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INSTITUTIONAL CHANGE AND SERVICES FOR FARMERS IN IRRIGATION MANAGEMENT

by

Prof. Hassan M. Ishag, ARC
Eng. Gafar Mahgoub, MOI
Sayed Galal Hamid Osman, SGB
Dr. Hamid El Faki, ARC
Dr. Ahmed M. Adam, MOI
Dr. Hashim El Obeid, SGB
Sayed Mohamed A/Rahim, SGB
Sayed Mohd A. Hassan, Tenant, Gezira Scheme

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INTRODUCTION

The importance of the irrigated sector in the Sudanese economy is well known. About 4.5 million feddans[1] are annually put under irrigated cropping and with that this sector is the largest in sub-Saharan Africa (De Silva, 1984). This constitutes around 25 percent of the total cultivated area but produces some 50 percent of the production. These figures vary due to the seasonal variability in the level of rainfed areas and yields. All of the Sudan's wheat, most of the food legumes and 90 percent of cotton are produced in the irrigated sector. The agricultural exports of the country are highly dependent on that sector. More important is the greater stability in areas and production of irrigated farming. In years of low rainfall, the irrigated sector has the potential to alleviate problems of acute food shortages. Further, most of the developments have been towards expansions or improvements in irrigated farming and such a trend is expected to continue.

Major Systems of Irrigated Agriculture:

Various categorizations of the irrigated sector can be made. With respect to the method of water provision, gravity, pumping, and basin irrigation, sub-systems exist where gravity irrigation has the biggest share, followed by pump irrigation.

However, in line with the theme of this paper, classification according to the system of management is of greater relevance. Two major categories can be identified: Government parastatals; and farmer-managed subsystems comprising private pump schemes and cooperatives. Such a classification is important due to its relationship to the provision and management of non-water inputs and services. Many disparities prevail in that respect:

* The degree of government involvement varies among the parastatal schemes. There are also differences with respect to rotation and crop mixes.

* Government parastatals have received the greatest attention in the supply of support services.

* Within that category the large parastatals such as the Gezira, Rahad, and New Halfa are more favored to others such as Northern, Blue Nile, and White Nile Corporations.

* Disparities as regards the crops grown, are also found within the government parastatals. Cotton and, to a lesser extent, wheat have received greater attention than the other crops like groundnut, sorghum, food legumes, vegetables, and fodder crops.

[1]Feddan = 0.42 hectare = 1.038 acres.

Because of these differences, it might be relevant to categorize the irrigated subsector into the following subsystems in order to set proposals for future studies in the field of irrigation support services:

a) Large government parastatals (e.g., Gezira, Rahad)
b) Small government-oriented subsystems (e.g., Northern, Blue Nile, and White Nile Corporations).
c) Private pump schemes.
d) Cooperatives.

I. MANAGEMENT OF IRRIGATION SUPPORT SERVICES TO FARMERS

Categorization of irrigation support services provides a procedure for future studies. In this report, the following categories are identified:

a) Financial aspects.
b) Material inputs.
c) Power.
d) Research.
e) Extension.

These categories are worth consideration in each of the following identified subsections. Areas of future studies are also discussed. Most of these areas require compilation of quite a large amount of available information.

a) Financial Aspects

1. Cash credit

Credit is one of the crucial aspects affecting the productivity of small farmers. Formal credit sources are quite limited and informal ones are expensive and discouraging. Ahmed (1975) found that the rate of interest on informal loans to farmers ranged from 115 percent to 280 percent despite the fact that a branch of the Agriculture Bank of Sudan (ABS) is present in the area and would provide low-interest loans at 7 percent interest. Cash credit is highly related to labor needs although it can also be important for the purchase of some material inputs. The most important study areas are:

* Labor demand in different demand periods.
* Availability of family labor for farm work.
* Hired-labor availability and sources.
* Credit needs for hired labor.
* Credit institutions and possible improvements and changes.
* Available credit sources and amounts.
* Credit recovery.

The end objectives of such studies would be the matching of credit availability to needs with respect to its efficient allocation among different farming activities, and better management of credit provision and institutions. It is suggested that the credit for the required inputs (fertilizers, seeds, etc.) be used under the direction and supervision of extension workers.

2. Pricing Policies

Although not confined to the irrigation sector, pricing policies have a crucial impact on productivity, resource use, and risks to the farmers. The main aspects are the price levels of crops and the timing of the price announcement. These are especially important for crops other than cotton; mainly groundnut and wheat, whose price levels are very much related to marketing institutions. Relevant areas of study are:

* Feasible mechanisms for determining price levels (Groundnut, wheat, cotton seed, and cotton lint for local industries).
* Feasible mechanisms for announcement of prices, and their levels to the farmers.
* Effect of exchange rates on local pricing of inputs and products.
* Taxation and price subsidies.
* Marketing systems and institutions for different crops i.e. cotton, wheat, groundnut and sorghum.

b) Material Inputs

These have a direct effect on productivity and most of them have interdependencies with irrigation water management. It is not only their level which is important, but also the timing of their supply. The most important are seeds, fertilizers, jute sacks, and pesticides. Relevant ares of study are:

* Level and supply of seeds; their sources and costs.
* Impact of new seed cultivars.
* Fertilizer needs of crops by subsystem and possibly by zone.
* Amount and timing of fertilizer supply in different sub-systems.
* Needs for pest control in different subsystems.
* Supply of pest control inputs; sources, amounts, and costs.
* Potential for nonchemical pest control measures.

c) Power

Again, both level and timing of supply of power services are critical factors for productivity. They involve machinery, animal power, and implements. Crop establishment, a critical stage in plant development, is highly dependent on power availability which is most lacking in farmer-managed subsystems. In addition, harvesting operations of some crops require power and are affected both in quantity and quality by power constraints. Relevant areas of study are:

* Current power needs for land preparation in different subsystems: machines, animal power, and implements.

* Available power in different time periods.
* Efficient utilization of available power.
* Potential for intermediate technologies.
* Impact of livestock integration in farming systems on power supply.
* Feasibility of combine harvesters and the timing of wheat harvesting and machine mobility between rainfed and irrigated sectors.
* Transport inside schemes.

d) Agricultural Research

The interdependencies between research, extension, and farmers should be deeply considered. Development of technologies should be geared towards solving farmers' problems. Farming-system research should be supported and strengthened in agricultural research institutions. Possible research areas are:

* Practical ways of linking research to farmers' conditions and extension.
* Ways of strengthening farming-system research in agricultural research institutions.
* Role of government agencies in the research-farmer-extension linkages.
* Flow of feedback information from farmers to research.
* Research for farmer-managed systems.

e) Extension (Social Aspects)

The role of extension needs no further emphasis. Extension input has been limited and quite localized. Farmers' objectives and attitudes need to be considered for technology acceptance and adaptation. Suggested areas of study include:

* Farmers' attitudes towards new technologies.
* Social factors and their interaction with farming.
* Feasible methods by which technologies can be promoted to farmers.
* Institutional set-up of research-farmer-extension linkages.
* Role of extension in government parastatals.

II. MANAGEMENT OF CHANGES IN INSTITUTIONS FOR IRRIGATION[2]

This part of the study indulges in the changes considered important to the various institutions dealing with irrigation. The ultimate goal is to ease difficulties and boost the productivity.

These institutions are: the Ministry of Irrigation (MOI), the Sudan Gezira Board (SGB) and the tenants. The MOI plays an important role in providing the irrigation water through the main irrigation system; however, the responsibility of water distribution to the field is shared between the three parties.

[2] The Gezira scheme is a model to most big irrigation schemes in Sudan and so it is referred to as an example.

a) Water Delivery

The current process of water delivery can be described as follows:

At each block (the smallest agricultural unit) the field inspector of the SGB adds together the number of cultivated numbers in each minor and multiply them by 5000 m^3 which is the estimated discharge per abu XX per 12 hours. This quantity gives the indent of the minor. The total indent for all the minors in his jurisdiction is passed to the irrigation engineer. The irrigation engineer will add the indents of all block inspectors in his jurisdiction to the downstream demand and pass it to the upstream irrigation engineer after making some modifications. These modifications deal with the capacity of various canals, which are called canal factors (eg., 15, 16, 17, 18). The largest canal has the smallest canal factor and the smallest canal has the largest canal factor.

The delivered water has to be handed over to the block inspectors at the offtake of the minor canals. From that point it is the responsibility of the SGB staff to distribute it among various Abu XX. The distribution depends mainly on the water levels in the minor canal. If the design full supply level (FSL) is secured, problems will be rare. However, recently it has become the habit rather than the exception to achieve less than the design FSL.

b) Water Shortages

The problem of water shortages is a nuisance to all parties, first to the MOI and second, with a greater impact, to the poor farmer. Why is there a water shortage? Or is there really a water shortage?

These are two big questions which need separate studies; nevertheless we will try to touch on the important factors.

The second question poses a dilemma. The gauged water at Sennar headwork is considered, by international standards, to be more than the requirements for the cultivated crops, while on the farm-level most tenants accuse the MOI of being responsible for water shortages.

It is a fact that there are water shortages at some locations. Many factors contribute to the water shortages. First is the introduction of intensification and diversification which increases the area and thus the demand for water in quantity and duration and consequently reduces the available time for maintenance. Recently, the drought aggravated the situation by increasing the amount of silt entering the system. Considering all these factors and the gradual reduction in the number of machinery per feddan, it becomes understandable that the irrigation system is under stress. This is what led to the water shortages. The most affected zone in the irrigation system is the minor canal.

c) Night Storage Versus Continuous Flow

The minor canal area is the most affected by the irrigation method. Originally the system was designed to irrigate continuously, but because of social reasons it was converted to a night storage system where the minor canal acts as a buffer zone between continuous and intermittent flow. During the night the flow velocity decreases in the minor canals and this results in deposition of silt. If maintenance is not carried out regularly and properly the situation will lead to higher levels and smaller velocities sufficient to cause submergence to upstream structures. A submerged structure will not function properly and the passing flow will be smaller than originally anticipated.

Another cause for higher levels in the minor canals is the build up of silt on the land and negligence of water courses (e.g., Abu XX).

Adoption of an alternative method of irrigation like Continuous Flow needs to be studied carefully to determine its sustainability socially, technically, and economically.

d) Operation and Maintenance of Minor Canals

Currently the operation of the minor canals is the responsibility of the SGB, while its maintenance is the responsibility of the MOI. In fact a neglected canal without maintenance will not perform well and cannot fulfill the required flows. On the other hand if the operator of a minor canal does not understand the behavior of water flow, that will adversely affect the maintenance process.

Let us consider an example to explain the interrelation between maintenance and operation of a minor canal.

We have a clean canal performing well and water is delivered to the minor canal in the right amounts, as requested. The night-storage structures along the minor canal are supposed to be left open in order to fill the last reach first. By doing this we ascertain that a large proportion of the silt will be distributed along the canal. If the night-storage structure in the first reach is closed, then a major portion of the silt will deposit there and disrupt the flow to the downstream reaches. Another consequence is a high level and submergence of the structures at the minor offtake, and thus the weir discharging capacity is lowered. In a short period of time, the canal needs to be cleaned.

Negligence and delayed canal maintenance does lead to the same consequences and interrupts water delivery to the fields. Operation and maintenance are strongly interrelated. The irrigation canals, heavily infested by aquatic weeds, don't allow the passage of the right quantities of water to be delivered on time. Integrated aquatic weed control is needed to alleviate the problem of water shortages, and it is better to consider the following alternatives for operation and maintenance of minor canals:

* Operation and maintenance by MOI.
* Operation and maintenance by SGB.
* Operation by SGB, and maintenance by MOI.

A study is needed to identify advantages and disadvantages of each alternative.

e) On-farm Water Management

Delivery of water to the fields through the field outlet pipes (FOPs) is monitored by the SGB gaffirs and tenants. Equity of water distribution among the group tenants in one number depends on many factors; the location of the farm, land levelling, and attendance at watering influence the water distribution to the various tenants.

The current practice is to irrigate every 30 feddans simultaneously. The irrigation method needs to be studied in view of the existing water shortage to determine the optimum area for low-flow conditions.

III. PRODUCTION RELATIONS

Various production relations exist in different farming sub-systems. They have an impact on production depending on how they motivate farmers. The famous "joint-account" system of the Gezira Scheme was adopted from traditional irrigation systems, many of which are still following different types of crop-sharing arrangements. The "joint account" which was maintained for a long period in the Gezira Scheme led to dissatisfaction among the hard-working tenants, and consequently the government introduced the "individual account" in 1982/83. Its philosophy is based on giving complete responsibility of production costs of all crops to the tenant.

To cover the cost of managing the scheme and capital interest, cost recovery of irrigation work, and land rent the system of water and land charges was developed for each crop according to the recommended number of waterings.

However, seven years after it was adopted the "individual account" faced some problems. These can be listed as follows:

* Debt problems: the cost of production exceeded the gross revenue for a large number of the Gezira tenants.

* Water distribution: many disputes arose between neighboring tenants regarding water distribution along the minor canal Abu XX.

* Misbehavior of some tenants who sell their yields to other tenants resulting in recording of yields higher than the potential values.

* Social problems: the introduction of the "individual account" increased the land value and that led to court cases between members of the same family.

III.1 Water Charges in the Irrigated Subsector of the Sudan

In Sudan the capital and recurrent costs of providing irrigation services to public schemes are higher than any other input used in agriculture. Hence, the charges made for irrigation water can be considered as an important issue in the formulation and operation of irrigation schemes.

The system of water charges was introduced to the Northern Provinces Public Schemes as early as the 1918/1919 season. The Suki Scheme (1971) was the first scheme, in the recent past, to base its production on land and water charges. The Rahad project, since the inauguration of its first phase in 1976, represented a major attempt to introduce water charges.

Since the inception of the Gezira Scheme in 1925, until 1981, tenants were paying an indirect charge on land and water in the form of a crop-sharing arrangement based on the cotton crop. The system of implicit land and water charges was introduced by the British who established the scheme at the turn of the century. With the passage of time this system of crop-sharing taxes on cotton revealed its shortcomings and a number of calls have been made for altering this taxation system.

In June 1980, a presidential decree declared a new policy of accounting (individual account) including an explicit Land, Water and Administrative Charges (LWAC).

The LWAC calculations were based on the number of waterings of each crop and on the time span of each crop. This instrument of water charges became a controversial issue between the researchers, administrators, and the tenants. Some studies like Fakki, Bailey and Badwi (1984) revealed that there is inequality in water distribution between head and tail ends particularly along the minors and Abu XXs. Elobeid (1986) supported their findings and his results showed the disparities in water distribution among beneficiaries. If possible the socioeconomic differences which are created along the minors and Abu XXs should be eliminated.

Suggested areas for study are:

* Pros and cons of the joint account and individual account; their effect on productivity and improvement possibilities.
* Systems of water and land charges.
* Production relations in privately-owned subsystems and ways of improvement.
* Production relations in cooperatives.
* Efficient use of inputs.

III.2 Prevention of Hazards to Farmers

In many government parastatals, management problems which are outside of farmers' control result in untimely provision of inputs such as fertilizers and pesticide and in their mismanagement. Studies are needed to identify mechanisms by which the negative effects of management factors, not under farmers' control, can be avoided, and, if not, compensated for.

III.3 Training

The development of manpower has close links to increased productivity. The areas to be considered include:

* Areas of training in management aspects of government personnel of parastatal bodies.
* Training of extension staff.
* Farmers' training.
* Staff training in research institutions.
* Cross-training: agricultural scientists and engineers.
* Extension in water management institutions.

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