

Performance Measurement in Farmer-Managed Irrigation Systems: The Case of Kimani Irrigation Project in Tanzania

*Mwanitu Kagubila*³⁹

ABSTRACT

THIS PAPER EXAMINES the current structural and organizational performance indicators of the farmer-managed rice irrigation systems run by Traditional Canal Committees (TCCs) in the Kimani Basin of Tanzania. Possible future performance indicators of a rehabilitated system through the Kimani Irrigation project have been hinted at. It is suggested that these indicators be treated as measurement parameters in rice irrigation systems in the country in the future.

The role of the individual farmer as a specific structure in an irrigation system and as a key player in performance measurement techniques has been highlighted. Land tenure, water use, the place of women, family and hired labor constraints, and technological measurement in FMIS based on the experiences in the Kimani Basin during the last 50 years have been dealt with in this paper.

It is recommended that the performance and behavior of individual farmers in irrigation systems be re-examined in relation to landownership, land renting, residence and cultural forces. Also, there is a need to focus attention on the concept of ownership of FMIS and on women's participation in them, and on the specific roles of engineers, agronomists and community organizers in the process of transforming farmers into irrigation technicians.

INTRODUCTION

The concept of farmer-managed irrigation systems (FMIS) is perhaps synonymous with the concept of "autonomous civil organizations." The emergence of these concepts in development literature is a testimony to the crude experiences concerning the gap which exists between government departments, development agencies and the beneficiaries of development projects. The distance that exists between the process of decision preparation, decision implementation and the population which will be affected by those decisions is the main reason for today's discussions on the concept of community participation in development work, and in particular, discussions on peasant economics in Third World countries.

This paper discusses how traditional irrigation systems in the Kimani Basin have shaped people's struggles for their own development through rice production, and the role of the Canadian

³⁹ The author is a Community Development Consultant of the Canadian International Development Agency (CIDA) in the Kimani Irrigation Project, Mbeya Region, Tanzania.

International Development Agency (CIDA) as a donor agency in those struggles, through its financial, material and technical support in the rehabilitation of the Kimani Irrigation Project. Both the traditional and future performance measurement indicators in the FMIS are discussed from this perspective.

THE KIMANI CONTEXT OF EXISTING FMIS

The features of the traditional irrigation system in the Kimani Basin (Kagubila 1990, Manjalla 1991) briefly include:

1. Water control structures are temporary and seasonal.
2. The floodplain is composed of alluvial soils and it is within it that the intakes have been built. This causes the river and the intakes to relocate and the intakes and canals to silt over.
3. On-farm water control is a serious problem due, in part, to fields being unlevelled and highly fragmented.
4. The canals are of different shapes resulting in fields with irregular layouts.
5. Many of the field-level canals are both supply channels and drains, forcing farmers to rely on a field-to-field water distribution format and networks.
6. Many of the main and secondary canals are eroded and deep, resulting in weak water supply routes into the fields.
7. Canals are often overgrown with grass and weeds.

Traditional canal committees called *Kamati za mifereji za jadi* (traditional canal committees, or TCCs) govern the FMIS in the Kimani Basin. The functioning TCCs include: Mbuyuni—Mabadaga, Mapula, Kwa, Makonji, Zambia, Roscampuni, Mayota, Lyandegele, Senyela, Wachalipite and Mdabadaba.

Table 1 below shows the traditional canals and drains used for irrigation in the Kimani Basin with their location, total numbers of farmers, their lengths and sizes (Manjalla 1991).

PERFORMANCE INDICATORS OF THE TRADITIONAL SYSTEMS

The existing traditional irrigation structures in the Kimani Basin are the means for the structural and organizational performance measurement. This approach helps to locate the rice farmers and to understand the nature of their confrontation with nature in the process of rice production.

Structural Performance

The measurement of the structural performance of the FMIS in the basin refers to the location and allocation of the resources for irrigation, i.e., water and land; the farmers' conceptualization in using these resources; their technological level; the way land tenure has evolved in the area as a means of production and as a force for the operation and management of the system; and lastly, the structure of other users of the Basin and how that affects rice irrigation.

Table 1. Traditional canals and drains in the Kimani Basin.

No.	Name of Canal	Length (km)	Size (ha)	Village	Farmers
01	Mbuyuni	6.0	450.0	Mbuyuni	650
02	Kwa Makonji	1.05	26.60	Mbuyuni	94
03	Mgalo	1.30	46.10	Mbuyuni	67
04	Mapula	2.25	186.00	Mbuyuni	400
05	Mayota	2.20	50.30	Uturo	16
06	Zambia	2.48	67.10	Mbuyuni	118
07	Roscampuni	3.83	148.10	Mbuyuni	316
08	Mtamba A&B	1.5	12.5	Uturo	9
09	Lyangegele	6.9	203.40	Uturo	340
10	Shule	1.0	23.8	Uturo	13
11	Miembe	2.9	82.40	Uturo	17
12	Mlelwa	1.0	28.0	Mabadaga	15
13	Mabadaga	2.25	116.60	Mabadaga	20
14	Senyela A & B	3.6	143.60	Mabadaga	132
15	Mdabadaba	1.40	30.0	Mabadaga	20
16	Old Wachalipite	1.8	67.5	Mabadaga	17
17	Wachalipite	2.15	67.50	Mabadaga	89
18	Lyahamile	11.0	1650.0	Mbuyuni, Mabadaga	150
19	Lyampande	2.8	200.0	Mabadaga	100
20	Mawendo A, B & C	7.7	466.30	Uturo	260
21	Idilu A	0.60	60.50	Mbuyuni	17
22	Idilu B	0.50	5.50	Mbuyuni	8
23	Ukwavila A & B	5.80	52.0	Ukwavila	104
24	Lifutufutu	1.6	50.0	Ukwavila	50
25	Ulongwa	2.50	13.60	Ukwavila	24

Farmers' concepts of land and water. Until the 1970s the Usangu Plains were considered an empty space free to be taken over by anybody from anywhere. Pastoralism as the main economic activity of the people depended on water and land. Ownership of land is still through the customary land tenure system while water rights are based on proximity to water sources. Water is understood to be a free commodity while land is now perceived as a village property to be shared equally by all members of a village. This differentiation is important: while village governments are supposed to own and benefit from the natural resources found within their boundaries, people do not consider water to be the property of a village, rather it is seen as a free resource to be exploited according to demand.

Land tenure and land fragmentation for rice production. Thirty to fifty years ago, before canalization, farmers cultivated rice using the broadcasting method and depended on rainfall and on flooding. The rice plots in the area range from 0.1 ha to about 3.2 ha. Farmers own rice plots in several farming zones thus complicating the agricultural system in use. Land for rice is scarce because of poor technological inputs which do not allow expansion into new irrigable areas. Farmers struggle for the same irrigated land throughout the year.

Access to and between fields is poor as there are no roads but only small footpaths between the fields. The most difficult problem involves crossing the Kimani River. There are only three main footbridges across the river. The problem of field accessibility has been compounded by the distance between homes and fields. Distances increased as a result of the villagization program of 1974/75, which moved people from the Kimani Basin localities into the upper areas five to eight kilometers from the farm fields. This has undoubtedly affected the performance of farmers and their irrigation systems. This is one of the major problems about which farmers have frequently complained to the project staff since 1989. This problem has been raised earlier in connection with agricultural performance following the villagization program (Dumont and Mottin 1980). People walk many kilometers to reach their fields, arriving tired and so work for only a few hours before they start their homeward trek.

Organizational Performance

Irrigated agriculture, unlike rain-fed agriculture, demands cooperation, discipline, organization and commitment to the interests of the whole community (Pradhan 1989). It is this type of formalized social structure of production that becomes the catalyst for all types of performance measurements since one may recognize some of the farmers' struggles for their survival in the process from production to consumption,

The TCCs versus village governments. The Villages and Ujamaa Villages Act (1975) created villages as both administrative and economic institutions in rural Tanzania. In 1982, the Local Government Act was enacted as a revision of the 1975 Act giving greater powers to village governments. Under this act, village governments have become the single, most powerful organs of state. Nothing may be done within the villages without the prior approval of the village governments. The traditional canal committees (TCCs) are tied to the village government structures.

Relations between resident and nonresident farmers. There are immigrant and indigenous resident farmers, nonresident farmers from within the Usangu Plains but from outside the Mapogoro Ward, and nonresident farmers from the neighboring districts.

It is the presence of nonresident farmers which raises some questions about performance measurement, since their participation in maintenance of the irrigation structures and access routes is minimal. Conflicts develop between resident and nonresident farmers over water distribution because nonresident farmers do not participate in water management.

Absence of women in traditional canal committees. The absence of women in TCCs is apparent in all canal committees. Women have been excluded from leadership positions in these committees even where they are as important as men rice farmers. Direct objection to the inclusion of women in TCCs has not been stated by male farmers.

Input support and land productivity. Land and water are the two main natural resources in the project area. Ownership, use, protection and future development of these key resources will depend on the development of the social and physical environment (Yaxley 1991). It was reported in the Kwa Makonjii Case Study that production per acre has fallen from 20 bags in the period 1970–79 to between 9 and 15 bags in the decade 1980–90. In general, many fields are still productive but require fertilizer application for increased productivity.

Input support is not a formalized and organized operation in the area. Farmers obtain farm inputs on their own. The village cooperative societies which are supposed to supply inputs are not economically viable and so cannot guarantee the provision of fertilizers, gunny bags, hand hoes, plows and other needs.

Rice marketing and the behavior of farmers. Until 1961, the marketing of crops in the Usangu Plains was controlled by the Baluchis, originally from Baluchistan in Iran, who settled in the area in the early 1920s, and by the Indo-Pakistani traders based in Mbeya town about 100 km away. In 1961, a cooperative system was established in the area through the creation of the Usangu Farmers' Cooperative Society. However, most trade in rice is carried out through the informal market. Farmers usually sell during the months between November and April when the price is high. Storage of rice is a common practice here although some farmers sell immediately after harvest.

POSSIBLE FUTURE PERFORMANCE INDICATORS

Possible new performance indicators emerge from the interventions of the Kimani Irrigation Project through CIDA as the donor agency. CIDA is involved in the agricultural development of the area and is committed to the modifications defined in the Project Objectives and to a philosophy of community participation. The new performance indicators have to be noted here. Our forecasts assume and believe that during the process of change, new types of rice farmers will emerge in the Kimani Basin. This calls for new thinking about possible new performance indicators. The following would appear to be key performance indicators.

Use of sustainable technology. One of the main objectives of the Kimani Irrigation Project is "to enhance sustainable irrigation-based agriculture" (KIP 1989). This objective considers sustainable technological intervention as the major factor in selecting rice irrigation tools which correspond to the level of the beneficiaries.

The performance of the Kimani Basin FMIS in the training of its farmers and how they respond to that process, merit measurement. Their current technology has a low rate of productivity. The aim is to introduce an appropriate and sustainable technology which is more productive and less dependent on human energy. Questions that come to mind are: Is technological and crop

variety sustainability achievable under the climatic conditions of Usangu or must the farmers continue depending on natural forces for their agriculture? Can human manipulation of nature assist the FMIS performance? How long will it take for a sustainable technology to develop in the area?

Farmer participation in environmental issues. Farmer management and protection of the watershed and floodplain of the Kimani Basin have been stressed in the project objectives. It has been noted that skills in watershed and floodplain management have to be made available to the farmers in order to ensure long-term benefits of rice irrigation-based agriculture in the basin (KIP 1991).

Studies carried out in the area have shown that environmental destruction in both the watershed and the floodplain has increased since 1948. Vegetation cover changes have been alarming in some parts of the watershed (Malende 1991).

Farmer participation in the protection and management of the basin is crucial. It would be desirable to monitor the future performance of the FMIS in preventing further environmental damage to the basin and its vicinity. Sustainable irrigation-based agriculture can only be of long-term benefits if water and land are well-protected and judiciously used within a culture that seriously thinks about its posterity in its development planning.

Basin-level farmer organization. The current recommendation of the Kimani Irrigation Project is for a single basin-level organization. This recommendation is based on the experience with the Kimani River Canals Committee (KRCC), the interim basin-level farmer organization.

This recommendation will test the performance measurement indicator of farmer cohesiveness and unity of purpose. Will the future basin-level farmer organization be different from the current canal-based organizations?

New farm management techniques. In the future, it will be interesting to learn how the on-farm performance of the farmers improves with the improved water management system and extension services offered by irrigation technicians.

Table 2. Farm operations and hired labor by residence and sex.

Operation	Resident Laborers	Non-resident laborers	Sex	Rates per 0.4 ha
Land cleaning	Few	Many	Male	N/A
Cultivation	Few	Many	Male	4,000/= (\$20)
Seedbed preparation	Few	None	Male	N/A
Puddling	Many	Few	Male	5,000/= (\$25)
Transplanting	Many	Many	Male/Female	6,000/= (\$30)
Weeding	Few	Few	Male/Female	4,000/= (\$20)
Bird scaring	Few	Few	Male/Female	3,000/= (\$15)
Harvesting	Few	Many	Male/Female	3,000/= (\$15)
Threshing	Many	Few	Male/Female	N/A
Winnowing	None	None	N/A	N/A
Transporting	Few	Many	Male/Female	N/A
	—	—	Bicycles	
			Trucks/Tractors	50/= (\$0.4) per bag

Note: N/A = (Data) not available

Table 2 above illustrates the type of farm operations by sex, and rates paid for hired labor. Rates in Tanzania Shillings have been equated to US dollars. Data source is Kwa Makonji Canal Case Study in the Kimani Basin and shows the practice during each season.⁴⁰

With the development of a common farming calendar, it is hoped that the current irrigation problems will disappear. The risk factor, however, remains as a persistent theme of peasant agriculture. Will the new farm management techniques improve the performance of the FMIS in the basin? It is the role of each individual farmer which is the determinant in measuring FMIS performance for any given indicator.

It is to be expected that the introduction of new rice varieties will require new farm management techniques. This implies that farmers will now become producers of high-yielding varieties using chemicals, different types of fertilizers, pesticides, etc. The disappearance of the traditional rice varieties will affect production, consumption and marketing patterns in the area.

New land use systems. With the development of a new irrigation system, new land use patterns will inevitably emerge. The negative impacts on the FMIS will likely be enormous because it will not be possible to accommodate all the demands for land and water within the same irrigation system, if we recognize the problems associated with such innovations in the developing countries, where designers often tend to ignore the needs of the new consumers.

RECOMMENDATIONS

The individual farmer as a key player. The immediate key player in the performance of the FMIS in Tanzania appears to be the individual farmer. This may be true for all FMIS in all parts of the world. The individual farmers are the key players because they participate in both worlds: in their own fields they are the leaders and managers of themselves and of their families and in the collective leadership and management of canal committees. In our attempt to measure the performance of FMIS, we necessarily measure the performance of individual farmers as they are now and the behavior of states in the geopolitical games in international relations. What is the behavior of farmers during certain times of the year or in certain types of organizations?

Ownership of FMIS in the future. One of the intriguing assumptions emanating from the reality presented here about TCCs and village governments, is that the village governments, and Ward Development Committees might control and therefore "own" the FMIS in the future. If this develops into the future relationship between the basin FMIS, the villages and the Ward, it is clear that the farmers will have lost their autonomy. This process of space and autonomy within the community, must be monitored as a performance indicator in the Tanzanian type of FMIS. Can the FMIS remain independent of the state at village and ward levels? That is where the rub is in our country.

The experiences from other irrigation projects in Tanzania (Kagubila et al. 1990) show that donor agencies and banks have insisted on the formation of farmer organizations such as cooperative societies or water users' associations prior to funding of projects.

⁴⁰ The Kwa Makonji Canal Case Study was carried out by David Rain and Mwanitu Kagubila during the 1990/91 farming season.

Women's participation in the future FMIS. Participation of women in different leadership positions at village, ward, district, regional and national-levels is low. The Traditional Canal Committees have had no women members as leaders. The interim Kimani Irrigation Canal Committee (KRCC) has six women and six male farmers and two male agricultural extension officers. It began with three women and six men in December 1989.

The monitoring of FMIS performance will require adequate evaluation of the participation of women throughout the years and of how they influence the direction of the FMIS.

Transformation of farmers into irrigation technicians. While we may be proud of the inherited knowledge of farmers in irrigation engineering and farm management techniques, we think that there is a mission link between old and new knowledge in irrigation demands. It is possible to claim that most farmers have not changed much even if new irrigation structures have been built and new organizational systems have been introduced. Why has the training of farmers in developing countries proved difficult? The goal should be to transform our peasants into qualified irrigation technicians and engineers. Unless land tenure systems change, our farmers shall remain poor and unproductive. The training of farmers should be one of the performance criteria of FMIS and should be measured.

CONCLUSION

It is obvious that the structure of production of the farmers within an FMIS is a crucial indicator of performance. The struggle for land in the area, for example, might characterize the agricultural scene in the foreseeable future. This indicates that the structure of production is bound to change drastically.

As the population increases, institutional structures and organizational forms must also change. Rapid change in Usangu Plains is to be expected due to high immigration into the area. The future Kimani Basin FMIS must also change in order to adjust itself to the new knowledge emerging from development research.

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