# CHAPTER 9
# INSTITUTIONS AND MANAGEMENT

## 9.1 Introduction

The irrigation management context and goals were introduced in Chapters 1 and 5 and illustrated in Figures 1.2 and 1.3. This chapter is concerned with four specific aspects of irrigation management institutions as they relate to the management of maintenance of irrigation and drainage channels:

- Organisational structures
- Maintenance responsibilities
- Financing and cost recovery of operation and maintenance expenditure
- Data collection and monitoring

## 9.2 Organisational structures

### 9.2.1 Introduction

Sagardoy (1982) described two types of organisational structure: the segregated structure and the integrated structure. These are related to a hierarchy of goals assumed for management of irrigation systems: greater agricultural production, greater income, and betterment of farmers' welfare. Specific goals will vary between irrigation schemes, and organisational structures evolve for various reasons, but the distinction between segregated and integrated structures is generally useful.

### 9.2.2 Segregated structure

In a segregated structure several organisations are involved, each of which is concerned with a specific area of activity and one (or a few) related goals. For example, an Irrigation Department has the goal of appropriate use of water, and an Agricultural Department the appropriate use of other inputs. It is assumed that the interaction of these line agencies working independently will produce the overall goal of improving farmers' welfare. An example of a typical segregated organisational structure is given in Figure 9.1.

The advantages of this approach are its simplicity and focus on one goal which is related to the organisation's particular area of expertise.

One disadvantage is that the services provided may be more dependent on the national norms applied by the line agencies than on the specific needs of farmers within the irrigation scheme. For example, it may be difficult for the Agricultural Department to provide a greater than normal number of extension workers and a more intensive agricultural extension service within the irrigation scheme so that farmers can take advantage of the new opportunities.

Another disadvantage is that there is no co-ordinating mechanism in this structure. It is assumed that there are dynamic social groups who will ensure co-ordination through "bottom-up" forces, for example, farmers demanding adequate services.

As far as weed control is concerned, this lack of coordination means there is no centralised information on problem weeds in both channels and fields, and no coordination in use of equipment for maintenance and agricultural operations.

Attempts are sometimes made to overcome this problem through co-ordination committees with representatives from the different organisations. An example is the system of Irrigation Committees used in Sumatra, Indonesia (Helmi, 1996). However the constraints of the individual organisations may restrict the committee's effectiveness.

Segregated structures are common in large-scale irrigation and drainage schemes, for example, the Welland and Deepings Internal Drainage Board in UK. They are also found in small-scale irrigation schemes (such as Gem Rae in Kenya) where farmers, organisations concentrate on supply of water and outside agencies provide agricultural services. These schemes have been described in Chapter 2.

### 9.2.3 Integrated structure

In the integrated approach it is assumed that the overall goal can best be achieved by one organisation which co-ordinates a number of departments or sections, each concerned with the individual goals. Integrated organisations are therefore responsible for managing other activities as well as irrigation, for example:

- agricultural extension (e.g. advice on cropping practices)
- agricultural inputs (e.g. seed, chemicals, machinery)
- agricultural operations (e.g. on a state farm)
- agricultural credit
- community facilities (e.g. housing, water supply and sanitation, health, communications and transport etc.)
- collating information (e.g. list of aquatic needs)

Integrated management structures are used on state farms (for example, the Chisumbanje case study) and settlement schemes (for example, Mwea ISS). The organisational structure at Mwea ISS is shown in Figure 9.2.

The integrated structure has the advantage that it makes specific provision for the co-ordination of all the important aspects to achieve the various goals. In this way it can ensure that the farmers receive all the necessary services, such as extension, inputs and credit, to enable them to make use of the irrigation water. Particular services provided at Mwea ISS include mechanised land preparation and transport of the harvested rice.

The structure can be used to centralise information on a range of aspects, e.g. trials of new weed control measures on both agricultural fields and channels.

The disadvantage is the complexity of the resulting structure. For this reason the integrated structure is mostly found where farmers' conditions are fairly uniform, such as on settlement schemes, state farms and estates, and on schemes below about 10,000 ha in size.

**Figure 9.1 A typical segregated organisational structure**

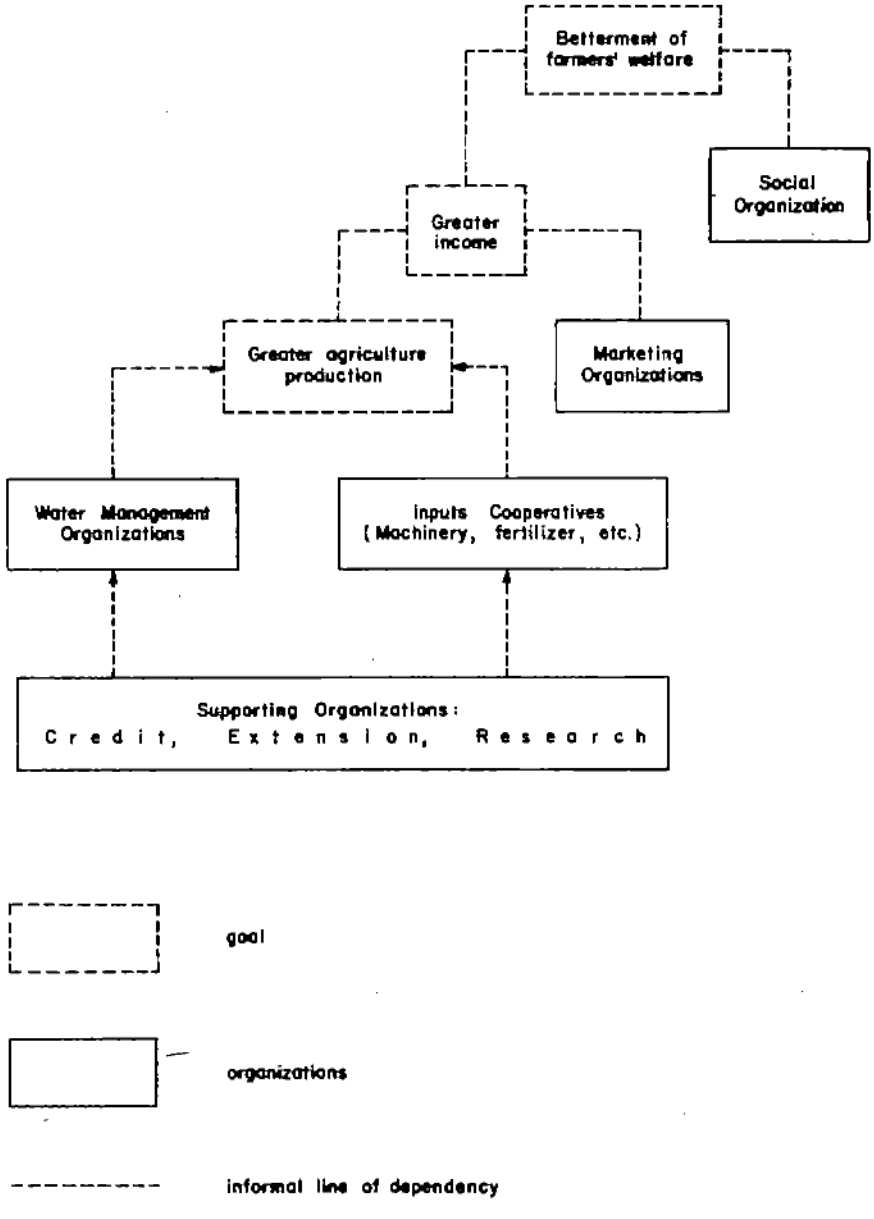
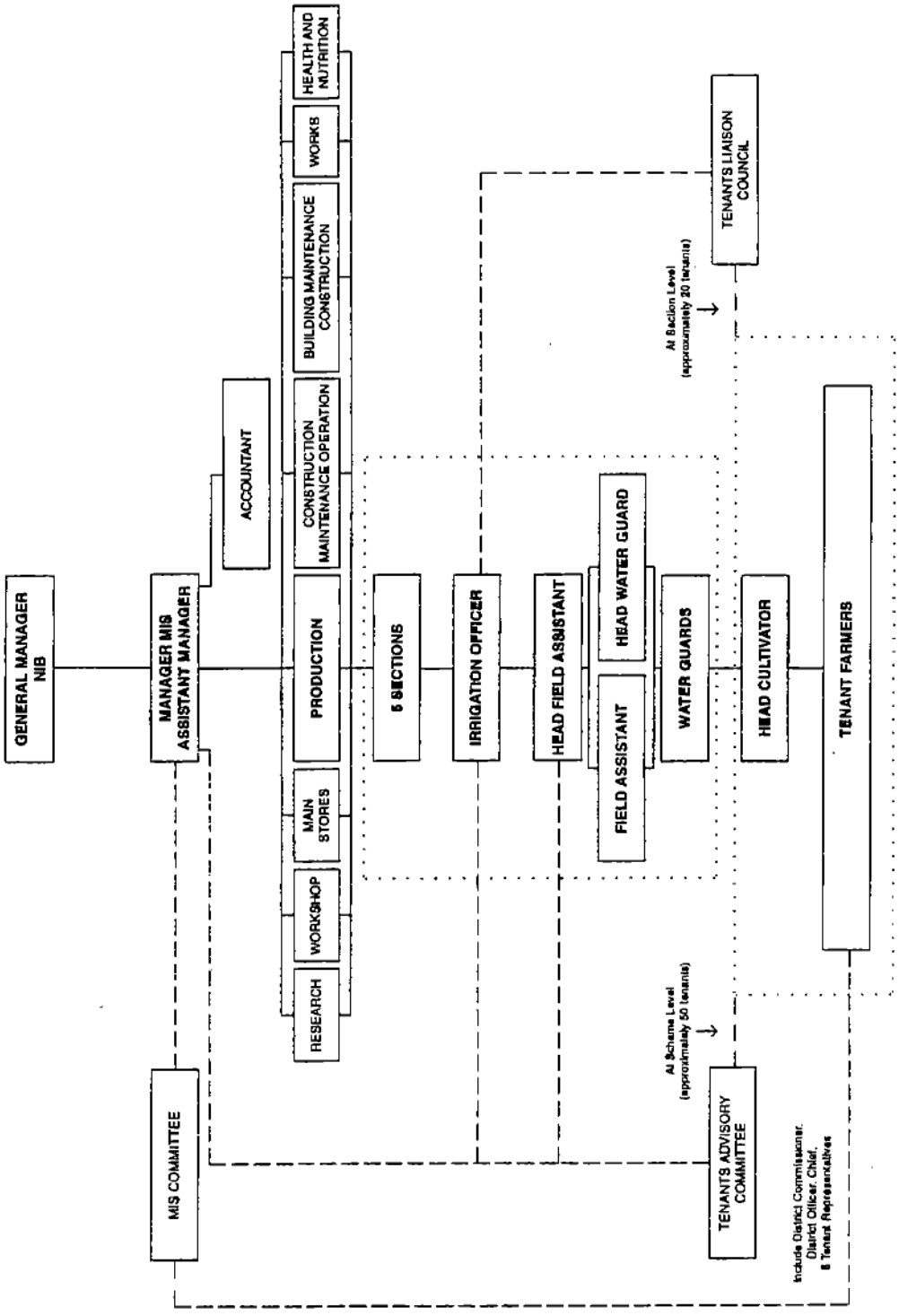


**Figure 9.2 A typical integrated organisational structure - Mwea ISS**



### 9.2.4 Project organisations

Projects are essentially investment activities undertaken over a particular time period. An organisation may be created to implement a project, but this is also limited to the duration of the project and is thus a temporary organisation, not a long term organisation.

Projects usually have specific goals which justify the investment, and as a result irrigation projects often include a range of components covering activities such as irrigation, agricultural extension, agricultural inputs, credit which are required to achieve the project goals. In some cases where these activities are normally undertaken by a number of segregated government agencies, integrated project organisations are set up to provide the concerted effort on the range of components without fragmentation between different line agencies. The project organisation may undertake all the activities directly, or may just provide co-ordination and attention to bottlenecks, leaving the implementation of the components to the line agencies.

### 9.2.5 Water User Associations

Water User Associations (WUAs) is a term used to describe organisations of the farmers in an irrigated area, for their own benefit. They are normally set up by government according to particular rules. The structure of WUAs may be based on one of the following:

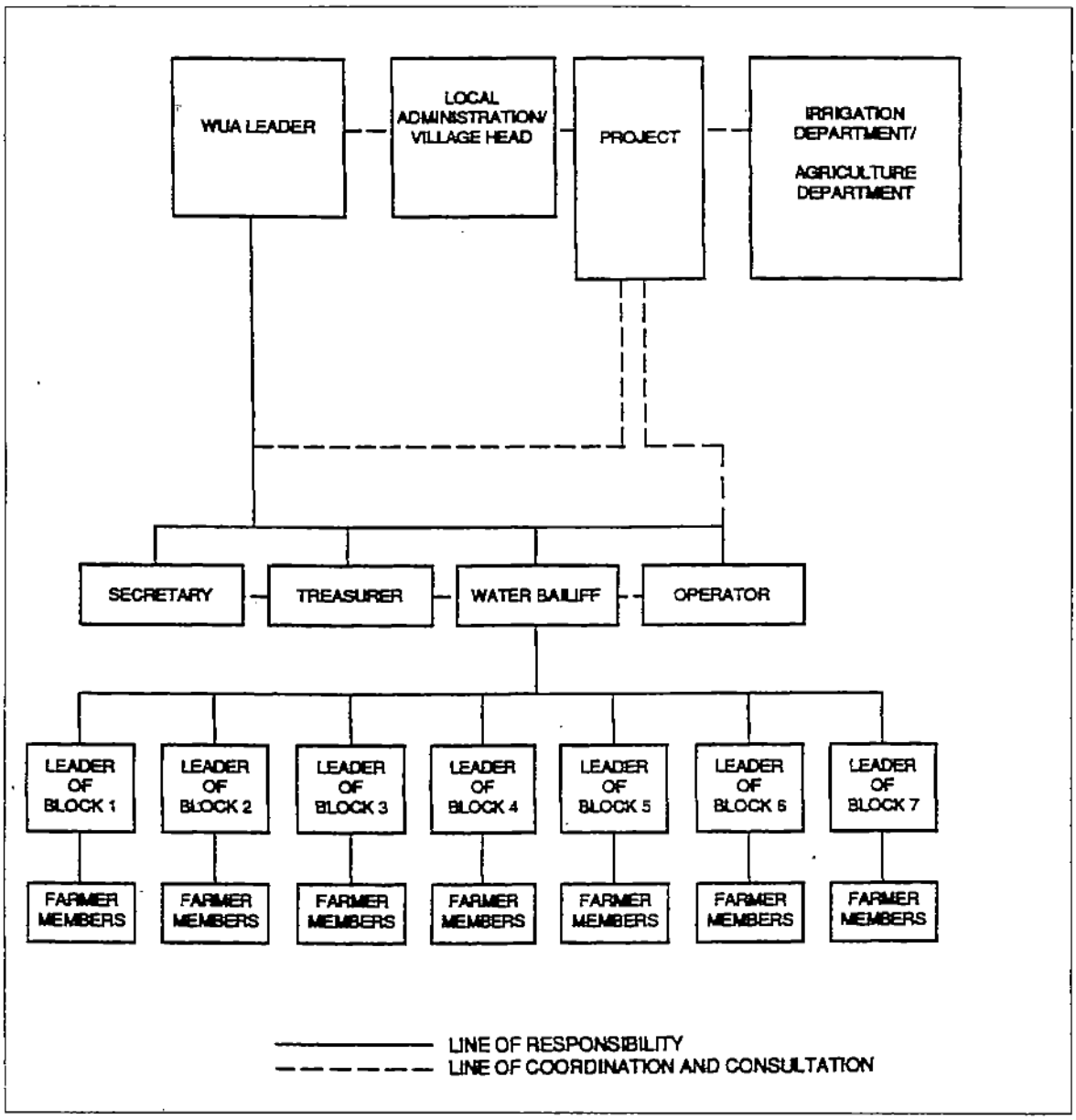
- social units (communities)
- local government units (official villages and districts)
- irrigation units (tertiaries, secondary canals)
- existing, usually informal, organisations.

For a simple small-scale irrigation system with a single tertiary canal, these units will commonly be the same. On larger systems, the standard and generally most effective organisational form for WUAs is based on irrigation or hydrological boundaries, so that the WUA can coordinate water supply and maintenance among the users.

WUAs are commonly based on tertiary canals and a typical WUA structure (for example, the Madura Groundwater Irrigation Project, Indonesia) is shown in Figure 9.3. In this example the WUA is primarily concerned with the distribution of water, maintenance of field channels and resolving conflicts between individual farmers. WUA activities vary from country to country, depending particularly on the limit of the irrigation agency's responsibility. The WUA can also have an important role in eliciting group decisions, for example on cropping, patterns and planting dates, and in providing two way communication between government and farmers, for example explaining, to farmers the purpose of the various irrigation structures and bringing farmers' problems to the attention of government staff.

The Gem Rae system is another example of the WUA structure (see Chapter 2).

**Figure 9.3 A typical Water User Association (WUA) structure (from Madura Groundwater Irrigation Project, Indonesia)**



## 9.3 Maintenance responsibilities

Policy issues were discussed in Chapter 5 (section 5.5). The government agency will usually be responsible for maintenance of the major canals and structures, down to a point (for example, the head of the tertiary canal, or the outlet to the farm) where responsibility is taken over by the farmers or a Water User Association.

### 9.3.1 Maintenance by government agency

This requires the following activities:

- systematic reporting of condition of canals, drains and structures
- systematic scheduling of work and budgeting
- regular servicing of pumpsets or other equipment
- emergency repairs following breakdown or damage
- servicing and repair of operation and maintenance equipment itself, e.g. by an efficient workshop
- surveillance for alien invasive aquatic weeds.

In canals and drains the important tasks are to clear sediment by labour or machine and weed by labour, machine, chemicals or biological methods. Such methods have been described in Chapter 4. Maintenance may be carried out while the canal is flowing or at fixed closure periods.

Maintenance of structures includes:

- measures to safeguard their structural stability, particularly maintaining earthworks and downstream protection to prevent by-passing or undercutting due to scour
- greasing and painting of water control structures (e.g. gates)
- attention to blockages, for example accumulation of weeds behind weirs and silt deposits in culvert pipes which would affect the structure's operation
- repair to leaking joints of concrete pipes, and repair of damage to structures.

On all types of scheme, maintenance is frequently neglected, leading to serious problems which eventually require a scheme to be rehabilitated. This neglect reflects the low priority given to maintenance, and consequent low budgets.

### 9.3.2 Maintenance by the water user association

The main problem here is that maintenance tasks and their importance are not always immediately apparent to farmers who may therefore neglect preventive maintenance on improved irrigation schemes, as tends to happen on other types of community development schemes. A strong effort is needed by government staff to overcome this, firstly by explaining the tasks, secondly by training someone to be responsible for ensuring that the tasks are carried out, and thirdly by checking from time to time that the scheme is being maintained properly.

Maintenance activities typically include the following:

- minor day-to-day reshaping and weeding of canals and structures to prevent blockages and leakage developing into more serious problems; these can be carried out by an agency employee (e.g. water guard) or farmers;
- repairs to canals and structures before each season as necessary, usually carried out by all the WUA members working together; some materials may need to be purchased, such as cement and paint (e.g. for water control gates);
- regular servicing of pumpsets or other equipment;
- emergency repairs following breakdown or damage.

These activities require diligence from the water guard and the mobilisation of labour by the WUA. The requirement for funds varies with the type of scheme and the responsibilities of the WUA, from simple gravity schemes which may occasionally need a bag of cement, to tubewell schemes which need funds on a daily basis for operation, with additional requirements from time-to-time for repairs.

Farmers are understandably reluctant to part with their money and suspicious about what will happen to it, so if funds are not needed regularly, it is unnecessary for the WUA to collect fees until the need arises or the WUA has built up trust among the farmers. However if funds are needed frequently it is important that systematic procedures are introduced for the WUA to follow, covering for example:

- agreeing a budget and water charge;
- collecting and keeping funds (e.g. in a WUA bank account);
- recording receipts and expenditures (e.g. in an official cash book);
- accounting for these publicly (e.g. by reading them out in the WUA meeting).

If farmers are satisfied about security of funds and the financial procedures, the WUA can aim to collect sufficient funds on a regular basis to build up a reserve for emergency maintenance.

## 9.4 Financing and cost recovery of operation and maintenance expenditure

Expenditures may be financed from government funds but it is usual for a direct contribution to be made by farmers paying water charges to the government or scheme management.

Experience shows that collection of these charges is very difficult. The farmers often regard it as another tax, and indeed the government often treats water charge payments as general government revenue, e.g. for administration by Ministry of Finance. Recent studies (Small and Carruthers, 1991) have concluded that it is important that payments for water are directly linked to operation and maintenance budgets, to improve incentives.

Governments generally find it very difficult to collect sufficient revenue from water charges to cover the operation and maintenance costs; as a result there is little chance of recovering any of the capital costs. However farmer participation (e.g. unpaid labour) can make a contribution to cost recovery by reducing direct operation and maintenance costs and by reducing direct construction costs, particularly at tertiary level.

Water charges may be set in one of the following ways, or a combination:

1. irrigation service fee
- area charge, where a charge is levied per hectare irrigated - this is a simple system, and land records can provide the basic data
- crop area charge, where a higher charge per area is levied for some crops (e.g. rice, which has higher water requirements)

2. water price
- volumetric charge, but this requires records of volume of water delivered
- time charge (e.g. in tubewell irrigation), requiring records of hours of supplied water

At Mwea ISS farmers pay an irrigation service fee through a crop charge at the time of harvest.

## 9.5 Data collection and monitoring

Monitoring refers to the systematic inspection of assets condition and the judging of their fitness to fulfil their intended functions. Monitoring should be ongoing and routine rather than an occasional and special event.

Routineness increases the probability of early identification of potential and actual sources of system failure. Early identification may allow relatively cheap and quick preventative maintenance rather than later expensive remedial work.

The success of monitoring condition may be enhanced by:

- the use of checklists requiring evaluation of asset condition
- the inculcation in all members of the workforce of the philosophy that timely preventive maintenance saves costly repairs
- the encouragement of inspection and reporting by all workers, perhaps supported by a reward system
- accumulation and collation of data on the aquatic weed communities
- data availability from which judgement can be made as to asset condition overtime
- provision of a reliable reporting mechanism to a responsive management.

Items to be monitored include:

- the type of weeds and their rates of growth
- the rate of silt build up
- the significance of weed and silt conditions for the hydraulic performance of the system
- the appearance of alien invasive water weeds
- the physical condition of machinery, canals and drains
- identification of weak spots
- regular, systematic measurements of discharges of canals and channels
- the productivity of workers, machines and management

Data collection should be selective and provide a resource to improve the management and planning of the maintenance programmes. It is particularly useful to develop time series on a monthly basis of resources required for programmes and a record of their costs.

The specific tasks upon which resources are deployed through time should be recorded e.g. maintaining canals, drains or roads. Each of these broad areas of work may be thought of as cost centres and can be broken down further into sub-costs e.g. main, secondary or tertiary canals.

For each cost centre and sub-centre the specific tasks on which resources are deployed should be recorded. On a monthly basis the split of labour and machine time is recorded showing the demand for inputs through time.

For each month the input costs associated with specific levels of input use should be recorded.

The purposes of this data collection exercise is to:

- identify when particular inputs e.g. excavator time or casual labour is most in demand
- aid the synchronisation of input use between tasks and locations
- suggest periods of especially heavy input demands and focus attention upon when economies in input use would be particularly rewarding
- illustrate the profile of costs through the agricultural year as an aid to budgeting
- provide the quantities and cost of inputs needed as ingredients for the calculation of annual machine costs and annual labour costs. These are main items in the calculation of annual maintenance costs in the Least Cost Analysis calculations.

Figures 5.3 and 5.4 in Chapter 5 give an example of the analysis of data in this way, to show canal maintenance and drain maintenance inputs by machine and by labour at Mwea ISS. It would be useful for management to break these down further into cost-centres for weeding and desilting, and to convert the inputs into costs. The effectiveness of the weeding and desilting operations could then be assessed, and compared with alternative methods.

## References

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