainage reservation areas.

During the last five years the soluble salts initially present in these newly developed lands have been leached out by the Class I quality irrigation water that comes from the main Lunugamvehera reservoir. At present very little salinity is reported for the rice crop during the wet maha season. Only if rice is grown during the dry season after May when irrigation supply is limited and also when the evaporation rates exceed 7 mm per day, there is yet some upward capillary movement of salts, mostly during July and August. This depresses the performance of the rice crop, but it does not affect the OFC's which are recommended during the dry season.

9.4.2 The Old Ellegala Irrigation System

In the preceding years more serious complaints of salinity have come from the OEIS where farmers reported that the soluble salts leached out from the NIS were being collected in the four old major tanks that service them.

For the last 100 years the alluvial soils of the Ellegala have been irrigated with Class I irrigation water originating from the main Kirindi Oya and diverted to the command area through the Ellegala anicut. This coupled with the incised nature of the downstream Kirindi Oya had prevented the building up of salts.

The Ellegala used to have an adequate drainage network leading to several outfalls. These outfalls were damaged by the 1969 floods and have not been repaired or

maintained since then. It is from this time that farmers in the lower reaches of the Ellegala report incipient occurrences of salinity in their areas.

In January 1990 the Department of Agriculture commenced a program to test, once every fortnight, the quality of the water in the Lunugamvehera and in the five Ellegala tanks. The quality of the water in the Lunugamvehera was well below EC of 0.20 milli mhos per cm during the wet season from October to January and hovers around 0.25 for the rest of the year. In the case of the Tissa Wewa and the Yoda Wewa EC values increased to 0.75 milli mhos per cm between March and June and between August and October. EC values for the Weerawila exceeded 0.75 milli mhos per cm between March and June. While for almost all twelve months of the year the water quality in the Lunugamvehera is Class I, the quality of the water in the reservoirs of the Ellegala fluctuate considerably during a season. This depends on the reception of substantial amounts of salt enriched drainage water from the new areas and on the amount of Class I water received from the Lunugamvehera via the Ellegala anicut.

The Ellegala has now to cope with added accretion of soluble salts coming from the drainage waters of the new system. As a result of the inadequate drainage in the Ellegala it presently acts as a sink for salts coming from both the upstream new areas and normal cyclic salts and other accretions as well.

Monitoring of the quality of the drainage water at four outfalls located within the command areas of the Tissa Wewa and the Yoda Wewa commenced in May 1993. A clear trend of increasing salinity of drainage water for the upper to the lower reaches of the command area was observed.

The following recommendations are made to mitigate the effects of salinity.

1. A low-cost water quality monitoring system for the five reservoirs should be sustained with a view to releasing the required amount of Class I water from the Lunugamvehera reservoir.
2. As two factors contribute to the salinity problems of Ellegala, two different solutions are suggested. Firstly, the increased salinity contribution of tank water should be modified by dilution from Lunugamvehera water. Secondly, the drainage congestion in the Tissa and Yoda Wewa command areas should be cleared by keeping the drainage ways free from blockage and by ensuring that they are connected to the main arterial drains and eventually to the outfalls to the sea.
3. It is extremely important to continue the fortnightly monitoring of water quality in all reservoirs and the four outfalls over the next five years. This would help to keep track of the trends in salinity as the basis for the appropriate corrective action to be taken.

9.5 Modification in Hydrology of the Old Ellegala Irrigation System

Consequent on the construction of the Lunugamvehera reservoir the following dominant changes in the hydrological regime have taken place.

1. There is no natural scouring of the Kirindi Oya river bed especially in the section between the Ellegala anicut and the point of entry of the Weerawila Ara. There is also less scouring of the river bed from this point up to the sea outfall in the rest of the main Kirindi Oya.
2. A new river course has carved itself out as an outfall to the sea. However, this river can take only a smaller discharge than the main Kirindi Oya river and is therefore just sufficient for the minimum evacuation of accumulated salts in the lower flood plain.
3. There is no further flooding of the lower flood plain during November and December and no further deposition of any river borne material in this area. The settlers had thriving gardens of coconut and other tree crops which are now adversely affected by the absence of flooding and enrichment.
4. In contrast to earlier days farmers now report a significant dry weather flow in the Kirindi Oya resulting from the drainage flows in the NIS during the yala season. This has helped them to lift small quantities of water from the river during this period and to cultivate high value crops on the levee banks of the river.
5. The altered hydrology of the OEIS has affected both the water table and the water quality of the wells in the homestead settlement areas. Complaints of increasing salinity have been reported from users of wells located close to the hydrological influence of the Weerawila and the Yoda Wewa during the dry season. Yet, the salinity was not high enough to make the water unusable. Wells located further south down the river course have benefitted from an enhanced water level during the dry season.

9.6 Soil Erosion

The Old Ellegala Irrigation System is located within a slightly uplifted flat alluvial plain and has an incised major river the Kirindi Oya, cutting through it. In this type of landscape there little or no erosion hazard nor silting is experienced.

The New Irrigation System on the contrary, is located within an undulating residual mantled plain with slopes varying between 3 and 6 percent in the upper aspect of the toposequence and between 1 and 2 percent in the lower aspects. The soils are 75 percent reddish brown earth and 25 percent solodized solonetz. The reddish brown earth soils

have a low structural stability and are thus subject to erosion on sloping lands. The solodized solonetz soils are sodic soils with an exchangeable sodium percentage of more than 15 percent. They are subject to dispersion under flood irrigation until the sodium gets flushed out. But because all the irrigable land has been terraced for wet paddy cultivation, the erosion threats have been minimized. The limited erosion that was found, is mainly slumping and has been observed on poorly maintained field channels, on a portion of the distributary channels and on the unprotected banks of the main canals where the channel is located on filled sections of the channel traverse.

Almost all the land in the NIS was previously under chena cultivation. Because the fallow periods shortened in some parts of the former NIS, there had been observable soil degradation. The terraced land development for wet paddy cultivation has arrested this trend, the irrigated land is now in good health.

The removal of the forests for land development for irrigation has had no adverse impact since a more productive and sustainable tree cover has been established around the settlement homesteads. In sum, it could be stated that the development of the NIS has had a positive environmental impact with respect to the soil erosion menace.

9.7 Silting of Waterways

Most of the surface soil wash and silting of drainage ways and streams has occurred during the development phase and the initial irrigation phase of KOISP. A three year period of monitoring commencing in June 1991, recorded very little or no silting in the first and second order drainage ways. Substantial silting was observed in the higher order drainage ways. A major part of the silt load comes from the less stable banks of the main canals especially in those locations that are used by buffalo herds as crossings. Run-off from the poorly maintained road network also contributes to the silt wash.

CHAPTER 10

PROJECT MANAGEMENT, INSTITUTION DEVELOPMENT AND BENEFICIARY PARTICIPATION

10.1 Introduction

This chapter considers key aspects of the management of KOISP, institutional development under the KOISP and beneficiary participation in the KOISP. These aspects are evaluated only in a general way, the goal is to identify lessons that can be of value to future area development projects.

Data for this chapter were derived from a variety of sources, including published works and reports, interviews with responsible officers from the Irrigation Department, Land Commissioner's Department and Irrigation Management Division, project quarterly reports from both Phase I and Phase II, minutes of the Project Coordinating Committee and Central Coordinating Committee, interviews with knowledgeable observers and settlers in Kirindi Oya, other project documents, the large-scale sample survey, and the ARTI study on beneficiary participation (Razaak & Wijetunga, 1994)

10.2 Project Management

Project management issues discussed in this chapter are as follows:

- Overall project planning errors, including the overestimation of water availability, failure to deal with the displacement of cattle, and the miscalculation about the possible degree of crop diversification.
- Problems in irrigation system construction, particularly the problems of cost overruns and construction delays.
- Problems in settlement, including the problems caused by the advanced alienation policy and the difficulty in keeping settlers in the New Areas.
- Difficulties in coordination, particularly with regard to problems that fell outside the purview of the major participating agencies such as crop diversification and the cattle problem.
- Weaknesses in the benefit monitoring system for the project.
- Beneficiary participation in project planning and construction.

- Beneficiary participation in rehabilitation of the Ellegala Irrigation System.

Although many aspects of the KOISP went very well, this section focusses on the problems in an attempt to learn how to improve project management for future projects.

Financial management is not discussed here as it is the subject of auditor's reports. However, reference is made to the effects of the various problems on total project costs. The fact that the costs about doubled over the life of the project requires explanation.

10.2.1 Project Planning Problems

There were a series of controversial decisions and errors that occurred in the planning of the KOISP. Firstly, the much discussed decision about the dam location was apparently motivated by the need to maximize the new area to be brought under irrigation rather than by consideration of what would be the most cost-effective approach.

Secondly, the water availability in the Kirindi Oya was badly overestimated. Although this seems to be due to a weather change rather than errors in data collection or analysis, it might have been better to be more cautious in planning around the estimated figures.

Thirdly, the Project Appraisal Reports proposed the planting of other field crops to reduce water demands. However, whether markets for OFCs existed nor the access that farmers would have to them were not considered carefully by the planners. Moreover, the suitability of the soils for this cropping pattern was assumed while experience in the new areas indicates that about half the new areas that have been developed are suitable only for paddy during maha. The proposed cropping pattern appears to have been designed to fit the estimated water availability without full consideration of the needs of the farmers. As a result there has been only a small shift to OFCs.

Further, studies of the geology of the proposed dam site failed to adequately sample the the variability at the side. Thus, after excavations began in 1980, it was found that the proposed dam site was not totally appropriate. Much more detailed investigations were necessary to define the geology well enough to allow for satisfactory redesign of the dam. The required changes took time and added greatly to the costs. Also estimates on the availability of construction materials turned out to be overoptimistic. Materials had to be brought from further away, significantly increasing costs of construction.

Without investigating groundwater, project planners planned to use dug wells to provide domestic water for the settlers. Problems arose in 1982, leading to investigations that showed suitable groundwater was not generally available and to the decision to build a piped water system that takes its water from the Lunugamvehera Reservoir. This decision also raised costs considerably.

Although the Hambantota area has long been famous for its dairy products and cattle herds, the planners seem not to have given thought to the consequences of taking over the large areas of graze for the cattle for small-holder irrigated agriculture. There is now a "cattle problem" in Kirindi Oya since cattle cause much crop damage, particularly to OFCs.

The main problem seems to have been that the project was planned by irrigation, settlement, and agriculture specialists. Neither livestock specialists nor local residents were included.

If the issue of the dam location is left aside, all of these planning problems resulted, at least in part, from inadequate information for planning. Better information on water availability, on the geology of the dam site, on the availability of groundwater, on the distribution of soil types, on crop markets, and on cattle would have enabled the planners to anticipate most of the major problems that occurred, many of which raised the costs and reduced the benefits of the project.

It would have helped to have considered the problem from a basin-wide viewpoint, this might have induced caution about water availability since others were also interested in exploiting the water resources. More time and effort should have been spent on gathering the basic data before project plans were completed. Soil surveys, groundwater surveys, studies of the local economy, etc, could have been carried out.

Much more extensive consultations with the local population would have helped. Better information on the cattle problem, the groundwater problems, whether markets existed, perhaps even on the water availability issue could have been gathered from knowledgeable local persons. Such consultations should have complemented the detailed technical studies.

More caution in planning would have been warranted. A project design that would have been implementable in stages might have helped.

10.2.2 Delays in Construction of the Irrigation System

The 1977 Appraisal Report estimated that it would take four years to complete the dam and six years to complete the construction of the whole system. In fact, it took eight years to complete the dam and the whole system was never completed. Also, costs increased tremendously during the period.

The following factors contributed to construction delays at Kirindi Oya:

- The basic data on the geology and water resources of the area were insufficient for the design of the dam, for adequate network and construction planning. The

dam and the spillway had to be redesigned, channels often had to be realigned and structures moved. All this increasing costs and time delays.

- There were significant delays and problems with contracting and procurement processes. The most important of these was the delay in awarding the contract for the dam construction. The original work plan assumed that the contractor would be fully mobilized by mid 1979. The contract was not awarded until 1980 and the contractor did not begin work until September 1980.
- The Irrigation Department had great problems keeping some of the contractors on schedule. The Department seemed to have relatively little control over the construction schedule of the dam contractor, the River Valleys Development Board (RVDB). The RVDB had great difficulties with equipment maintenance and getting spare parts. They had an undisciplined work force and further, because of security problems getting the needed explosives was problematic. The biggest problem however, was not having sufficient cash. Ultimately, the Irrigation Department took part of the dam contract from the RVDB and awarded it to another contractor. That contract was completed ahead of time.
- There were also delays in the construction of the main canals. A variety of arrangements were used, larger contracts, small contracts and force account. The basic problem seems to lie in the balance of power between construction supervisor and contractor. With small contractors, the Irrigation Department is quite willing to demand performance and threaten to cancel contracts. In contrast to large contracts, a small contract can easily be awarded to a new contractor without causing major delays. In the case of the dam contract, the RVDB had political support to consider.

These delays were a major cause of the cost increases. The following suggestions might help future projects avoid these delays:

1. Either better data on the area should be provided through better project planning studies or provision should be made in the design and construction process itself to get the data. In the latter case additional funds have to be provided to cover the redesigns that will arise.
2. Sri Lankan and donor contracting and procurement procedures should be streamlined and simplified to avoid major delays. One cause of slow contracting is the requirement for Cabinet approval of the award of large contracts. This requirement should be dropped not only because of the delay but also because it encourages political interventions.
3. In Sri Lanka, the balance of power between agencies supervising contracts and large contractors is weighted too heavily in favor of the latter, partly because of

lengthy contracting procedures and political involvement in contracting. Power needs to be rebalanced by a) streamlining contracting procedures as mentioned above, and b) using the smallest contracts consistent with efficient project management.

10.2.3 Problems in Management of the Settlement Process

The settlement process at Kirindi Oya included several separate tasks: surveying the area, selecting the settlers, allotting each settler family a house site in a hamlet and farm site, providing initial support for the settler family until their income starts to flow, constructing the basic public infrastructure, training the settlers in irrigated agriculture and other needed skills, and solving problems of the settlers as they occur. All of this was handled by the Land Commissioner's Department (LCD). For the most part, the process flowed smoothly, there are few complaints. However, three major problems have arisen:

- Advanced alienation refers to the practice of settling farmers on the land before the irrigation construction is complete to prevent problems with squatters. The first settlers were given their allotments in the second half of 1983, expecting that the first water issues from Lunugamvehera would be made in 1985. Because of the delays, some settlers had to wait almost three years before cultivating their allotments. LCD was responsible for supporting them during this period, thus raising the costs. Besides, in many cases LCD officers had to identify the settlers' allotments before the irrigation channels were constructed or even before detailed designs were done. As a result, many settlers ended up with a false idea of their plot boundaries. Also, the channels were often realigned. Because of these problems a great many disputes have arisen between settlers.
- A current problem in the new areas of Kirindi Oya is the nonresident allottee. These are persons who have resources elsewhere that they use for making a living. These allottees do not participate in farmer organizations, they also rarely live up to their obligations to clean channels etc. About 18 percent of the allottees fall into this category. Although hard figures are lacking, it is widely reported that most of these persons received their allotments as a consequence of interventions by politicians in the selection process in disregard of the criteria for selection.
- Failure to investigate the groundwater resources of the area led to a failure to plan for adequate domestic water supplies. The chosen alternative, the piped water supply system raised costs, not only because this system was more expensive than digging local wells, but also because, until the system was completed, the LCD had to supply water to the hamlets in bowsers.

The main difficulties laid in the contracting process to be followed for

constructing a piped water supply system. The plans and the contract were much delayed by the need to donor and Cabinet approval for each.

The real causes of these problems lie elsewhere. The problematic consequences of advanced alienation were greatly aggravated by the delays in irrigation system construction while the nonresident allottee problem has been aggravated by political intervention in the selection process. The delay in construction the piped water system is due to the same constraints.

The direct intervention of politicians in settler selection has been constantly reported verbally. For KOISP, this intervention aggravated the "non-resident settler" problem. As noted above, politicians also oversee the award of large construction contracts. Reducing the direct role of politicians in these areas would help to prevent some of the reported abuses, such as ignoring settler selection criteria.

While reduction of direct intervention by politicians overall will require a major cultural change, specific efforts, including widespread publicity about the problems, can be directed at specific situations. This can only happen, however, when the top political authorities make it happen.

10.2.4 Project Coordination

For the KOISP, the various executing agencies worked largely independently of each other. Coordination mechanisms functioned primarily to keep finances flowing, to ratify major changes in the project, and to adjust time schedules. Although the mechanisms proved adequate to solve many problems, they were not able to address those problems whose solutions required cooperative planning and effort from two or more agencies. As a result two major problems were not dealt with: the cattle problem and crop diversification.

The cattle problem consists of the fact that the owners of the large herds of cattle in the area have difficulty in finding pasture. As a result, the cattle often wander freely near cultivated areas and damage crops. The solution to the cattle problem involves some combination of finding pasturage for the herds, perhaps including finding ways to share the cultivated area, and reducing herd size. Finding a solution requires coordinated help from the LCD and other government agencies concerned with land administration and help from livestock agencies. Although reference was made to the problem in Project Coordinating Committee minutes from 1983, no coordination exists and no solutions have been found.

Effective promotion of OFCs among farmers requires help from the Department of Agriculture to teach farmers how to grow OFCs, help from the Irrigation Department to make sure water is delivered in the right amounts at the right time, help from unspecified agencies to prevent crop damages from elephants and cattle, and help from

marketing specialists to identify and provide access to markets for the crops. Although crop diversification is a key requirement for the success of the KOISP, the KOISP coordination mechanisms did not supply an effective means of getting the needed coordinated efforts. No progress was made until 1989.

There are two ways to provide coordinated effort that have worked in Sri Lanka:

1. Creation of a special interdisciplinary project agency like the Gal Oya Development Board or the Mahaweli organizations can provide coordinated efforts. However, this is expensive and it has so far proven impossible to kill these agencies once their job is over. For example, the main dam contractor, the RVDB, is the descendant of the Gal Oya Development Board.
2. Using limited purpose committees whose members include agencies that can provide special rewards to the participants or that include farmers who can provide personal satisfaction. This is not as satisfactory a solution as the a special agency but it does not give rise to the problems created by special agencies.

10.2.5 Benefit Monitoring and Evaluation

For this component, ARTI has carried out a baseline survey and a midterm evaluation study and a large number of studies on specific aspects of the project. These studies have generated a great deal of information on the area and on the effects of the project.

Two aspects of ARTI's work kept it from serving the needs of the project as well as it might have: ARTI did not establish a continuous monitoring program to provide feedback to KOISP management. And secondly, the results of ARTI studies often came out late and were thus less useful for planning and decision-making than they could have been.

A continuous monitoring system that could provide frequent and rapid reports would have been more useful and is suggested for future large projects.

10.2.6 Beneficiary Participation in the KOISP

ARTI's study on beneficiary participation carried out among farmers and officers, points out that there was no system to involve local persons in the planning and design of the irrigation systems or settlements. For the two main construction activities of the irrigation system and of the settlement facilities local persons were recruited to provide labor. In the 1992 ARTI survey, 99 percent of the surveyed settlers indicated that they had contributed to road construction, 69 percent to construction of the canal system and 32 percent had worked on buildings. Participation in the construction activities during the early 1980's was a significant source of income to early settlers and others in the area.

While there was little participation in the early Ellegala rehabilitation work, there was significant participation in the planning and execution of the Rectification of Irrigation Difficulties in 1992-93. The greater participation in the latter program was a major reason for the greater success.

While providing unskilled construction labor is clearly beneficiary participation of a sort, it is not the type of participation that provides the greatest benefits to the project. As shown by Esman & Uphoff (1984), it is *participation in decision-making* about the project that contributes the most to development. While local farmers, particularly those few who were in the area when the project was being designed, could not contribute significantly to technical aspects of dam and irrigation system design, their involvement might have prevented some of the planning mistakes that were made, such as ignoring the cattle problem and depending too heavily on non-rice crops. This point is also demonstrated by the results of the different Ellegala rehabilitation programs.

10.3 Institutional Development

10.3.1 Farmer Organizations (FOs)

Development of farmer organizations under the KOISP was necessary to help manage the irrigation system and to represent farmer interest. They have been created with government sponsorship and help under Sri Lanka's participatory irrigation system management policy. Organization efforts were initiated in 1986 with the assignment of two Irrigation Management Division (IMD) Project Managers to Kirindi Oya, but until 1990 the organizations had relatively little importance and were not very effective. According to the IMD, there are currently 690 Field Channel Groups (FCGs) and 59 Distributary Channel Organizations (DCOs) in Kirindi Oya and Badagiriya in addition to the 4 Subproject Committees (SPCs) and one Project Management Committee (PMC).

Although almost all farmers know about the farmer organizations and are acquainted with their Farmer Representatives, they are relatively ignorant about many aspects of the functioning of the farmer organizations. Lack of knowledge about meetings and about the status of Farmer Organization funds implies a lack of communication among members. The general dissatisfaction with funds handling implies problems in this area as well. IMD data too, showed that the DCO's organizational strength is reasonably good except in the area of finances. Also, IMD has not been able to collect a full set of reports since June 1993, indicating weakness in both the DCOs and the Institutional Organizer program.

Overall, farmer organizations have taken over maintenance but not operations. Their performance in maintenance seems to be satisfactory and they clearly have helped improve water distribution, at least on the field channels. The great majority of the farmers feel that they can do routine maintenance better than the Irrigation Department

can. Also, about half the farmers feel that the farmer organizations can successfully handle operations if turned over by the Irrigation Department and about 40 percent of the Ellegala farmers feel that the Ellegala tanks should be operated jointly by Irrigation Department officers and farmers.

Joint Management Committee Performance The most important function of the joint management committees, particularly of the Project Management Committee, is making seasonal plans, including making the key water allocation decision each season. IIMI reports indicate that the PMC has begun to play a strong and effective role in seasonal planning (IIMI 1994).

As mentioned above, a few years ago many farmers were ignorant of this important function of the PMC. Awareness has increased but it is still low.

Fifty-two respondents (34 in the New Areas and 18 in Ellegala) gave reasons why they were not satisfied with the performance of the SPCs and PMC. The single most important reason (15 answers) was that decisions of these committees were not implemented by the agencies. Almost as prevalent (14 answers) was the opinion that these committees cannot find solutions to the problems.

Overall Evaluation of the Farmer Organizations The key points about the farmer organizations are a) they have been formed but are not strong, and b) there has been only partial turnover of operations and management responsibilities to them.

The data presented here implies the seemingly paradoxical findings that

- The FOs are well known to and well accepted by farmers - virtually all farmers claim to be members of their local FO - but are also relatively ineffective.
- Although the majority of farmers do not know clearly what the Subproject Committees and the Project Management Committee do, these committees now effectively play a part in seasonal planning.

The DCOs are the only farmer organizations that are recognized by the agency officers. Thus, no matter what the organizational weaknesses are, they offer the promise of serving as a means of interacting more effectively, from the farmers' point of view, with the agencies (cf conflicts between the FOs and the "independent" FO during maha 1992/93 as reported in IIMI 1993). Also, the PMC is clearly the body most fitted to do seasonal planning (IIMI 1994).

Overall, while the FOs and joint management committees at Kirindi Oya have problems, they have recognition and legitimacy so that they can be developed to the needed level with appropriate inputs.

Cattle Owners Farmer Organizations (COFOs) The Cattle Owners Farmer Organizations have been created recently to help solve the cattle problem. Two strategies are being followed: First, the COFOs are working with the Divisional Secretary and others to find alternative graze for the herds. Second, the COFO leaders try to work with the FO leaders to resolve disputes and losses due to cattle damage to crops in an efficient and amicable manner. So far they have not been able to do so, but this initiative should be supported.

10.3.2 Government Agencies

Government agencies needed to manage the new infrastructure created by the KOISP under today's governmental system are described below.

The Irrigation Department created a special organizational structure for the construction activities of the KOISP. There has been a gradual change from this organization toward the normal Irrigation Department O&M organization. This process is going on but it has not yet been fully scheduled.

The Irrigation Management Division is responsible for creating and supporting farmer organizations. Since the farmer organizations are not very strong, there is a real need to strengthen IMD at Kirindi Oya.

The Department of Agriculture is responsible for agricultural research, extension and training. Few farmers benefit from extension services and training is not being done. On the other hand research to solve problems at Kirindi Oya is being carried out and is known to the farmers.

Local Government and the Land Commissioner's Department. When the settlers first arrived in the New Areas, the Land Commissioner's Department (LCD) provided virtually all services, including government services. The local government structure has been fully created for the New Areas. All of Kirindi Oya is under two Divisions - the Lunugamvehera Division and the Tissamaharama Division. Most local government functions have been transferred from the LCD to the Divisions.

Various Central Government Agencies. The LCD created a large number of physical facilities for communities. The schools, health centers, post offices, and agrarian service centers were to be turned over to and manned by, respectively, the Department of Education, the Department of Health, the Post Office Department, and the Department of Agrarian Services. Basically, none of these departments have been able to fully staff and equip these facilities.

Virtually all facilities created by the KOISP have now been transferred to the agencies that will manage them routinely. Almost all special project management offices and bodies have been disbanded. There are two exceptions: a) the Irrigation Department has

not yet completed the transition for a construction organization to an O&M organization, and b) the Land Commissioner's Department maintains a skeleton office that deals with a few remaining responsibilities, including maintenance of hamlet roads.

No full evaluation of the agencies that have taken over was attempted. However, it appears that all suffer from the funds and manpower shortages endemic in Sri Lankan government agencies. Solutions to this problem will require major changes in government practices and attitudes.

CHAPTER 11

COST-BENEFIT ANALYSIS

11.1 Introduction

A cost-benefit analysis of the KOISP was undertaken to determine whether the originally estimated project benefits could be attained over the balance life of the project, on the basis of the performance of the project up to the present. There were considerable cost as well as time overruns during project implementation. Water availability was heavily overestimated and the projected area could not be brought under cultivation. The cropping patterns that were originally conceived for the project never materialized due to inadequate water resources. Cost-benefit analysis is also expected to assist in evaluating the financial and economic viability of the project, under the current circumstances. The environmental as well as the indirect negative and positive impacts of the project were not fully understood at the time of implementation. An attempt will be made to incorporate these impacts in the cost-benefit analysis.

The project has been in operation since 1986, when the first water releases were made for cultivation. Construction of the project began in 1978, but due to cost overruns and inadequate funding, work on the project was halted. Rehabilitation of the existing areas as well as start up work continued till a re-appraisal of the project was completed in 1982. The project was reformulated into two phases, Phase I for the construction of the dam and provision of irrigation facilities for half the extent earmarked for the project. Settlement was carried out concurrently for the irrigated areas. The first phase was completed in 1986, about three years behind the original schedule. The second phase was for the provision of irrigation facilities for the balance area and the settlement of the rest of the allottees. Only about 25 percent of the balance area was provided with irrigation facilities due to a lack of water resources and a similar proportion settled under the project. This phase of the project began in 1987 and was completed in 1994, about two years behind schedule.

11.2 Methodology

A formal cost-benefit analysis using actual costs and benefits of the project was undertaken. For this purpose, actual production, cost and price data were collected from the period of commencement of the project. Details of investment costs were obtained from the records of the Irrigation Department. All available previous reports and studies were compiled to obtain data on conditions prior to the project as well as subsequent to project implementation. Indirect benefits and costs were estimated using special studies as well as data collected for the other components of the present study. Cost of production of paddy and other field crops were obtained from data collected by the Department of Agriculture (DOA) for the Hambantota districts. These were supplemented by data from previous studies and reports.

Economic prices for important traded commodities like paddy and fertilizers were computed using world market prices and projections, suitably adjusted for local costs such as handling, packaging, transport and storage. Economic costs, prices and returns of other components and non traded commodities were computed using conversion factors estimated by the National Planning Department. Current data on cost of production, income and prices of crop and livestock production were obtained from the special studies conducted by the Ruhunu University for the current study. This was supplemented by data from the recently concluded Irrigation Management and Crop Diversification (IMCD) Study by IIMI in the project area. Market prices were obtained from the Department of Census & Statistics, Central Bank, ARTI and DOA.

Net benefit streams were calculated with and without project for the old areas, which consisted mainly of the incremental paddy production from the area. For the new area, incremental benefits from paddy, OFCs, livestock and forestry were included in the benefit stream. The following costs were included in the analysis: production costs, investment costs, O&M costs and costs foregone. All costs and benefits were converted to constant 1994 US dollars, for the analysis. A separate analysis of the new and old areas was also undertaken. Sensitivity analysis was undertaken for cost, price and cropping pattern changes.

11.3 Project Costs

The project was estimated to cost Rs. 570 million in 1977. This was subsequently revised in 1982 and 1986 to Rs. 1,500 and Rs. 3,000 million respectively. The final cost of the project over a 15 year period of implementation was Rs. 2,700 million. This is almost a 500 percent increase over the original estimate. The dollar cost of the project increased from \$ 52 million to approximately \$ 100 million, nearly a two fold increase. The dollar cost was contained due to the depreciation of the SL Rupee against the US dollar, over the extended period of implementation lasting over 15 years.

An analysis of the project costs shows that a little over 40 percent of the total cost was spent on the dam. If the distributary system is also included, this proportion rises to 52 percent of the total costs. This high level of expenditure on the dam was partly due to unforeseen foundation problems discovered during the excavation stage of dam construction. The long delays in implementation of the project also added to the cost. As this is relatively a high cost dam, the full benefits can be achieved only if the maximum possible area is developed for irrigation. Unfortunately for the KOISP, the full area could not be developed due to inadequate water resources. A third of the area planned for development was abandoned, thus causing a reduction in benefit flows from the project. The full benefits of the project cannot be realized unless the entire land area earmarked under the project is fully developed for irrigation and cultivated. However, it is theoretically possible to generate additional incomes through marginal investments in the distributary system, provided that the water resource availability improves

considerably (either through improved water management or additional resources of water).

11.4 Project Benefits

The project envisaged the construction of a dam across the Kirindi Oya and irrigation facilities to cover 8,300 ha. of new lands and supplementary irrigation facilities for 4,500 ha. of existing irrigated lands. However only two thirds or 5,342 ha. of new lands were actually provided with irrigation facilities. The entire extent of the old irrigated lands were provided with supplementary water. The cropping intensity in both areas were to rise to 1.7 according to project estimates. However, the actual cropping intensity of these areas as observed over the last few years was 1.6 (about 95 percent of the expected value) in the old area and 0.9 (52 percent of estimate) in the new area. Only about 60 percent (5,200) of the targeted number were actually settled on the new lands.

It was also expected that half the extent in the new lands and a smaller proportion in the old areas would be grown with OFCs. This expected diversification did not take place. Less than 10 percent of the land was actually diversified. This too in very water short years and with much efforts from the management. The lack of enthusiasm for OFCs was due to many reasons. These included, lack of know-how and finances, price fluctuations and the resulting uncertainty of income, inadequate facilities for irrigating OFCs, soil and topographic conditions, etc. But in water scarce situations farmers have been persuaded to diversify with good success, although their preference would be to grow paddy.

In terms of the incremental annual outputs envisaged by the project, the achievement for paddy was 55 percent (24,000 mt.), and that for other field crops 14 percent (1,600 mt.). Incremental milk production was 17 percent of the target (0.7 million liters). The project did however generate 5.5 million man days of incremental employment in the construction phase and 2.6 million man days in production activities since the commencement of construction of the project in 1978. The poor achievements for OFCs and milk production, reflect poor planning of the project, particularly the lack of farmer input in planning. Forestry development was also restricted to 25 percent of the targets.

11.5 Cost-Benefit Analysis

11.5.1 Data

Project investment costs were obtained from the records of the Irrigation Department. They have been recorded in different formats according to the needs of the user. The annual accounts which appeared to be the most reliable, provides cost data in an accounting format. The data are aggregated by major components and are not ideally suited for cost benefit analysis. Quarterly progress reports of the Irrigation Department

also provide expenditure statements, that are more detailed, but less reliable. Cost figures did not match in the two documents. Therefore it was decided to use data from the annual accounts in the analysis, supplemented by data from the progress reports. Data on cost of production were obtained from 1977 onwards. These data were obtained from the Department of Agriculture, Cost & Production Publications. This was supplemented by data from the various studies undertaken in the project, the IMCD studies by IIMI and data from the surveys conducted by the Ruhunu University. World market prices for traded commodities were obtained from various sources, including, FAO, commodity bulletins, World Bank, as well as the Fertilizer Secretariat of Sri Lanka. Local farm gate prices were obtained from the Census and Statistics Department, ARTI and Central Bank. In almost all cases there were gaps in the data which were either estimated or, taken from supplementary sources. Data on crop production and cultivated extents of the old irrigated areas were the most difficult to obtain, particularly for the years prior to 1986. All available information was used in the analysis.

Data on non-agricultural benefits were obtained through special surveys conducted in the project area, supplemented by previous studies done on the subject. The data on economic and financial benefits obtained from the survey were not reliable, as the respondents were unwilling to reveal such information. Therefore, no attempt was made at valuing the non-agricultural benefits for purposes of cost benefit analysis.

11.5.2 Assumptions for Cost-Benefit Analysis

The assumptions for cost benefit analysis for the old and new areas with and without project are listed below.

Without Project

Old Irrigated Area (OIA):

- | | | | |
|-----|--------------------|---|-------------------------|
| (a) | Yield | - | 2.9 mt/ha. |
| (b) | Cost of Production | - | Rs. 23,000/ha (1994) |
| (c) | Fertilizer Use | - | No Increase |
| (d) | O & M Costs | - | Lower than with project |
| (e) | Cropping Intensity | - | 1.3 |

With Project

Old Irrigated Area & New Irrigated Areas (NIA):

- | | | | |
|-----|--------------------|---|-------------------------------------|
| (a) | Yield | - | 3.8 mt/ha rising to 6 mt/ha in 2007 |
| (b) | Cost of Production | - | Increases after 1994 |

- (c) Fertilizer Use - Increases after 1994
- (d) O & M Costs - Higher than without project
- (e) Cropping Intensity - OIA: 2.0 of paddy or 1.7 of paddy and 0.2 of OFC. NIA: 1 of paddy or 0.8 of paddy and 0.1 of OFC.
- (f) Livestock - No Incremental benefits from the OIA
- (g) Chena and Highland - No Incremental benefits from the OIA
- (h) OFC - Incremental benefits only after Phase I completion in 1986 in both OIA & NIA

Economic prices for OFCs and milk were obtained by using a conversion factor of 0.87 for OFCs and 0.774 for milk.

Investment costs were converted to economic costs using conversion factors estimated by the National Planning Department after breaking down costs into machinery, labour and materials.

11.5.3 Results

The projected ERR of the KOISP in 1977 was 17.6 percent. This was later revised to 11.0 percent for Phase I of the project, and 13.6 percent for both Phase I & II in the reappraised project report of 1982. The ERR in the base case as estimated by this study was 6.3 percent for the whole project, which is substantially lower than the anticipated rate of return.

The results of the base case and alternate assumption were as follows:

Cropping Intensity			
	Paddy	OFC	ERR
Base Case:			
Old Area	2.0	-	6.3
New Area	1.1	-	
Alternate Case:			
Old Area	1.7	0.2	5.56
New Area	0.8	0.1	

Inclusion of OFCs in the cropping pattern as in the alternate case reduces the ERR to 5.6 percent. This was considered a feasible option, as the entire extent of paddy cannot be substituted with OFC for technical reasons. Net returns from paddy are lower than that obtained from high income OFCs but lower or equal to the low income OFCs.

The economic farm gate prices of paddy were consistently higher than market farm gate prices indicating that the country would gain from cultivating paddy. In the case of OFCs, the market farm gate prices were higher than the world market prices, in most years. Although OFCs may be more remunerative to the farmer, the country does not gain, unless these crops are exported.

11.5.4 Sensitivity Analysis

Sensitivity analysis shows that the rate of return is more sensitive to output price declines than cost increases. A 30 percent cost increase reduces ERR for the base case by 0.5 percent, while a similar level of price decline reduces ERR by 2.0 percent. A 30 percent price decline together with a 30 percent cost increase reduces ERR by 3 percent. A separate analysis of the new and old areas was undertaken. This showed that most of the project benefits were derived from the OIA, with returns as high as 900 percent. However, only the rehabilitation costs were included in the analysis for the OIA. If 50 percent of the total investment costs are assigned to the OIA, then the ERR comes down from 900 to 7-8 percent. The new area shows very low or negative returns with the full costs of investment included in the cost stream. With half the investment cost assigned to NIA, the ERR goes up to about 5 percent.

The analysis indicates that the overall project rate of return is above the 6 percent Economic Discount Rate . The financial rate of return was lower than the ERR. The project is thus viable in terms of the direct economic benefits from the project. However if one takes into account the indirect benefits, and the possibility of a higher level of cropping, with improved water management and change in weather patterns, the future returns may improve considerably.

11.6 Non-Agricultural Indirect Benefits and Costs

There has been a substantial increase in agriculture related and non-agricultural economic activities in the project area. Business as well as service activities such as rice mills, milk, tourism, inland fisheries, groceries, marketing, and transportation etc. have expanded considerably after the project. While most of its indirect benefits have come after the establishment of the KOISP, other development projects implemented in the region have also contributed to this. The value of the indirect benefits could not be estimated due to lack of reliable data.

The major negative impact of the project has been identified as losses in prawn fisheries

in the adjacent lagoons. Prawn fisheries has been almost wiped out in the Malala lagoon. The number of prawn fishermen has been reduced from 400 before the project to less than 10 at present. The losses have been estimated at Rs. 3-4 million annually. Salinity has also cropped up in pockets of the old areas, due to salts being leached into this area from the newly irrigated area. The resulting losses are estimated at Rs 1 million annually. Inclusion of these costs in the economic analysis has very little impact on the rate of return.

11.7 Conclusion

The rate of return of this project is estimated at 6.3 percent and is above the economic discount rate of 6.0 percent worked out for Sri Lanka. It does not necessarily reduce the overall impact of the project in terms of social and indirect benefits. The possibility of future improvement of the water regime is another factor that should be considered. The project area has experienced a prolonged period of water shortages, due mainly to changes in weather patterns. Experience over the last few years seems to suggest that this pattern is changing gradually with the possibility of improvement in water availability to the project, over the next decade or so. Better use of the drainage water (estimates of drainage flows were much lower than currently measured quantities), reduction in the very high water duty for paddy (estimated at 8 acre feet/acre) and improved water management, as well as diversification to water saving crops are all likely to increase the cropped area and thus enhance project benefits. This study also shows that more studies should have been undertaken, particularly in the areas of feasibility of the various crops in relation to soil, topography, water use, economic returns, environmental impacts, irrigation design, etc. prior to undertaking such large investment projects such as the KOISP.

CHAPTER 12

CONCLUSIONS, RECOMMENDATIONS AND LESSONS

The KOISP Impact Evaluation Study has revealed many of the conditions which have influenced the relative successes and failures of the respective components of the project. While the foremost objective of this research was to assess the impacts of the interventions, it is evident that lessons which relate to these conditions should be formulated as well.

There were several contributing factors and circumstances which had a bearing on the development of the KOISP. The result was that some of the objectives of the KOISP were only partially met and that the "end-product" was not in line with the initial targets as specified in the project documents. There were circumstances in the external environment (e.g. the drop in rainfall in the Kirindi Oya Basin), human as well as technical factors relating to planning, management and coordination and other aspects of the project, that led to the above.

Whatever the reasons were for the discrepancy between the plans and reality, this study was not meant to lay blame on institutions or organizations involved in the planning and implementation of the KOISP. Neither was it meant to blame the government or donors. Some of the more generic conclusions drawn from this study presented below form the basis for the lessons learned from the experiences in the KOISP.

Irrigation System Development, Operation and Maintenance

- The estimated inflow into the Lunugamvehera reservoir does not take place mostly due to reduction in rainfall within the basin during the last 20 years. The average rainfall within the basin has reduced by about one-third of its normal rainfall. Moreover, a number of small tanks constructed within the catchment has obstructed regular flow to the reservoir. Because of this water shortage, only 71 percent of the proposed irrigable area was developed during the Phase I and II construction of the project.
- The average annual release from the reservoir during the last eight years of operation works out to 177.6 mcm which is only 60 percent of the estimated release. However, the irrigable area developed is 71 percent of the design area.
- The cropping pattern suggested in the project Appraisal Report did not materialize for a number of reasons. Farmers preferred to grow paddy initially, but only recently they have started diversifying to other field crops.

- The proposed cropping intensity for the project was 170 percent to be achieved in three out of four years. Every fourth year, the suggested cropping intensity would be less than 170 percent. This cropping intensity was for raising paddy and OFCs both during maha and yala. Against this, the cropping intensity achieved is only 133.2 percent with mostly paddy crop.
- The Lunugamvehera reservoir water is used more efficiently. The water duty obtained during various seasons in both Ellegala and the new systems indicate that water is used more efficiently, equitably and to the satisfaction of farmers.
- The maintenance allocation for the Kirindi Oya project is low when compared to the neighboring Uda Walawe system operated by the Mahaweli Economic Agency. However, even from this low maintenance allocation, a considerable amount is expended on administration and overhead cost leaving less for works. In view of the fact that a large amount is expended on administration, it is suggested that the irrigated area as well as operational procedures under each operation and maintenance division of the ID be reappraised and suitably modified to reduce the overhead and administrative cost.
- The construction standard appears to be normal. The assumed design parameters appear to be more or less in line with what has been measured in the field. However, the actual time taken and the quantity of water used for land preparation are very much higher than what the design allows for.
- Most of the farmers perceive that they receive sufficient water during the maha season while they do not get adequate water during the yala season.
- Detailed hydrological analysis together with an integrated approach of using surface water together with a drainage return flow and groundwater are very essential to plan an efficient project especially in water-short areas such as the Kirindi Oya basin.
- Water rights especially with regard to old area and new area settlers should be decided very clearly before the start of the project for efficient operation of the project.
- The present procedure of aligning field channels traversing well-drained, imperfectly-drained and poorly-drained soils is not conducive for efficient operation when OFCs are to be raised during the dry yala season. Separate provision of parallel field channels for well-drained and poorly-drained soils would facilitate better system operation when OFCs are raised. This would effectively intercept the drainage flow and increase on-farm water use efficiency.

- Better maintenance, improved monitoring and evaluation of the system performance and incentives for the operating personnel are necessary for further improving the system performance.

Land Development and Settlement

- The project planners of the KOISP have followed two approaches to select suitable persons to allocate land: alternative settlers and open settlers. Approximately half of the open settlers reported to have been allocated land not only because of they were landless, but also because of their political affiliations. On the other hand, almost all alternative settlers said that they were provided land mainly because of the loss of their lands to the project.
- A prescribed range of assistance was provided to new settlers to establish themselves early in their allotments and communities. This included food aid, drinking water, assistance in constructing shelter, fencing and the provision of free planting materials along with some agricultural implements. Also a subsidy scheme was implemented with a package of various items.
- The agricultural assistance program and the development of agricultural related organizations had a considerable impact on the settlers. They have supported as well as encouraged settlers to venture into agricultural related activities. However, old area farmers have benefitted more than new area farmers. As predicted by theories of economic and agricultural development, with the higher gains in productivity and income in the old area, income disparities between the new and old area settlers have tended to increase. Hence, carefully designed further assistance is required until the disparities are eliminated.
- The housing loans have not been repaid by the settlers, which has led to a hesitation from the side of the government to provide more loan schemes. The housing program has not been sufficient to assist most of the settlers in building permanent houses. Only the higher income groups have been able to construct permanent houses.
- At the beginning of the project settlers who were brought into the then non-irrigated areas received food subsidies until they settled down. Dry food rations were provided for a period of 18 months for all the family members. The World Food Program (WFP) assisted further by providing adequate quantities of food to all settlers. During the latter stages of the project food assistance was reduced to promote domestic productivity. But the haphazard manner of this scheme negated the settlers' anticipations and consequently forced them to seek alternatives. Hence, it recommended that the program of food assistance to the settlers be revived.

- The majority of the respondents in the new area reported that their land boundaries were clear. However, one cannot overlook the fact that some of them have oversized plots and do not want to admit this on the fear that they would lose the excess land. Approximately 37 percent of the respondents stated that their boundaries are not clear, most of them having undersized plots. The boundary problem appeared to exist only in the lowlands. Highland settlers expressed satisfaction with the demarcation of their plots.
- Initially a significant number of open settlers were reluctant to stay in the project area. The main reason was uncertainty of receiving irrigation water. The non-residency problem has caused a cancellation of the allocated plots in 5 percent of the cases. Another 7 percent are yet to be canceled.
- Due to various reasons several originally allocated plots were abandoned and the settlers received new land elsewhere. The most important reason for abandoning the plots has been salinity of soils. 138 plots (3 percent) have been reallocated due to salinity.

Infrastructure Development

- The KOISP has established 20 primary schools in hamlets and 4 junior and senior secondary schools in new towns. All of these are operational except for one at the Left Bank where the people are not yet settled. The construction of 22 schools and the upgrading of two existing schools by the KOISP has substantially improved the type and volume of the educational infrastructure in the project area. There were only 28 schools in different categories in the area before the project started.
- The educational standards of the KOISP area has improved gradually during the project period. This is reflected by the improved literacy rates and school participation rates of boys and girls in the old area. At national level the literacy rate increased from 87 percent in 1981 to 89 percent in 1993. In the project area the literacy rate increased from 85 to 96 percent during the same period. Women are still more illiterate, but the large gap between the male and female educational levels has been reduced.
- About 26 percent of the households in the new area and 6 percent of the households in the old area have sent their children to schools outside the project area. The majority of the settlers who reported this did so because they considered the school facilities in their original areas to be of better quality.
- While the health facilities in the KOISP area have improved substantially, further improvement could be gained by equipping the hospitals in the area with adequate personnel and materials; by developing transportation facilities, especially outstation; conducting training programs on hygienic measures at

school, household and staff level; introducing family planning methods and finally by conducting research to develop and operate an improved health program.

- The anthropometric survey revealed that in the KOISP area, 36 percent of the children had signs of chronic undernutrition, which is almost equal to the national average. Wasting, which is a sign of acute undernutrition, is indicated by a deficit in weight for height. The percentage of acute undernutrition appeared to be very high in the project area. About 46 percent of the children in the project area had signs of wasting, whereas the national figure was only 18 percent.
- In the pre-project period the total length of existing roads amounted to 175 km. The project constructed a further network of 435 km. of roads in the area. Homestead roads for access to households and service centers have been constructed stretching over a length of 200 km. Furthermore, linking feeder roads were constructed, connecting hamlets with main roads and towns up to a total length of 60 km.
- The settlers have appreciated the construction of project roads and recognized the consequent improved transport facilities. They claimed that costs of transporting their produce has reduced with the changed mode of transport, which was enabled by the improved network of roads. Faster transport in case of emergencies was mentioned as an other important effect.
- The project road network has reduced the problems of access to various service stations and also the time required to reach them. Although the settlements are now connected with the major towns by better roads, the distances are very often large. Consideration should be given to the construction of cross roads between hamlets and major towns to solve this problem.
- Cooperative stores have been established in the project area. However, under the prevailing liberalized economic system there are alternative places to purchase goods. Sometimes the open market offers better quality products at lower prices. The cooperatives have not always been able to buy the produce from the farmers at attractive prices. Therefore many cooperatives are making a loss. These shops are viable only in places where there are a sufficient number of permanent settlers and a large number of food stamp holders. Lack of protection of these cooperative shops from thieves was another important reason for closing down these shops in the hamlets.
- The project plan to provide drinking water to the new area by constructing one dug well for every 20 families has been unsuccessful due to the high rock table, salinity and severe drought in the area. Only 37 dug wells have been constructed. As an alternative the project has supplied bowser water to each

household and service center. This was continued until every family was given piped water.

- The majority of the settlers expressed their dissatisfaction with the bowser water distribution. Most of them felt that the amount of water supplied was not sufficient. A considerable number of settlers mentioned malpractices of the officers involved in water distribution (giving more water to people with whom they had a close relationship) and also irregularities in distribution.
- As a result of the project's water supply scheme the time spent especially by women to collect water has been drastically reduced. In the pre-project period the vast majority of the households (90 percent) in the new area depended on nearby wells or tanks and rivers for their domestic water supply and the housewives had to spend around 30 minutes to collect water. Now this time has been reduced to between 5 and 15 minutes.

Socio-Economic Conditions

- The average family size for the KOISP area is 5.5, which is only marginally higher than the national average of 5 persons per family. During the pre-project period the family size came to 5.7. The declining trend is similar to the national pattern. Two additional reasons specifically applicable in the KOISP area should be noted. Firstly, the health and education facilities in the area gradually improved during the last 15 years. Secondly, some settlers in the higher income groups did not bring all their family members to the project area because of the lack of educational, residential and infrastructure facilities. These factors were also responsible for reducing the family size.
- The vast majority of the houses in the KOISP area are small. In the new area 84 percent of the houses had a floor area less than 500 square feet; in the old area only 50 percent of the houses fall into this category.
- Water availability is an essential infrastructure facility for better living conditions of the people. Nearly 80 percent of the households in the new as well as the old areas obtained their drinking water from their own wells or pipes. In 1981 only 10 percent of the households in the new area and 40 percent in the old area received their water from these sources. Hence, it can be concluded that the water supply in the project area has improved considerably.
- A considerable increase in the employed population of the new area must be noted. The percentage employed in the labor force in the new area increased from 32 percent in 1986 to 71 percent in 1994. Corresponding figures for the old area

are 29 and 63 percent respectively. This expansion is mainly due to employment opportunities provided upon completion of the project.

- Salaried employment in the private and state sectors has shown a sharp upward trend in the same period. Self-employment showed an upward trend and was found more frequently in the old area, whereas skilled employment showed a downward trend in both old and new areas.
- Almost two-thirds of the households in the new area received an average monthly income of more than Rs. 2,000/=. An average monthly income of more than Rs. 4,000/= was received by 24 percent of the sample households.
- The majority of the population in the old area (65 percent) received an income of more than Rs. 3,000/=. Better infrastructure facilities and related education facilities further encouraged and strengthened the possibilities for seeking employment in other than the agricultural sector, which however has remained the major source of income.
- The study revealed that expenditure on food items as a percentage of household income, decreased with the increase in incomes in the new area. This was also observed with regard to non-food items as well as income from food stamps and Janasaviya. Among the lower income groups (below Rs. 1,500/=) the monthly expenditure on food was nearly equal to their income or even above it.
- In the old area too expenditure on food as percentage of household income has decreased along with increases in income. The lower income groups spend a large proportion of their income on food and non-food items despite the food stamp program and Janasaviya. The monthly expenditures in the old area were almost double of what was observed in the new area for all income classes .

Crop production

- The majority of the farmers in the old system cultivated rice in both seasons but the number of rice farmers in the yala season has declined to 63 percent. In contrast, farmers in the new area cultivated rice only in the maha season.
- The average yields of paddy in the old and the new areas is estimated to be 3,706 kg/ha and 3,649 kg/ha, respectively for the maha season. Hence, there is no significant yield difference in the two domains during the maha season. The average yield of paddy in the entire area is 3,605 kg/ha. This can be regarded as a reasonable achievement.

- The total annual paddy production in the project area is estimated at 41,000 mt. However, due to high production cost and low prices farmers receive a low farm income.
- Crop diversification in the rice fields has occurred only marginally. Approximately 31 percent of the farmers in the old area and 92 percent of the farmers in the new area had abandoned their rice fields during the yala season. Cultivation of Other Field Crops was limited to the maha season. Nearly 80 percent of the farmers in the new area have encountered conditions of water shortage in the yala season. In general, farmers were not inclined to grow OFCs due to many limitations.
- The annual total production of OFCs was estimated at 2,800 mt. Compared with the target of an incremental production of 11,400 mt of OFCs, this cannot be considered as a reasonable achievement.
- The farmer performance index indicates that on average, farmers have exploited 75 percent of the potential rice yield. The majority of the farmers was unable to exploit the full yield potential in the area.
- The cropping intensity of lowlands in the Right Bank of the new area was 98 percent and in the Left Bank 48 percent, but lowlands of the old area had a cropping intensity of 163 percent. The cropping intensity of the highland area (both old and new system) is well below 65 percent. The KOISP expected to increase the cropping intensity of the old system and the new area to 170 percent. Only the lowland area of the existing system has approximated the target.
- The degree of technology adoption was investigated by employing an adoption index. It demonstrates that technology utilization in the project area is still not satisfactory as 40 percent of the farmers can be considered as low adopters.
- The KOISP has made efforts to improve institutional facilities such as supply of agro-chemicals, extension and training, research, credit and insurance and marketing. It appears that private sector involvement has increased, but farmers still encounter certain difficulties which should be addressed.

Livestock Production

- It is evident that the project, at its initial stages, did not recognize the Kirindi Oya area as an important cattle and buffalo raising area in the country neither the importance of the scrub jungles and the countless number of small irrigation tanks in the sustenance of this livestock rearing system. Most of the problems encountered by herdsmen today are the result of this negligence.

- Although it was envisaged to develop 1,000 ha. for livestock development and agro-forestry, this reforestation project failed to contribute any notable impetus to the development of the livestock industry. Livestock management systems based on these reforested lands were not evident in the present study.
- While the project planned an incremental production of 4.1 million liters of milk annually, it appeared that even the total collection of milk from the area today is less than this figure. Information obtained from the two largest milk collectors Nestle and Milco reveal that they together handle approximately 50 percent of all cow milk produced in the KOISP area. With a total collection of 601,221 liters of milk during the first 7 months of the year 1994 and assuming a half of that quantity for the last five months of the year (which is usually the case in the dry months starting in June/July), the total quantity collected would amount to 900,000 liters. Therefore, the total production of cow milk in the KOISP area would be around 1.8 million liters a year. Since the buffalo population and the average milk yield per cow are not much different from that of cattle, one may assume the same quantity of milk produced by buffaloes. Therefore, the total quantity of milk produced in the KOISP area would be roughly around 2.6 million liters, which is far below even the incremental milk yield envisaged in the project proposal.
- With respect to the objective of improving living conditions of the settlers, the project has been able to help a few settlers (about 5 percent in the new area and 3 percent in the old area) to take up livestock raising on a small scale. Yet less than half of these herdsmen used improved breeds of cattle and buffalo and it appeared that they are only concerned with meeting home consumption needs of milk. Therefore, they are not much interested in purchasing expensive animals which can produce high average milk yields but need closer attention and more purchased production inputs. Most of these herdsmen (under the Tethered Grazing System) obtained their animals from fellow herdsmen. Most of the improved animals provided by the MDADDP have been purchased by herdsman-settlers rather than by settler-herdsmen.
- Poultry appeared to be a livestock enterprise gaining popularity among settlers. Settlers rear poultry mainly for egg production to meet domestic consumption needs rather than for the market. Various costs and returns associated with this activity could not be obtained from settlers because the activity depends purely on family labor and household resources. Settlers who raised poultry complained of the lack of extension education facilities for this activity. In view of the nutritional status of households, this is an activity that should receive attention of those concerned about the development of the Kirindi Oya area.
- Goat raising is not popular in the Kirindi Oya area (only one farmer in the old area reportedly kept goats), although it is an animal which is well adapted to dry

zone scrublands as found in the KOISP area. Research work carried out by Dr. W.W.D.A. Gunawardena of the Faculty of Agriculture of the University of Ruhunu reveals that this animal can be very profitably raised by the people in this area. As in the case of poultry, when asked about raising these animals on a small-scale many settlers said that they are reluctant to do so lacking the knowledge. What is therefore required is a well formulated extension program with incentives for innovators and early adopters.

- It can generally be said that the project has failed to achieve its objectives with respect to the dairy industry, but some progress is seen in the raising of other livestock such as poultry which can contribute significantly to improving the level of nutrition of the population. Even with regard to dairy industry some progress has been achieved in bringing down calf mortality and in improving and upgrading herds. Systems like the Tethered Grazing System which makes use of 'non-marketable' resources appeared to help settlers to raise livestock at the least possible costs to meet domestic consumption needs.
- Of the different types of large scale cattle and buffalo raising systems, the Village Based and Jungle Based Systems of management would disappear in the long run for these systems give negative net profits. Migration and Traditional Systems would remain but their sustenance depends on the rate of deforestation for other development activities and the rate of encroachment of jungle land by chena cultivators. One of the most important strategies in helping the livestock industry in the KOISP area is to allocate grazing land for the herdsmen belonging to the three Cattle Owners Associations. These associations should be helped by way of technical support required for reconstruction of tanks which are in a ruined state and, to construct wells. Grazing lands should be allocated but they should also be properly protected by enforcing laws against encroachment by chena cultivators and by erecting fences around the lands to protect herds from wild animals. The herd sizes would then become stabilized in the long run after adjusting to the available resources.
- The other important aspect of intervention is to impose strict rules and regulations on cultivators to put up proper fences around their cultivated plots. The bias against the herdsmen in paying crop damages caused by animals can not be justified at all occasions.
- Veterinary services in the area and the herd improvement program should be strengthened. It is quite clear that the staff at the Veterinary Surgeons office at Tissamaharama cannot cater to all needs of herdsmen in the area. Although the herd improvement program could not achieve much in terms of targets, it has been able to improve the herd composition somewhat by upgrading the herds with improved animals. It should be noted that herdsmen used traditional techniques to rear animals in the open scrublands. Changes in the attitudes of

these traditional herdsmen would require time and concerted extension effort. Therefore, a good herd improvement program should be supported by a strong extension service that encompasses farmer training classes on all aspects of livestock production. At the initial stages of such a program, the number of improved animals distributed can be kept small with more funds to build up an extension program.

- Marketing of buffalo milk is not considered a problem with the market being more competitive. It is more problematic in the case of cow milk, where the market is more oligopsonic with only a few buyers. Moreover, the collecting centers are located away from producing areas, causing losses to herdsmen. One solution is to help herdsmen establish more collecting centers under the leadership of Cattle Owners Associations. These associations should be helped to set up dairy societies by way of providing milk marketing equipment, soft loans, other technical help, etc. This decentralization of collection points would also keep herdsmen from adding Hydrogen Peroxide to arrest deterioration of milk quality. Herdsmen did not complain about milk prices, other than fluctuation of prices, caused by supply fluctuations.
- The livestock center of the MDADDP farm at Jambugaswewa could still serve as the Livestock Center for the area. The services of this center should be extended to include herdsmen in the old area. As noted earlier, attention should be focussed on strengthening the extension base of the center rather than expanding and increasing technical input packages.

Salinity

- There are two factors that are major contributors to the salinity problems of Ellegala. The first is the increased salinity contribution of tank water which can in the future, be modified by sufficient dilution from Lunugamvehera water by proper monitoring of water quality. The second is the drainage congestion in the Tissa and Yoda Wewa command areas and the poor drainage in micro-depressions and lower topographical locations which have poorly drained soils.
- A low cost water quality monitoring system of the five reservoirs should be sustained with a view to releasing the required amount of Class I quality water from the Lunugamvehera reservoir in order to effect the necessary dilution.
- Early action should be taken to clear the drainage congestion and to keep the drainage ways free from blockage and ensure that they are connected to the main arterial drains and eventually to the outfalls to the sea.
- It is extremely important that the fortnightly monitoring of water quality of all reservoirs and the four outfalls (Basnawas) be continued over the next five years.

This would help to keep track of the trends in salinity over this period and form the basis for appropriate corrective action that would be needed.

- Special note should be taken of the salinity levels of water during extra-ordinary dry years such as 1992, so that the necessary levels of dilution in the old Ellegala could be maintained at the critical threshold levels.

Project Planning

- Water resource development projects like the KOISP need to take a basin view of these resources. Planning on the basis of basin development would have encouraged better investigation of all water resources, including groundwater which was totally ignored in planning the KOISP.
- Good geological, soils, and economic information is needed and should be provided with thorough investigations made before the preliminary design of the major structures. A primary consideration in these investigations is assuring that local variability has been adequately assessed.
- An alternative to more thorough investigations is inclusion of a significant amount of unallocated resources in the project budget to cover changes needed and inclusion of a more thorough investigation in the project work plan. This alternative would not have been adequate for the KOISP since the cost escalations were so large that no project planner would have predicted them.
- The project planners failed to consult the residents in the area in any meaningful way. It is quite likely that careful consultations with the residents during the project planning period would have highlighted some problems that were missed by the project planners, like the cattle problem at Kirindi Oya.

Construction

- Sri Lankan and donor contracting and procurement procedures should be streamlined and simplified to avoid major delays. One cause of slow contracting is the requirement for Cabinet approval of the award of large contracts. This requirement should be dropped not only because of the delay but also because it encourages political interventions.
- In Sri Lanka, the balance of power between agencies supervising contracts and large contractors is weighted too heavily in favor of the latter, partly because of lengthy contracting procedures and political involvement in contracting. Power needs to be rebalanced by a) streamlining contracting procedures as mentioned above, and b) using the smallest contracts consistent with efficient project management.

Political Interventions

- The direct intervention of politicians in settler selection has been constantly reported verbally. For KOISP, this intervention aggravated the "non-resident settler" problem. As noted above, politicians also oversee the award of large construction contracts. Reducing the direct role of politicians in these areas would help to prevent some of the reported abuses, such as ignoring settler selection criteria.

While reduction of direct intervention by politicians overall will require a major cultural change, specific efforts, including widespread publicity about the problems, can be directed at specific situations. This can only happen, however, when the top political authorities make it happen.

Project Coordination

- For the KOISP, the various executing agencies worked largely independently of each other. Coordination mechanisms functioned primarily to keep finances flowing, to ratify major changes in the project, and to adjust time schedules. Although the mechanisms proved adequate to solve many problems, they were not able to address those problems whose solutions require cooperative planning and effort from two or more agencies. There are two mechanisms for coordination that have worked in Sri Lanka:
 - Creation of a special interdisciplinary project agency like the Gal Oya Development Board or the Mahaweli organizations can provide coordinated efforts. However, this is expensive and it has so far proven impossible to kill these agencies once their job is over. For example, the main dam contractor, the RVDB, is the descendant of the Gal Oya Development Board.
 - Using limited purpose committees whose members include agencies that can provide special rewards to the participants or that include farmers who can provide personal satisfaction. This is not as satisfactory a solution as a special agency but it does not give rise to the problems created by special agencies.

Benefit Monitoring and Evaluation

The benefit monitoring and evaluation system for the KOISP has produced a great deal of useful information in special studies. However, for purposes of project management, a continuous monitoring system that could provide frequent and rapid reports would have been more useful. Such a system is suggested for future large projects.

Farmer Organizations and Participation in Irrigation System O&M

- Under Sri Lanka's participatory irrigation system management policy, farmer organizations have been created at Kirindi Oya to take over management of distributary channels and below and to share in the management of the whole system through the joint management committees.
- Today, the farmer organizations exist and are well recognized by the farmers. However, most are weak and do not play a significant part in system operation. While they do handle aspects of maintenance, they do so in conjunction with the Irrigation Department. The joint management committees exist and play a significant role in seasonal planning. However, that role is not generally understood by the majority of the farmers, thus showing that linkage between Farmer Representatives and other farmers is a major weakness in the participatory management structure.
- Given the importance of the participatory management policy and the greater success that has been found elsewhere in Sri Lanka, there is a clear need to invest more effort in strengthening the farmer organizations at Kirindi Oya. Resolving the "non-resident settler" problem is probably necessary for strengthening the farmer organizations in the New Areas.

Government Agencies

- Virtually all facilities created by the KOISP have now been transferred to the agencies that will manage them routinely. Almost all special project management offices and bodies have been disbanded. There are two exceptions: a) the Irrigation Department has not yet completed the transition from a construction organization to an O&M organization, and b) the Land Commissioner's Department maintains a skeleton office that deals with a few remaining responsibilities, including maintenance of hamlet roads.
- No full evaluation of the agencies that have taken over was attempted. However, it appears that all suffer from the funds and manpower shortages endemic in Sri Lankan government agencies. Solutions to this problem will require major changes in government practices and attitudes beyond the scope of this paper.

Beneficiary Participation in the KOISP

- Beneficiary participation in planning of the KOISP was virtually nil. Participation in construction activities, particularly in irrigation system construction during the early 1980's was a significant source of income to early settlers and others in the area.

- While there was little participation in the early Ellegala rehabilitation work, there was significant participation in the planning and execution of the Rectification of Irrigation Difficulties in 1992-93. The greater participation in the latter program was a major reason for the greater success.
- While providing unskilled construction labor is clearly beneficiary participation of a sort, it is not the type of participation that provides the greatest benefits to the project. As shown by Esman & Uphoff (1984), it is **participation in decision-making** about the project that contributes the most to development. While local farmers, particularly those few who were in the area when the project was being designed, could not contribute significantly to technical aspects of dam and irrigation system design, their involvement might have prevented some of the planning mistakes that were made, such as ignoring the cattle problem and depending too heavily on non-rice crops. This point is also demonstrated by the results of the different Ellegala rehabilitation programs.

Cost-Benefit Analysis

- The total cost of the project as at the end of 1994 is estimated at Rs. 2,700 million (US\$ 100 million) in current SL Rupees. This is about 5 times the original estimate of Rs 570 million in 1977 (US\$ 52 million). In current US \$ terms the cost is double that of the original estimate. The depreciation of the SL Rupee in terms of the US\$ enabled the dollar cost of the project to be contained within the revised estimate of US\$ 100 million.
- An analysis of project costs shows that over 40 percent of the total cost was spent on the construction of the dam. If the distributary system and other civil works are included this proportion rises to 62 percent of the total. Since this is a relatively high cost dam, the larger the area developed for irrigation the higher will be the benefits. In this particular case insufficient water resources led to the non development of a third of the area originally planned under the project, and thus reducing the benefits from the project. It is possible to increase benefits substantially by further marginal investments in the distributary systems provided that the water resource availability improves considerably (either through improved water management or additional sources of water).
- In terms of incremental outputs envisaged by the project, the achievement for paddy is 55 percent (24,000 mt.), for other field crops (OFCs) 14 percent (1,600 mt.) and for milk 17 percent (0.7 million liters). The cropping intensity in the old area is close to the projected figure while that in the new area is only 50 percent of the target. The project did however generate 5.5 million man days of employment in the construction phase and 2.6 million man days in production over the last eight years of operation of the project. The latter is about 20 percent of what was expected by the project.

- The projected ERR of the KOISP in 1977 was 17.6 percent. This was later revised to 11.0 percent for Phase I of the project and 13.6 percent for both Phases I & II in the re-appraised project report of 1982. The ERR as estimated by this study works out to 6.3 percent for the whole project, which is substantially lower than the anticipated rate of return. This analysis is based on future assumptions that take into account past performance and the experience over the last eight years of operation of the project. The base case analysis assumes that only paddy will be cultivated in the project area, with cropping intensities of 2.0 in the old area and 1.1 in the new area.
- An alternate future scenario with the inclusion of OFCs in the cropping pattern was found to yield an ERR of 5.6 percent. In this case it was assumed that the cropping intensity in the old area would be 1.7 of paddy and 0.2 of OFCs and in the new area 0.8 of paddy and 0.1 of OFCs. This was considered a feasible option, since the reduction in the paddy area cannot be completely substituted by OFCs, due to technical as well as economic considerations such as soil, topography, irrigation limitations, high cost of inputs, price fluctuations and problems in marketing of OFCs. Net returns from paddy cultivation are lower than that obtained from the high income OFCs like chilli and onions but above that of low income OFCs like green gram, cow pea, gingelly, etc. Paddy has the added advantage of an established marketing system, price stability, and farmer preference. The economic farm gate price of paddy has been consistently higher than the financial farm gate price, thus providing greater economic benefits to the country.
- Sensitivity analysis shows that the rate of return is more sensitive to output price declines than production cost increases. A price decline of 30 percent reduces the ERR by 2.0 percent, while a cost increase of 30 percent reduces the ERR by 0.5 percent. Both a price decline and a cost increase by 30 percent reduces ERR by 3 percent. A separate analysis of the new and old areas shows that most of the project benefits are derived from the old area, with very high rates of return (over 900 percent). The new area shows very low or negative rates of return. If 50 percent of project costs are assigned to the old area the rate of return of the old area drops to around 7-8 percent. As one would expect, the overall rate of return of the project (both areas) remains unchanged, in this analysis.
- There has been a substantial increase in agriculture related and non agricultural economic activities in the project area. Business as well as service activities such as rice mills, inland fisheries, tourism, marketing, and transportation, etc have expanded considerably in the area. While most of the indirect development activities have been established as a consequence to this project, other major development projects implemented in the area have also contributed to this. It is not possible to value the impacts of these activities due to the non availability of reliable data.

- The major negative impact of the project has been identified as the losses in prawn fisheries in the adjacent lagoons. Prawn fisheries has been almost wiped out in the Malala lagoon. The number of prawn fishermen has been reduced from 400 before the project to less than 10 at present. The losses have been estimated at Rs. 3 to 4 million annually. Salinity has also cropped up in pockets of the old areas, due to salts being leached into this area from the newly irrigated area. The resulting losses are estimated at Rs. 1 million annually. Inclusion of these costs in the economic analysis has very little impact on the rate of return.

- The project area has experienced a prolonged period of water shortages, due mainly to changes in weather patterns. Experience over the last few years seems to suggest that this pattern is changing gradually with the possibility of improvement in water availability to the project, over the next decade or so. Better use of the drainage water (estimates of drainage flows were much lower than currently measured quantities), reduction in the very high water duty for paddy (estimated at 8 acre feet/acre) and improved water management, as well as diversification to water saving crops are all likely to increase the cropped area and thus enhance project benefits. This study also shows that more studies should have been undertaken, particularly in the areas of feasibility of the various crops in relation to soil, topography, water use, economic returns, environmental impacts, irrigation design, etc. prior to undertaking such large investment projects such as the KOISP.