Crop Post Harvest Programme (CPHP)

Rural Transport Services Project for Kenya

Rice and horticulture case study based on Mwea irrigation scheme

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For

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RICE TRANSPORT CASESTUDY BASED ON MWEA IRRIGATION SCHEME

Introduction

Transport or the ability to move from one place to another in search of comfort and consolation plays a vital role in our lives. However, this fact is often taken for granted because we have always had some means of transport around us at any one time. Yet, lack of transport constitutes one of the worst forms of poverty because it means one cannot get quick access to basic needs such as food, water, or medical treatment among other essentials. Availability of efficient transport and communication system determines the position of a community in the development scale. In fact, the main difference between developed and developing countries is that the former has good infrastructure for transport and communications compared with the latter.

In the rural agricultural areas, transport has been described as the yarn that threads through and binds together various agricultural activities from production, harvesting, processing and marketing. The higher the efficiency of transport and communication, the better the livelihoods of the farmers.

Mwea Irrigation Scheme was probably the natural choice for this Rural Transport Study (RTS). This is because:

- It is a hub of agricultural activity where rice and horticultural crops are grown at an enhanced scale. This turns in billions of shillings every year and has attracted many types of businesses transport being one of the major ones.
- It has many and diverse range of transport means ranging from bodabodas, oxen/donkey carts, picks ups, minibuses, and trucks. The numbers are astronomical and are estimated as follows: 20,000 bicycles, 5000 donkey/oxen carts, 1000 wheel barrows and over 500 pick ups and minibuses

The numbers and modal composition has changed a lot over the last 5 years owing to demand created by expansion of the rice scheme under Jua kali and due to fundamental change in scheme management from the control of National Irrigation Board (NIB) to control by end-users (farmers).

Mwea has therefore a lot of information and experience that may contribute positively to the goal of RTS which is stated here below:.

"To Systematically assemble data, information and experience that can provide key policy options for improved delivery of Rural Transport Services which improve livelihood systems of poor people at local and national levels.

RTS is a project implemented by the Kenya Network for Draft Animal Technology [KENDAT] and is sponsored by various funding agencies namely: DFID/IUUD, SIDA and Natural Resource International Limited (NRLI)

I used the following techniques in obtaining data and information for the Mwea Rice Case Study: -

- Studied available N.I.B. documents
- Studied available Mwea Rice Growers Multipurpose (MRGM) Cooperative Society documents
- Held discussions with MRGM staff
- Met and conducted interviews with Jua Kali and MIS farmers
- Met and conducted interviews with mill operators, transport operators and individuals doing rice business

This report is structured as follows: Chapters 2 and 3 give an insight into rice farming operations, rice processing and marketing first under N.I.B. and then after farmers take over in 1998. Chapter 4 is concerned with the impacts of change and the possible ways forward. The final Chapter contains summary, conclusions, and recommendations as per the terms of reference, which are themselves given in Annex 2. Annex 1 contains the programme of study and the list of persons met while annex 3 presents a table giving cost benefit figures of producing rice based on a JICA study in 1994

I would like to express my thanks to the staff of KENDAT who have been most open, friendly, and helpful in providing information as well as logistical support.

2.0 RICE FARMING, PROCESSING AND MARKETING UNDER NATIONAL IRRIGATION BOARD

Up to November 1998, Mwea Irrigation Scheme was managed by National Irrigation Board (NIB), a parastatal organization formed by an act of Parliament in 1966 to oversee the development and management of public irrigation schemes in Kenya. Besides MIS, NIB has been managing five other schemes namely Perkerra, Tana, Ahero, Bunyala and West Kano.

The official rice acreage under MIS in 1998 was 15,000 acres home to 3,250 farmers cultivating a minimum of 4 acres each with paddy rice annually. The arrangements for rice farming under N.I.B. were that N.I.B. would provide all inputs on credit to farmers at a cost determined by N.I.B. The farmers would then deliver produce to N.I.B. for processing, packaging, and marketing. After marketing, N.I.B. would pay final pay out to the farmers after deducting input costs and other statutory deductions. The producer price was also determined by N.I.B. Under NIB, the Mwea farmer remained a tenant with no title deed for his land.

Farm Practices for paddy cultivation (NIB)

Farming Practice		Mechanized situation
1.	Transport farm inputs to the field	Tractor + trailer or truck
2.	Nursery preparation	Mannual/Oxen
3.	Land preparation	Tractor +rotavator
4.	Transplanting	Mannual
5.	Application of fertilizers TSP and Sulphate of Ammonia	Mannual
6.	Application of Agro-chemicals Fentrothion or furadan	Sprayer/man power
7.	Weeding	Mannual
8.	Water management	
9.	Harvest/post harvesting	
	-Cutting	Mannual
	-Threshing (1-2 days after cutting)	"
	-Winnowing "	"
	-Bagging "	"

-Transport paddy to Reception Centre Hired transport

Upon harvesting, paddy was transported with hired trucks to the reception center, which had paddy drying and storage facilities. As transportation was not efficient, farmers had to brave mosquitoes many a night guarding their rice and as a result many fell sick from malaria. At the reception center, the farmer would receive 12 bags out of the 100 bags harvested from his 4 acres for his home consumption. The rest of the paddy would be sun dried and later shipped to Mwea Rice Mill (MRM) for processing, packaging and marketing. MRM, which has a milling capacity of 20tons/hr, would process 300,000 bags of paddy per year.

Paddy deliveries during N.I.B. were steady at 300,000 bags annually. However, this reduced to around 200,000 bags from 1992 following the introduction of multiparty politics and economic liberalization policy when farmers started smuggling rice despite high security by N.I.B.

The main buyers of Mwea Rice were the Kenya Armed Forces, supermarket chains in Kenya Schools and Colleges. Mwea farmers would be paid their final payout 6-12 months after delivery of their paddy. Sometimes it would take longer.

During the era of N.I.B., donkey carts were the main mode of transport because vehicles required special permits to ply on scheme roads, which were guarded by security personnel. Donkey and oxen were used as follows: to transport fertilizers and manure from their homes in the villages to farm; to transport paddy for home consumption (12 bags) from reception centers to their homes; to transport women to and from market places; to fetch water and firewood; to transport building materials (sand, ballast, cement, building blocks, iron sheets) : to transport other harvested crops e.g. maize, beans e.t.c. Donkeys and oxen were also used for ploughing in light soils. Donkeys were used extensively in transporting soil for field leveling.

N.I.B management

N.I.B. management style was characterized by strict discipline and strictness to deadlines, which is necessary for a successful public institution like MIS. However, the farmers took this strictness negatively mainly because they were not involved in key decision-making as

in fixing producer and input prices and they were convinced that N.I.B. treated them more like slaves. This did not go well with the farmers and as if the devil in farmers had been aroused, no amount of re-assurance would change their defiant attitude. At some stage, it appeared that the more N.I.B. gave in to farmer's demands, the more the farmers got wild and intransigent.

These developments also coincided with the era of multiparty politics, which permitted farmers desire for improved paddy prices to be transformed into a broader political agenda. More specifically, politicians encouraged the tenant farmers to agitate for major changes in the existing relationship between the farmers and the N.I.B. This agitation culminated in the tenant farmers forcefully taking over the running of MIS in 1998 and proclaiming themselves the owners and operators of the irrigation system. The farmers paid a heavy price for this victory: five farmers died and score others were maimed for life during a crash with security agents.

There was remarkable effort from farmer's side to prevent this from happening. Before take-over, the farmers had sent 29 delegations to the Chief Executive Officer (CEO) of N.I.B. to plead with him to increase producer price from Kshs. 17/Kg to Kshs. 20/Kg. Despite this, the C.E.O. declined categorically to which the farmers swore never to deliver paddy to N.I.B.

Giving credit where it is due, N.I.B.'s mode of operation was technically sound and professional. Land preparation was done properly and in good time except in the last 5 years leading to 1998. Quality inputs were supplied and applied at the right time. This led to high and sustainable rice yields over many years. N.I.B. also had a most efficient state of the art rice mill which produces high quality rice. N.I.B. had also established an efficient network of rice distribution and marketing.

The only mistake N.I.B. made was to ignore the role of the farmer in the whole equation of rice production yet farmers were at the heart of the production process. N.I.B. operated Mwea on "estate mode" rather than on "farmer friendly mode". They thus treated the farmer like a unit of production such as a tractor, which has no sense or feelings. If only N.I.B. had been farmer friendly, the fiasco that is N.I.B. would have been avoided all together.

Harvesting and post-harvest losses under N.I.B.

Losses in paddy were generally low during N.I.B.'s era. This was because best practices were followed during harvesting, drying, storage and processing of rice to ensure high standards.

Paddy rice was harvested at recommended moisture content of 18-22%. To reduce harvesting losses threshing of rice was done a day or two after cutting. There was adequate equipment and personnel to ensure compliance to required standards. Very occasionally, there would be losses due to wet harvesting in wet season when paddy would sprout in the field from rain soaking.

Paddy was sun dried to 14% moisture content before Storage. Losses in the storage were minimal because the go downs used were well designed and proofed against rodents. Any losses in the go downs through spillage would be recovered by sweeping. Milling losses were also low because paddy was well dried and handling systems were efficient. Any spillages could be recovered by sweeping and then recycling.

3.0 POST-TAKE OVER SITUATION IN MWEA

Introduction

When Mwea farmers took over MIS in December 1998, they entrusted their co-operative society, the Mwea Rice Growers Multipurpose Co-operative Society (MRGM) to undertake entire rice business from rice growing, processing, and marketing. At the time of take-over, membership to MRGM was over 90% to all the farmers. This was a tall order for it meant fitting into N.I.B. shoes which was not easy considering that MRGM had nothing: no tractors for land preparation; no qualified personnel to run the system; no reception centers, go downs or rice mill and no capital to procure in puts.

MRGM management, comprising of 9 elected farmers and a few hired staff had to make quick plans and decisions in order to push the scheme forward. It hired skeleton staff and acquired some 20 tractors on credit from CMC. With these, MRGM was able to start land preparation for 1999 season. Land preparation was boosted further when over 20 privately

owned tractors joined the MRGM fleet. Land preparation for entire scheme was completed in record time of 5 months. During N.I.B.'s time, land preparation would take up to 10 months.

Farmers delivered 140,000 bags of paddy to MRGM in 1998/99 season, which had been financed by N.I.B. Having no go downs then, farmers put their paddy in make shift shelters at Mwariko grounds near Ngurubani Town. The produce was exposed to vagaries of weather, as the shelters were temporary in nature. Consequently, there were huge storage losses.

To overcome the problem of processing, MRGM hired over 50 single-pass mills. Though capacity of the mills was limited (0.5t/hr) and the quality of milled rice low, MRGM was able to process all the paddy, pack and market it mainly to local, Nairobi and Mombassa markets. The cash generated through sale of rice was used to procure other inputs such as fertilizers, pesticides and harvesting inputs.

Despite the many initial teething problems, MRGM performed well with yields of rice in 1999 comparable or even exceeding the pre-take over years of N.I.B. Farmers who were in a vibrant mood following successful take-over of the scheme delivered rice to MRGM willingly – total deliveries in 1999 stood at over 270,000 bags. Cash generated from sale of this rice enabled MRGM to increase staffing levels, to acquire a 3 tons/hr rice mill and to put up 4 go downs for paddy storage.

Jua Kali Development

One of the most significant developments following take over was the development of Jua Kali rice farming either within or around the scheme. Jua Kali farming was not allowed under NIB because NIB wanted to maintain firm grip on production in order to control marketing.

By February 2003, the area under Jua Kali was estimated at 15,000 acres and was still expanding. This has had major impacts on Mwea. On the positive side, it has created employment for thousands of people (around 5000), has helped relieve pressure on land for scheme farmers, and has increased food production. However, owing to its exclusive reliance on MIS water supply, jua kali has posed considerable competition (and hence conflict) for water with MIS farmers with both parties suffering crop yield loss.

Paddy delivery trend to MRGM

Although the first year (1999) was highly successful as outlined above, the subsequent years (2000, 2001 and 2002) were less successful as farmers came to grips with the reality of managing a complex agri-business of the scale of Mwea. Paddy deliveries are a good barometer for measuring success of management in Mwea and the following table shows the trend of paddy deliveries to MRGM for the past 5 years since take over in 1998 as compared to total expected production in both Jua Kali and MIS.

Trends of paddy deliveries to MRGM versus expected paddy production in MIS and Jua Kali

Season	Varieties and % area planted in MIS	Actual Paddy Deliveries (bags) to MRGM	Expected /estimated paddy production (bags) MIS	JUAKALI
1998/99	SIND (25%) BAS (75%)	*140,000	350,000	100,000
1999/2000	SIND (25%) BAS (75%)	270,000	350,000	100,000
2000/2001	SIND (10%) BAS (90%)	110,000	300,000	200,000
2001/2002	SIND (5%) BAS (95%)	70,000	300,000	200,000
2002/2003	SIND (5%) BAS (95%)	**50,000	300,000	200,000

* **CROP FINANCED BY N.I.B.** ** **DELIVERIES BY 20TH FEBRUARY 2003**

VARIETIES: SIND - SINDANO

BAS - BASMATI

The table shows that there has been drastic reduction in paddy deliveries to MRGM from 270,000 bags in 1999/2000 to 50,000 bags in 2002/2003 season. This is a strong indicator of poor performance by MRGM.

There is general reduction in paddy production in MIS from 350,000 bags in 1998/99 season to 300,000 bags in 2002/2003 season. There are two reasons for this:

- The area under sindano which is high yielding (6.5t/ha) has decreased from 25% in 1998/99 season to 5% in 2002/2003 its place being taken by Basmati which is low yielding (5.0t/ha)

- There has been general decline in yield owing to poor availability of major inputs such as water (due to competition with jua kali) and fertilizers.

The estimated production from jua kali has increased over the years to 200,000 bags in 2002/2003 in proportion to increase in area. The rice yields from Jua kali is generally lower than from MIS because in the latter there is better supply of inputs (water, fertilizer) through the cooperative arrangement than in the jua kali where there are no cooperative arrangements. There is also better land and higher expertise in rice growing in MIS from the long experience than in Jua kali.

The amount of paddy going to private mills can be estimated as the difference between estimated paddy production (in both MIS and the Jua Kali) and the actual deliveries to MRGM. This has increased from 180,000 bags in 1999/2000 to 450,000 bags in 2002/2003 and explains the emergence of both small and large mills in Mwea, Thika and Nairobi. It can therefore be seen that MRGM controls a very small share of the rice market the main players being privateers.

Constraints

MRGM has the following major constraints:

- Poor delivery of rice by farmers to MRGM with farmers preferring to sell cash to the open market, which is readily available. This is a clear sign of lack of trust in MRGM.
- Lack of structured marketing arrangements for milled rice resulting in farmers competing with MRGM in rice marketing. Dumping of cheap imported rice has only added salt to the injury.
- Lack of adequate irrigation water and poor distribution of the available flow.
- Lack of maintenance of irrigation and drainage facilities including roads. This was due to lack of machinery
- Diversion of water from the main canal by non-scheme farmers for both horticultural and rice farming (Jua-Kali)
- Poor maintenance of MRGM tractors leading to long delays in land preparation.
- Land sub-division – Land has been subdivided into uneconomic units. This has left farmers with no paddy to spare for MRGM. This problem was reduced to some extent by development of Jua Kali farming.

The fact that the government of the day was against success of MRGM made things worse for it. Sometimes officials of MRGM would be arrested and harassed for no apparent reason.

The above constraints have put so much pressure on MRGM that it is gasping for air and space and it appears only the new government can bail it out.

Transport use following take over

The take over of MIS by farmers led to expansion of Jua Kali rice and horticultural farming. This increased disposable income which in turn created high demand for transport leading to the emergence of many transport modes ranging from bodabodas, hand/oxen/donkey carts, wheel barrows, pick- ups and minibuses.

Precise information on actual numbers of various transport means is difficult to come by as there are changes on a daily basis.

The estimated numbers and model composition are as follows:-

Means	**Estimated Number**	**% Contribution to transport within MIS**
Bodabodas	20,000	40
Donkey/oxen cart	5,000	40
Wheel barrows	1,000	Negligible
Pick - ups minibuses, trucks	500	20

The donkey/oxen carts and bodabodas are the major modes of transport in Mwea handling combined 80% of transport in Mwea. The deterioration of scheme roads have undoubtedly contributed to the increase in animal-based transport because most roads are impassable by vehicles.

Transport share of pick/ups minibuses and tracks stand at 20% and is increasing especially due to parallel development of horticultural crops (tomatoes, French beans and water melons) whose main market out let is Nairobi. Donkey and oxen continue to be used for various transport or land preparation purpose as at the time of N.I.B. However, the intensity and efficiency of use increased following take-over. Due to this it is no longer necessary for farmers to guard their rice at night as they did during NIB`s era and though not documented malaria cases could have declined. The following problems have been observed concerning use of donkeys and oxen: -

- Due to overloading of donkey carts their health deteriorated sometimes leading to premature death. It is typical in Mwea for a cart pulled by two donkeys to carry 18 bags of paddy of 100Kgs each. The get-rich-quick mentality has done a lot of disservice to donkeys in Mwea.

- Poor maintenance of carts coupled with poor harnessing has only compromised the already poor health of the animals.

- The development of Juakali has taken land, which was formerly used for grazing of cows, and this has led to their emaciation and decimation. This has pushed up the cost of land leveling from Kshs. 200/acre in 1997 to over 800/acre in the year 2002.

Paddy losses

Paddy losses during harvesting, storage and milling were higher after take over compared with NIB`s time. This is because best practices to minimize losses were not always followed due to various constraints: lack of personnel and equipment to monitor and control process, lack of proper paddy drying, storage and milling facilities. The various paddy losses incurred are discussed below: -

Harvesting losses

These are high due to following reasons:-

- Improper harvesting methods - rice should be threshed a day or two after cutting to improve on thrashing efficiency. This rarely happens and as result harvesting losses are high because a lot of grains remain in the rice straw especially if crop was harvested prematurely. Premature harvesting is common in Mwea to prevent theft in the field especially when prices are high. This also occurs where there are land ownership disputes and these are many in Mwea due to land pressure.

- Scavenging losses – Casuals involved in harvesting have formed habit of scavenging for paddy after the day of threshing. They have been found to intentionally lower the threshing efficiency so that they can have more scavenge. Some have been found to scavenge up to 4 bags/acre.

From interviews with farmers, harvesting loss ranges between 2-7 bags/acre depending on how well best practices are followed.

b) Transport Losses

These are generally low unless the bags in which paddy is packed during transportation are worn out.

c) **Drying Losses**

During N.I.B. times, paddy was sun dried in a reception center, which incorporated a concreted drying floor. Loss of paddy during drying was minimal. Spreading and heaping was mechanized. After take-over, MRGM did not have a drying floor and paddy was dried on either polythene sheets or on canvas materials, which are easily damaged especially during spreading. Paddy losses were relatively higher and in the range of up to 5%. These losses have however reduced after MRGM put up a drying floor in 2002 and mechanization may now be possible. A large proportion of paddy is dried in farmers' homes or in open spaces near milling points using these rather weak drying materials. The losses are in the same range of magnitude (5%).

d) **Storage losses**

Following take over, farmers delivered their rice and stored it in an open space at Mwariko grounds near Ngurubani Town. This was because MRGM did not have any go downs then. Storage losses during the first 2 years (1998 and 1999) were extremely high in the range of 20% in 1998 and 10% in 1999. The losses were mainly through rat and bird damage and spillages from bags.

Spillages were not recoverable because of absence of a floor. Spillage losses were further increased by fact that nylon bags used for packing paddy would burst a week after direct exposure to sunlight.

Paddy not delivered to MRGM is stored in farmers house or in the stores of business people. According to farmers and business people interviewed storage losses are in the range of 2 – 3 % and is caused mainly by rodents.

e) **Milling quality and Losses**

Milling losses for the single pass mills used by MRGM and the business community around Mwea has been high especially when compared to the MRM. This is because the single pass mills have have an inherent weakness of poor efficiency due to their simplicity. They for example mix bran, husk and broken rice. They produce a lot of broken rice, which is lost to the bran. It is due to these losses that the rice milling recovery is merely 55% compared with MRM`s 70% for Basmati paddy.

4.0 IMPACTS OF CHANGE AND POSSIBLE WAYS FORWARD

There have been major changes in MIS in the last 5 years, which continue to have far reaching impacts on the Mwea community. The main change that triggered other changes has been the change in MIS management from that of NIB to that of farmers through their cooperative the MRGM. This led to the expansion of Jua Kali rice farming by 15,000 acres and horticultural crops farming by similar or larger acreage.

The impacts from these changes/development are as expected both positive and negative.These impacts are discussed below.

Positive impacts of change

Creation of employment

It is estimated that over 20,000 Jua Kali farmers have benefited through gainful employment in production of rice and horticultural crops. This has increased food production, food security in Mwea and also the farmer's income. Cost benefit analysis for rice has revealed that a rice farmer obtains on average a net income of Kshs 57,500 per ha per season lasting 5 months or kshs120,000/year as shown in the table below. This constitutes an increase in earnings of over 100% compared with the earnings of kshs 22,000 in 1994 as seen in a JICA study (see annexe 3). This has in turn brought peace, progress and stability and general well being in Mwea. Many farmers in Mwea are proud owners of TVs, radios, bicycles, and donkey carts, semi-permanent houses and are able to take their children to school.

Cost/benefit analysis for 1 acre of rice as of February 2003

a) *Costs*

▪ Land Preparation	2,500
▪ Seed (25Kg)	1,000
▪ Nursery preparation	1,500
▪ Leveling by oxen 3 times @ 800/=	2,400
▪ Transplanting	1,000
▪ Weeding 3 times @ 1,000/=	3,000
▪ Fertilizers DAP 1 bag @ 1,300/=	1,300
Sulphate of Ammonia 2 bags @ 800/=	1,600
▪ Fentrothion 1litre	800
▪ Bird scaring	3,000
▪ Harvesting	3,000

- Gunny bags 20 bags @ 40/= 800
- Transport 20 bags @ 50 1,000
- Irrigation 5,500
- ***Total*** **27,000**

b) *Benefits*

- Assume rice yield 20 bags/acre
- Total yield: 20 x 100Kg = 2,000 Kgs
- Producer price: Kshs. 25/=/Kg
- ***Gross income*** **50,000**
- ***Income/acre/season*** **23,000**

***Income/ha/season in 1994 22,000 (JICA study)**

Increase in convenient means of transport

The availability of quick means of transport has improved the quality and standard of life in Mwea since it is easy and cheap to move about especially with bodabodas. The number of transport means ranging from oxen/donkey/hand carts, bodabodas, picks/ups, minibuses and trucks have increased tremendously thereby creating employment and income. Cases of malaria could have declined as farmers do not need to sleep in the fields guarding rice as in NIB`s time.

Increase in support service providers

Support services have increased such as, bicycle and vehicle spare parts shops, repair garages, cart fabrication and repair centers. This has increased employment and hence income.

Increase in number if rice mills

The number of small mills has increased tremendously to cater for rice increasingly diverted from MRGM. This has created employment and income for mill owners, operators, stockists for mill spare parts and mill mechanics. The number of mills in Mwea is around 500 with Ngurubani town having 42 mills alone.

Negative Impacts

Irrigation water conflict

There has been increased competition for irrigation water between MIS and jua kali farmers leading to serious conflict between the two groups. This has led to limited reduction of yield in MIS. Lack of or poor O&M of the irrigation and drainage system has only added salt to the injury.

In the short term limiting the expansion of the jua kali while improving water management can solve this problem. The long-term solution is to construct a water storage/regulation reservoir on river Thiba that provides irrigation water. Feasibility studies for this were concluded by JICA in 1994.

Increased road accidents

Road accidents have increased in the last 5 years along Nairobi-Embu highway as bicycles and donkey carts have increased in number leading to loss of life and property. Mounting traffic safety campaigns in the short term and providing separate lanes in the long run can solve this problem.

Increased Pollution

With small mills littered everywhere, pollution from noise, smoke, dust and husk has increased in Mwea. This is unlike NIB time when noise, dust, and husk were confined in MRM while drying was confined in reception centers. Businesswomen trading in rice use every square inch of space available in Ngurubani town for drying paddy. This has caused congestion and traffic jam in Mwea similar to that of Nairobi city.

Increased mistreatment of donkeys

With increased demand for transport, donkey cart operators have been found to overload and abuse the animals. This has led to premature death of some of the animals. The solution is counseling for operators and prosecution for those who do not reform.

Increased cases of water borne diseases

Cases of malaria, bilhazia and typhoid have increased n the last five years as result of collapse of control measures formerly carried out by NIB. The control measures included spraying water bodies with contril vectors for these diseases. Physical measures included desilting of canals and drains to prevent stagnant water. Aids pandemic has also not spared Mwea with the infection rates estimated at 30% of the population.

Idle machine capacity

Following the collapse of NIB there has been a lot of idle machine capacity. The major machines affected are MRM with its 20tons/hour milling capacity, 30 tractors, various plants, and equipments. Resumption of their use is only possible if a working formula is struck between Mwea farmers and NIB. The government should facilitate faster working out of this formula. The best chance for this to happen is now with the new government.

Way forward

The N.I.B. model of management of MIS failed because NIB monopoly on rice marketing could no longer be guaranteed after liberalization and because NIB was not farmer friendly hence its ouster by farmers in 1998. Five years down the line, the management of MIS by MRGM cannot be said to successful either judging from the declining paddy deliveries to MRGM. Mwea is at a cross road of identifying the best management model for its future. The challenge now is how to maintain the gains made so far to minimize the negative impacts of change. The government will have to lead the effort of identifying a lasting and sustainable approach to the management of the Mwea complex. To do this, the government may have to send a fact-finding mission to countries such as Mexico, Sri Lanka, Pakistan and Indonesia where farmer-based irrigation systems have been successful.

MRGM officials informed that during a recent visit to the scheme by Minister for Co-operative Development Hon. Njeru Ndwiga, the Minister ordered that both N.I.B. and MRGM should merge and work as a team and to stop wasting energy and resources to fight one another. He also urged farmers to deliver paddy to N.I.B. Following this directive the officials of N.I.B. and MRGM were busy taking stock of the assets of N.I.B. such as Mwea Rice Mills, Reception Centres, tractors and plants such as motor graders, excavators and bull dozers. At the time of our visit, there was plenty of confusion as to what role each side was to play in the running of the scheme. There was however talk that an all- inclusive committee involving farmers, N.I.B. and

Ministry officials would be appointed to oversee the smooth and effective running of the scheme. Sustainability of MIS will depend on judicious and careful well thought sharing of responsibilities between farmers and the Government.

If, by good luck Mwea finds a good manager, different transport operators have a great and rewarding future. This is because if well managed, Mwea has the potential to produce twice or thrice of what is producing today.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This case study of Mwea Irrigation Scheme was carried out in line with the attached terms of reference (see annex 2). Rice production operations covering cultivation, processing and marketing and accompanying transport chain were studied and analyzed for MIS first under N.I.B. management and then under farmers management following take over in 1998. Mwea was selected as a site for the Rural Transport Service Project because it has high density and rich diversity of IMTs including bodaboda, hand carts and wheel barrows, donkey and oxen carts all serving the Mwea Community.

Production of rice under N.I.B. was marked by strict discipline and professionalism to ensure all important operations such as land preparation, planting, weeding, fertilization and harvesting were done at the right time and in the right way. Predictably, the rice yields were steadily high. Paddy losses during harvesting, drying, storage and milling were minimal because best practices were used by NIB. Estimated losses were in the range of 0.5-1%.NIB hired trucks for transportation of paddy from fields to drying floors (reception centers) and finally to the mills. N.I.B. owned trucks and tractors did distribution of inputs.

At farmers level, donkey carts and bicycles were used to transport inputs from farmer's houses to the fields while donkey carts were used to transport paddy for home consumption from reception centres to farmers houses. Oxen continued to dominate wet paddy field leveling while donkey carts remained the transport of choice for most farmers.

Despite the sterling performance by N.I.B., Mwea farmers took over the management of MIS in 1998 in a battle that saw five farmers dead and score others injured for life. The reason for N.I.B. ouster was that it was using policies, which were oppressive and exploitative to the

farmers. N.I.B. would dictate producer price for paddy at the same time fix price for inputs. This did not go well with farmers.

The positive things said about rice management by N.I.B. cannot be said about MRGM, which was ill prepared for management of a complex agro-system such as Mwea. Under MRGM management rice yields have declined because of several teething problems, the main ones being lack of proper marketing structure, farmers failure to deliver paddy despite receiving credit input services, shortage of irrigation water among many others. Paddy deliveries to MRGM have reduced to a trickle (50,000 bags compared to 270,000 bags in 1999) and MRGM needs to re-engineer itself to attract more farmers in future. Some of the major changes that have occurred after take-over include the expansion of Jua kali rice and horticultural farming which have had far reaching impact on Mwea people. Impacts include an increase in employment, food production and mobility on the positive side. On the negative side, diseases and environment pollution have increased.

The current Government has reached the scene with a bang and as expected has already started issuing the much awaited rescue directives. One of the directives is that all farmers should deliver their rice to N.I.B. rice mills, which have been idle for the past 5 years. Another directive is that MRGM and N.I.B. should work together as a team and avoid wasting time and resources fighting one another.

The future of Mwea depends on government goodwill in developing suitable and sustainable working relationship between government agents and rice farmers in order to unleash the untapped potential in Mwea. To do this the government may need learn from successful case studies of farmer –based irrigation systems in Mexico, Sri Lanka, Pakistan and Indonesia. If Mwea is well managed, it has the potential to support many more transport operators, and in this way create employment, and improve the quality of livelihoods of the people of Mwea.

Recommendations

Here are recommendations on the main issues:-

1) Donkey carts and bicycles are the major causes of traffic accidents along Nairobi-Embu highway in Mwea. Measures to curb this should be put in place. Some of the measures include: -

-Short-term measures include the mounting of traffic safety campaign involving cyclists, carts operators and motorists to sensitize them on safety measures.

- Long-term measures include the provision of separate lanes for bicycles and carts in Mwea and other areas with similar density of IMTs. Provision of such lanes is a common feature in some of the developed countries e.g. Japan.

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2) Most donkey cart operators are unkind to their animals and deserve a lesson on animal kindness. In this regard, KENDAT's campaign in Mwea on respect for donkeys is much to be commended. The campaign should be intensified as improvement on handling of donkeys has been observed. In addition, the hiring of a veterinary doctor and Animal Health Assistant is also to be commended as it has led to improvement of the general health of donkeys in Mwea. This idea could be expanded to a clinic for donkeys where animals can be taken for routine check and treatment.

3) There should be improvement in the harnessing of the donkeys and oxen to improve power output and animal sustainability. Training of operators on cart and animal maintenance can go along way in improving their utilization.

4) The bodabodas should be improved by fitting small but simple engines which would reduce cycling effort without increasing their price too much as to make them unaffordable to common mwananchi. Tricycles and other modes of transport should be tried out at Mwea.

5) Enforce low to prosecute those mistreating donkeys.

6) Provision of access facilities (such as bridges over canals and drains) to the rice farms as many animals get hurt when crossing canals and drains.

7) Improvement of road network as this will improve transport in general whether by bodaboda donkey carts or by vehicles.

In all the above KENDAT should lead the effort.

ANNEX I **PROGRAMME AND LIST OF PERSONS MET**

Monday 3/2 (***morning***) Briefing on objectives and programme with the Executive Co-ordinator and other senior KENDAT officials officials at KENDAT office. In attendance

Dr. P. Kaumbutho	- Executive Co-ordinator
Dr. J. Mutua	- Technical Manager
Fred Ochieng	- Liason Officer
Daving Ljungberg	- PhD student, Department of Agric. Eng. Uppsala Sweden
Lucy Nkirote	- Information and monitoring officer

Afternoon Held discussions with David in KENDAT office

Left for Embu via Mwea with the following persons – David, Fred and Lucy

Briefly stopped at Mwea where we met Alexander Gichobi, Animal Health Assistant and Anthony Wachira Kimani, a numerator.

Tuesday 4/2 Conducted interviews at Mwea with rice farmers, mill operators and transport operators accompanied by David.

Wednesday 5/2 (***morning***) Attended a meeting with Mwea DO Mr. George Chelangat.

Continued interviews with rice and horticultural farmers at Marurumo village situated lower side of Mwea Irrigation Scheme. Our team comprised of David, Gichobi, Lucy and Wachira.

Afternoon Paid courtesy call at the offices of Mwea Rice Growers Multipurpose Co-operative Society

Thursday 6/2 (***morning***) Continue with interview of rice farmers and French beans farmers at Kimbimbi and Thiba. Also interviewed a mill operator and transporter operator.

Evening (5.00 p.m.) Travelled to Nairobi in the company of David.

Friday 7/2 (***morning***) Held discussions with David in KENDAT office. Reviewed questionnaires

Afternoon Travelled with David to Jomo Kenyatta International Airport to interview horticultural exporters. We visited homegrown, Sunripe, Mboga tuu and East African Growers but we were asked to visit the following day - Saturday.

Saturday 8/2 (5.30 a.m.) Visited Gikomba tomato market in the company of David and interviewed a number of tomato transporters and buyers.

9.00 a.m.	Visited HomeGrown Company
10.30 a.m.	Visited Sunripe Company
1.00 p.m.	Visited Mboga Tuu
5.00 p.m.	The End.

Production of							
(A) Farm input							
1. Seed	kg	13.95	4.7	656.00	10.60	47	498.00
2. Fertilizer							
SA	KG	19.00	400	7,600.00	19.00	650	12,350.00
TSP	kg	28.00	125	3,500.00	28.00	125	3,500.00
3. Agrochemicals							
Fentrothiry	litres	810.00	1	810.00	810.00	1	810.00
4. Other materials							
Gunny bags	No	56.00	53	2,987.00	56.00	84	14,704.00
(B) Labour requirement			229			229	
Family labour	M.D		195			172	
Hired labour	M.D	40.00	34	1,360.00	40.00	57	2,280.00
(C) Land preparation							
Rotavation	LS	3,750.00	1	3,750.00	3,750.00	1	3,750.00
Levelling ofOxen	LS	1,000.00	1	1,000.00	1,000.00	1	1,000.00
Subtotal				21,663.00			288,921.00
(D) Mscellaneous costs							
5% of A+B+C				1,083.00			1,444.00
Total production cost				**22,746.00**			**30,336.00**
Net Return				**22,053.00**			**21,263.00**

Source:

1. National Irrigation Board, Mwea Irrigation Development Project Vol 3 annex iv Agriculture 1994.

RESEARCH FINDINGS ON TRANSPORT CHAIN FOR HORTICULTURAL CROPS FROM MWEA

Introduction

To get an insight into transport chain involved in production processing and marketing of tomatoes and French beans in Mwea, we interviewed operators at various key levels:

- Farmers at the level of production
- Transporters
- Processing and packaging
- Marketing

The farmers interviewed were in the category of small scale with less than 5 acres of land and practicing supplementary furrow irrigation. The following are the main findings for tomatoes and French beans.

Tomatoes

Tomatoes in Mwea are grown on red, light well drained soils which are ploughed and furrowed using either oxen or tractor mounted implements. Farmers with one acre or less tend to go for oxen while those with larger chunks of land go for tractors. The furrows serve two purposes: to capture and conserve rain water and as conduit for irrigation water.

Tomatoes take 4 ½ months to mature and the main variety currently grown is Cal J, which is preferred because it has better keeping quality (up to 7 days) than its predecessor the moneymaker. Inputs required during production such as fertilizer, chemicals and knapsack sprayers, irrigation pipes and pumps are carried to the farm using bicycles, donkey carts or pick-up depending on farm holding size. Tomatoes require frequent spraying-at least once per week- and this places heavy burden on sprayers who have to carry Knapsack sprayers (20kgs) on their backs for long periods exposing them to chemical hazards. Something needs to be done to reduce drudgery in spraying and to reduce exposure of workers to chemical hazards.

Harvesting, Grading and Packaging

Tomatoes are harvested once or twice per week for 4 weeks depending on prevailing weather- once in cold weather and twice in hot weather. Yields attained will depend on weather and also managerial skill of the farmer. Under good conditions of weather and managements, an acre will produce 250-300 boxes of 60kg. On a typical harvesting day, 7 persons will be engaged to harvest 1 acre: 5 persons will do the harvesting while the other 2 will do the grading. Tomatoes will be graded in to 3 grades according to size and packaged into boxes of 60kgs accordingly.

At this stage, a farmer will have 3 options.

- Sell his tomatoes to a businessman who will load the tomatoes into a pick-up or truck and transport them to Nairobi for marketing.

- Sell his tomatoes at Nairobi. In this case, he has to hire a pick-up, which carries 20-22 boxes at the rate of Khs. 5,000/trip

- Take his produce to local market and sell it here. This is rare because Nairobi prices are always higher than local market prices. Farmer may use a bicycle, donkey/oxen cart or pick up to transport produce to local market depending on amounts of produce involved and on which is the most convenient transport for him. The farmer feeds any tomatoes not sold to cattle while in some cases farmers extract seed from this for next crop.

Transportation

The pick-ups normally collect produce right from the farm during dry weather. During rains however, most farms are inaccessible and that is when oxen or donkey carts become invaluable. They transport tomatoes from farm to main roads where pick-ups can access them. Cart operations charge for the goods according to distance traveled but charges will rarely go below 50/=/box

Harvesting, grading and transport losses incurred mainly depend on variety and handling as tomato is a delicate, perishable commodity. For moneymaker variety, these losses are high and may reach 8 boxes per acre. For Cal J variety, losses are normally less than 2 boxes per acre.

Marketing at Nairobi

Tomatoes marketed at Nairobi are from (in order of quantity) Mwea Subukia and Taveta. The main market outlets at Nairobi are Gikomba, Korogocho and Githurai. Pick-ups start arriving at these outlets as early as 2.00a.m and marketing starts almost immediately so that the business is over by 6.00a.m

No pick-up owners or farmers do the marketing. Special salesmen who are hired at the rate of Kshs. 500 per salesman do marketing. A pick-up will require 2 salesmen. The qualities of a salesman are that he is honest and well known by customers and able to deliver tomatoes to the customer's shops or stalls. Prices of tomatoes in the farms depend on demand and supply situation and in general ranges from kshs 200/box during low season to kshs 3000/box. At the Nairobi market prices vary in the same way and varies from kshs 500/box during low season to

kshs 4000/box during high season. At the time of our visit (February 2003), the farm gate and Nairobi prices were shs.1400/box and kshs 2800/box respectively. At these prices a bussinessman buying tomatoes at Mwea and selling at Nairobi would make a whopping net profit of up to Kshs.20, 000/trip as shown in attached cost/benefit analysis table. During low season, net benefits tend to zero (see table) and that is when tomatoes rot in the fields.

Cost benefit of tomato business at Mwea

Costs	**High Season (HS)**	**Low Season (LS)**
Buying tomatoes 20 boxes @ 1,400/box (HS) and 200/box (LS)	28,000	4,000
Transport (pick-up)	5,000	5,000
Salesman charges	1,000	1,000
Miscellaneous costs (assumed)	2,000	2,000
Total	36,000	12,000
Benefits		
Sale of tomatoes 20 boxes @ 2,800/box (HS) and 600/box (LS)	56,000	12,000
Net income	20,000	NIL

It was not possible to do cost/benefit analysis for the farmers interviewed because they did not keep records on costs and sales made. However, an idea of possible benefits and costs can be got from a JICA study report in 1994 (see annex attached). According to this study a farmer got kshs 60,000/ha/season but the main determinant of benefits are prices in the market and these vary quite wildly. What became evident from this survey was that brokers or middlemen never lose for they make sure that their margins are never affected and farmers in the end always carry the burden of any unfavorable developments in the market or weather.

Constraints and suggested countermeasures

1. High production cost due to high frequency of chemical spraying required also due to the need to move to new land every season to avoid the dreaded bacterial/fusarium wilt disease. Counter measures include:

- Development/adoption of varieties, which are disease resistant
- Development of appropriate chemicals to control bacteria/fusaruim wilt disease.
- Design of chemical sprayers, which make spraying les laborious and expose the workers less to chemical hazards. A good prototype is available at Agricultural

Engineering and Appropriate Technology Research Institute (AEARTI), Namarere, Uganda.

2. High transport costs to the main market in Nairobi. Counter measures:
- Development of a processing factory at Mwea. This will transport and harvesting losses and reduce wastage of the crop when there is glut and may even reduce the wild swings in prices from 200/- to over 3,000/- per box.

3. Lack of adequate irrigation water. Counter measures may include:
A switch in irrigation method from furrow to simple drip irrigation since the latter saves irrigation water.

4. Lack of market information leading to exploitation of tomato farmers. Advertising market information in local print and electronic media and use of mobile phone may assist in bridging the gap.

It is recommended that a survey be conducted to determine the actual costs and benefits of producing tomatoes at different times of the year.

French Beans

In terms of production process, French beans share a lot in common with tomatoes in regard to land preparation, method of irrigation and Chemical spraying. The main difference is that French beans take shorter time to mature and production is much more controlled by exporters than tomatoes. Dominant varieties grown include the Army. Samantha and monel.

There are two types of farmers, contracted and non-contracted. The latter depend merely on luck for marketing their crop while for contracted farmers, marketing is assured by exporter who may also provide key inputs such as a seed, fertilizer and pesticides. The contracted farmer is given a planting programme to follow depending on orders obtained by exporter from European market. Usually, contracted farmers plant a specified area after every two weeks. To minimize residual chemicals in produce, type of chemical and spraying regime is specified and controlled by the export company.

Harvesting and Grading

Harvesting begins 1- ½ months after planting and may continue for 2 months. Normally, beans are harvested twice per week except in exceptionally cold weather when harvesting is done once per week. Yields will depend on weather and farmers managerial skills. At time of our

visit, when the weather was said to be bad (too hot) production was 800 cartons of 3 kg per acre. When there is good, weather production goes up to 1,500 cartons /acre.

There are two types of packaging at the farm level: 3kg cartons and 15 kg crates. The export companies own the packaging materials. Women normally do the harvesting and for this they are paid Ksh 20 per carton for harvesting and grading. Beans are graded into 2 grades according to bean pond size. The smaller ponds are graded as extra fine while the slightly larger ones are graded as fine. They are packaged accordingly in either the 3 kg cartons or 15 kg crates.

Farmers use bicycles, donkey/oxen carts or pick-ups to transport beans from their farms to collection/buying center. The grading may be done on the farm or in specially built collection centers, which may handle crop from a group of farmers, contracted by an export company. After grading and packaging, the crop is ready for transportation to Nairobi.

At the time of our visit non-contractor farmers were getting Ksh 60/carton. This was a very poor price according to the farmers interviewed and cannot meet even half of production cost. This looked true considering the farmers emaciated and haggard appearance. We found that a broker sold same carton to exporter at Kshs 100 and so the main benefactor is the broker who obtains large profits without doing much. Although farmers interviewed were not keeping records on costs and sales, they confirmed that there are wide price variations from kshs 50/carton to 300/carton. However, an idea on the cost and benefit can be obtained from a JICA study (see attached annex) which showed an income of kshs69,000/season/ha.As in the case of tomatoes benefits swing with the market prices.

Transportation

In the morning of the harvesting days, vehicles (1-3 ton capacity) owned or hired by export companies will distribute cartons and crates to the farmers for packaging of beans. The same vehicles will come later in the day to collect produce using crates distributed in the morning. In some cases, export companies contract private vehicles to distribute packaging materials, collect produce, and deliver it to an agreed place. Contracted farmers get delivery note for beans delivered and payment follows in 2-4 weeks depending on contract agreement. Non-contracted farmers get paid through an agent (broker) who will be a contracted farmer. Companies avoid handling cash at the field because of dangers involved. There are many cases of non-contracted farmers not getting paid for delivered produce and this is a big

discouragement for most of them. Collected produce is delivered to Nairobi for further preparation for export market.

Cooling facility at Mwea

There is a 10-ton cooling facility at Mwea which is used to provide temporary safe storage for beans (if need be) before collection and transportation to Nairobi. Famers were wondering loudly the usefulness of this facility, which they say it too small to handle Mwea crop, which runs into thousands of tons every day. They argue that a processing (canning) factory would have been more useful. Such a facility would reduce transport costs and reduce wastage during times of glut (see constraints and suggested counter measures below).

Processing by exporters

We were able to visit 2 companies, which were very cooperative. These were the Sunripe and Mboga Tuu. The others namely HomeGrown, East African Growers and WAMU were not co-operative and literally threw us out of their compounds.

The processes in the two companies were more or less the same. They both processed and exported Asian vegetables (chillies. Karela, okra e.t.c) Frenchbeans, snow peas, passion fruits among many other items. Processing for European market is done under clean and Hygienic environment where workers put on white overcoats and facemasks to prevent any contamination.

The processing of French beans is quite simple and involves following steps:

- Weighing followed by quality control,. Each farmer's produce is processed at a time so that rejects, if any can be weighed and returned to him.
- Pre-cooling of produce at 8°C for 1 hour
- The produce is then transferred to raw materials cold storage where the temperature remains below 8°C. Maximum storage time: 3 days.
- Beans are then chopped on both ends and nicely re-packaged in different packages. Repackaging is done to improve marketing. Labels are fitted which specify company name, address and expiration date-usually 7 days after packaging.
- The packaged beans are then kept in finished processed produce cold room
- The produce is then palletized for air flight to Europe

The main clients are U.K Belgium France, Germany and Holland. The export companies would not disclose to us at what price they dispose the French beans in Europe. Neither would they disclose to us the freight charges. They would only say the charges are too high. However,

judging from their posh offices, posh cars they were driving, the many new vehicles collecting produce from the farms, it was pretty obvious export business is quite lucrative.

Constraints and suggested counter measure

1. High cost of transport and high loses during glut production period. When there is glut in the months of June, July, august and September, over 50% of crop produce is thrown away. Counter measures include:

- The establishment of as canning factory at Mwea
- Establishment of export processing facilities at Mwea

2. Exploitation of farmers by exporters-There is a large gap between farm gate and European market prices. David confirmed that European markets prices were a 100 times the farm gate price but this money does not trickle back to the farmers, who in any case are not aware. The exporters were the main beneficiaries because they have access to European market information unlike small-scale farmers who are ignorant and hence exploited.

   Advertisement of European market information in local print electronic media and the use of mobiles would improve flow of market information to farmers while formation of an association would increase farmers bargaining powers for better prices.

3. Shortage of irrigation water, counter measures same as those suggested for tomatoes.

4. High frequency of spraying of chemicals. Drudgery associated with this reduced by design of an appropriate spraying device as in case of tomatoes.

5 As recommended for tomatoes, data on production cost and sales should be collected to capture the variations in benefits throughout the year. There should also be an European market survey on commodity prices, freight charges and other costs throughout the year so that we may be in a position to know who is being exploited and by who.