Assessing the Competitiveness of Rice Production in Mwea Irrigation Scheme in Kenya: A Policy Analysis Matrix (PAM) Approach

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

To my wife Monica Wambui and our two children, Olive Mugeri and Alex Mugane, whose love and patience inspired me to pursue my studies.

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ALDEV	-	African Land Development Unit
C.i.f.	-	Cost Insurance freight
DRC	-	Domestic Resource Cost
DAP	-	Di-ammonium Phosphate
EPC	-	Effective Protection Coefficient
ER	-	Exchange Rate
FAO	-	Food and Agriculture Organization of the United Nations
GDP	-	Gross Domestic Product
GoK	-	Government of Kenya
IC	-	Internal Handling Costs
IMF	-	International Monetary Fund
Kg	-	Kilogram
KIPPRA	-	Kenya Institute for Public Policy Research and Analysis
KNBS	-	Kenya National Bureau of Statistics
Kshs	-	Kenya shillings
MIS	-	Mwea Irrigation Scheme
MMRG	-	Mwea Multipurpose Rice Growers society
Mns	-	Millions
MRM	-	Mwea Rice Mills
MT	-	Metric Tonne
NERICA	-	New Rice for Africa
NCPB	-	National Cereals and Produce Board

NFIFO	-	Net Farm Income From Operations
NIB	-	National Irrigation Board
NPCI	-	Nominal Protection Coefficient of Inputs
NPCO	-	Nominal Protection Coefficient of Outputs
OECD	-	Organization for Economic and Cooperation Development
OLS	-	Ordinary Least Squares
PAM	-	Policy Analysis Matrix
PCR	-	Private Cost Ratio
RCA	-	Revealed Comparative Advantage
RCDA	-	Revealed Comparative Disadvantage
SCP	-	Structure, Conduct and Performance
SA	-	Sulphate of Ammonia
SAARC	-	South Asia Association for Regional Cooperation
SACCOs	-	Saving and Credit Cooperative Societies
SSA	-	Sub-Sahara Africa
TOT	-	Terms of Trade
TSP	-	Tri-sulphate Phosphorous
UK	-	United Kingdom
USA	-	United States of America
WB	-	World Bank
WUA	-	Water Users' Association

ABSTRACT

This study aimed at comparing the costs of inputs and value of outputs in rice production systems at both local and world markets. This facilitated to assess the profitability of producing rice in Mwea Irrigation Scheme and determine its competitiveness vis-à-vis rice imports. The inputs included hired and family labour; chemical fertilizer, machinery and water; petrol, diesel and electricity in production, transportation, processing and marketing phases.

The input costs and value of output on production, transportation, processing and marketing were collected through comprehensive structured Policy Analysis Matrix (PAM) questionnaires. They were administered to 93 farmers, 68 paddy transporters, 37 rice processors and 32 white rice wholesalers. Analysis was done in Census and Survey Processing System (CSpro) and imported to Excel spreadsheet.

The results of the study showed that rice production in Mwea Irrigation Scheme (MIS) was profitable. The financial and social profits were estimated at Kshs 36,728 and Kshs 25,515 per acre, respectively. The private cost ratio (PCR) was 0.4 showing that the system could afford to pay domestic factors and still remain competitive earning normal profits. The net transfer was Kshs 10.10 per kg showing a high absolute figure. Domestic Resource Cost (DRC) was 0.41. This meant that the system in MIS was costing less than a dollar of domestic resources to earn a dollar of foreign exchange. Nominal Protection Coefficient on Output (NPCO) and input (NPCI) equals 1.40 and 1.23, respectively. The Profitability Coefficient (PC) was equal to 1.43, while the Subsidy Ratio to Producers (SRP) was

computed to be 0.23. This indicator showed that the output tariff equivalent required to maintain the existing private profits if all other policy distortions and market failures were eliminated was 23 per cent.

The recommendations from the findings of the study and preferred for the sub-sector were four. One, development of a water reservoir upstream to improve supply of water flooding in increased number of paddy fields (in Ng'othi, Kiarukung'u and Kiamanyeki out-growers), consequently operationalizing rice production system competitively. Two, relax the current restrictive policy on imported broken rice and Pishori grain to enable price stability in the market. Three, a policy in favour of investors must be instituted so that investments make a minimum excess economic profit of 10% for sustainability. In addition, an introduction of 13 per cent subsidy on tradable inputs (chemical fertilizers and herbicides) be implemented to cushion farmers on observed high input transfers to importers and fourth, promotion of agricultural based financial institution with incentives for farmers is critical to competitively stabilize the price of credit.

CHAPTER 1: INTRODUCTION

1.1 Background

Rice development in Kenya started in 1946 under the African Land Development Unit (ALDEV), which started as a broad agricultural rehabilitation program that included irrigation. This was driven by the need to contain agitation for land occupied by the European settlers. The ALDEV initiated a number of irrigation schemes, namely, Mwea-Tebere, Hola, Perkerra, Ishiara and Yatta. ALDEV used cheap labour from Mau Mau detainees (Kuria, 2004).

The Mwea Irrigation Scheme (MIS) was formally established in 1955 as a part of colonial policy on food self-sufficiency for Kenya's African population. The colonial government, in collaboration with the British Empire, established the MIS along other typical irrigation models in India.

After Kenyan's independence, MIS was taken over by the Ministry of Agriculture. It was later handed over to the National Irrigation Board (NIB), a government parastatal created through an Act of Parliament in 1966. The NIB was charged with day-to-day operation of the scheme, the responsibility of conducting research and investigation, formulating policy, coordinating and supervising schemes, providing land for public purposes, and marketing of rice in the Scheme. This involved provision of inputs and extension services, harvesting and processing of rice. In close collaboration with NIB, National Cereals and Produce Board (NCPB) was acquiring, marketing and distributing all rice

produced in the country during late 1970s and early 1980s. The NCPB was the only Government agency authorized for marketing cereals produced in the country then.

In rice production, factors involved are land, water, fertilizers, insecticides, seed, machinery, intensive labour among others. Kuria (2004), in a study of economic analysis of Mwea rice production, identified factors contributing to low paddy production as: (i) areas under rice has remained more or less constant while farmers' cooperative society does not have the capacity to cope with demand for services and hence delayed in land preparation; (ii) the continuous cropping throughout the year by rice farmers led to buildup of diseases and pests; (iii) the low volume of irrigation water, high cost of inputs (fertilizer, insecticide, machinery and labour) and low yield variety of rice seed also contributed to low production.

1.2 Rice Production

The Mwea Irrigation Scheme is the largest producer of rice in the country. It produces 75% of the country's rice output with 20% being produced by the other small irrigation areas, namely, Kano, Bura and Ahero. The remaining 5% is grown under rain-fed conditions in Kwale, Kilifi, Tana River, Busia and Teso districts (Republic of Kenya, Economic Review of Agriculture, 2007). In 2006, the country produced 41,991 metric tonnes milled rice and over 228,000 metric tonnes were imported to meet the national demand estimated at about 270,000 metric tonnes (Appendix 7-1). The data showed that the country produced about 16% of its consumption leaving a large deficit to be met through importation (Republic of Kenya, Economic Survey, 2007). The constraints

contributing to low production of paddy were: (i) low levels of irrigation water due to clogging of main and primary canals, (ii) non-availability of quality high yielding variety seed, (iii) low accessibility to credit, and (iv) competition from cheap imported rice. Some of the identified constraints could be addressed through policies on water, production of rice seed, credit accessibility, and even importation of rice.

Rice production in Kenya was done under three systems: NIB schemes, rain-fed, and Water Users' Association (WUA). The NIB schemes were Mwea, Kano, Bura and Ahero. The schemes were facilitated with machinery, fertilizers, seeds, pesticides and finances by the NIB with an agreement that harvested paddy rice would be delivered to NIB. The yields were about 4.5 tonnes/hectare for aromatic *Basmati* paddy rice and 6.5 tonnes/hectare for non-aromatic *BW 196* and *IR 2793* (Kaluli and Gatharia, 1991). Irrigation schemes accounted for about 90% of the rice produced in Kenya while the rest was rain-fed and water users' initiatives.

The paddy varieties grown in Mwea Irrigation Scheme were low yielding medium-grain aromatic *Basmati 217* and *370*, and high yielding non-aromatic BW 196 and *IR 2793*. High valued *basmati 217* and *370* yields ranged 20-30 bags while non-aromatic *BW 196* and *IR 2793* yields ranged 40-50 bags per acre per crop year (National Irrigation Board, 1994). This study focused on *Basmati 217* and *370*. It was grown with a commercial intention by the farmers while *BW 196* and *IR 2793* varieties were cultivated in small areas for farmers' home consumption.

The rain fed systems were in Kwale, Kilifi, Tana River, Busia and Teso districts. The system's yield was 1667 kilograms per hectare (Kaluli and Gatharia, 1991). This accounted for 5% of the rice produced in Kenya. The Water Users Association system was practiced in the surroundings of the schemes. They used water from both the feeding and draining canals of the designated schemes for cultivation. The best period for farmers of water users' association in Kandongu, Nderua, Kiamanyeki and Gathigiriri zones to start their preparation were usually when the Scheme's farmers were drying their paddy field ready for harvest. During this period (November to December), the canal water demand was usually low and also coincided with the short rains.

1.3 Rice Marketing

Rice marketing in the world market is relatively very thin accounting for only 6.5% (39,651 thousand tonnes) of the total rice produced globally in 2004 (Wailes, 2005). This has been attributed to high protection mechanisms to achieve national policy objectives of domestic food security and support for producer prices and incomes in major producing and consuming countries (Wailes, 2005). The largest producers, namely, China, India, Indonesia and Thailand are the highest consumers and exporters. Africa, Bangladesh and the Arab world are the highest importers. Asia produces 90% (549,000 thousand tonnes) of rice consumed in the world and contributes 73% (445,300 thousand tonnes) of the world market. The highly protected medium-grain and short-grain rice was marketed in form of paddy, brown and milled rice. Long-grain and aromatic milled rice were relatively less protected. In Europe, North America and Australia, production and marketing of rice was highly subsidized and import tariffs and quality standards are set

very high to discourage entry of foreign rice (Wailes, 2005). Africa is a net importer of rice mainly from the Asian countries although Egypt is the African rice exporter in the world market with a very small share. Change of consumer preference to rice in African urban households has created a demand of rice at an average of 6% per annum, the fastest in the world (Wailes, 2005).

In early 1990's, the International Monetary Fund, World Bank and other development partners prescribed a full commodity (including rice) marketing liberalization in Africa. This was to propel most of African economies to an open market growth with a decontrolled agricultural inputs and outputs prices. The results expected were (i) stimulation of export production, (ii) improved output prices, (iii) cost reduction for marketing output, and (iv) cost reduction in purchasing input (Temu *et al*, 2004).

In Kenya, rice farmers marketed rice through NIB and NCPB. The institutions were determining on the prices to prevail in the market. The decision was done in consideration of urban Kenyan worker's ability and compensation to farmers. In January 1992, rice marketing was liberalized by the Government through Legal Notice number 13. Rice farmers were free to purchase inputs and sell their output to different market participants (traders) other than NIB. This study has singled out market liberalization policy, which had the following achievements at MIS: (i) entry of large number of traders in rice marketing, (ii) improved farm gate prices, (iii) reduced processing costs, and (iv) reduced marketing costs. This concurred with an earlier study by Temu *et al* (2004)

which showed that the expectations were partly realized. The prices of paddy rice and milled white rice improved significantly.

1.4 Rice Consumption

Rice consumption in the world accounted for more than 20 per cent of the global calories and 29 per cent in low income countries in 2000 (Wailes, 2005). In Asia, rice is the staple food competing with wheat, while in Africa rice is becoming an urban staple food and rising with an average of about 5 kilograms per capita in 2006. In recent years, rice consumption in Kenya has been growing steadily from 138,535 metric tonnes in 2001 to 270,197 metric tonnes in 2006 (Republic of Kenya, 2007). This represents a 95 per cent increase in six years. Similarly, per capita rice consumption in Kenya almost increased twofold from 4.6 kilograms in 2001 to 8.1 kilograms in 2006. If this trend continues, meeting consumption needs poses a major policy challenge.

Table 1-1: Trend on Total and Per Capita Consumption in Kenya

Year	2001	2002	2003	2004	2005	2006
Total Consumption (MT)	138,535	147,821	161,269	223,165	264,967	270,197
Per Capita rice consumption (kg/person)	4.587	4.784	5.12	6.931	8.078	8.09

Source: Appendix 7-1

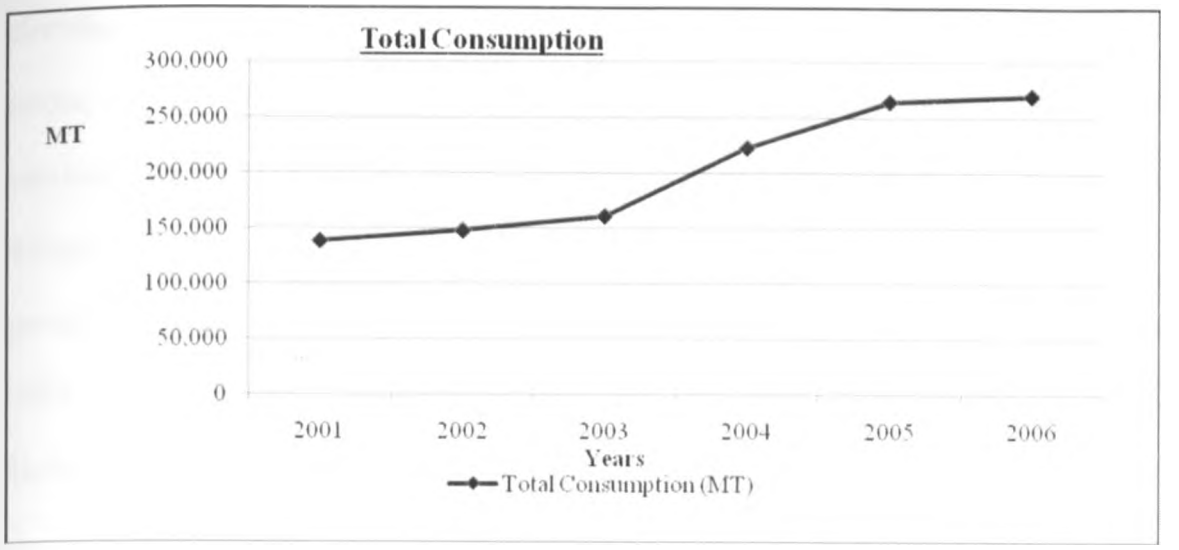

Figure 1-1: Total consumption

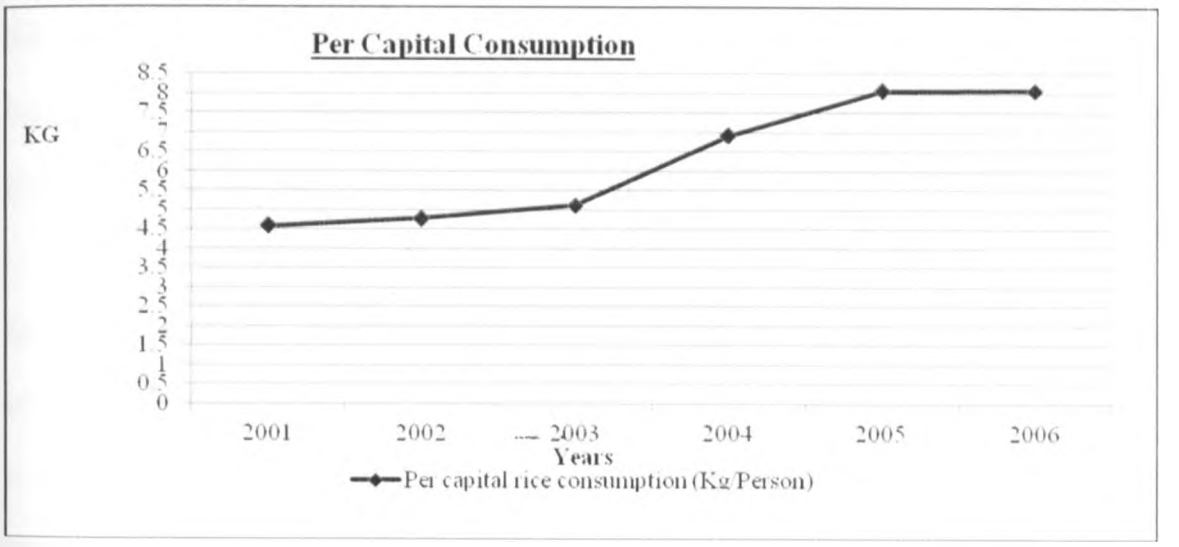

Figure 1-2: Per Capita Consumption

1.5 Problem Statement

Liberalization of marketing cereals and grains sub-sector in 1992 witnessed several changes in both paddy marketing and milling of rice. The reforms had profound implications on production of rice in the country in general and Mwea Irrigation Scheme in particular. The prime motives of liberalization of the cereal markets in Kenya, like

elsewhere in Africa, were: (i) to stimulate production for export, (ii) to improve output prices, (iii) to reduce the costs of marketing output, and (iv) to reduce the cost of purchasing inputs (Temu *et al.*, 2004). The policy was expected to boost farm production through stabilizing markets and offering high produce prices to farmers. This was partially achieved. In MIS, producer prices ranged between Kshs 4.00 to 6.50 per kg in 1987-1992, Kshs 7.40-15.00 per kg in 1993-1997, and finally stabilized at Kshs 25.00-30.00 per kg in 1998-2006 as shown in Appendix 7-3.

The notable achievements as consequence of food market reforms in the World that had a direct impact in Kenya and MIS in particular were (i) increased entry by private traders into food trade, (ii) reduced marketing margins, and (iii) increased producer prices (Beynon, Jones and Yao, 1992; Barrett, 1994; Jones, 1996).

In MIS, cultivation required heavy investment and high operational costs for purchasing of seedling, hiring of bullock power, hiring of rotavatory tractor and labor; chemical fertilizer, pesticides and water costs (Kuria, 2004). Despite the heavy investment incurred by the rice farmers and liberalization of the sub-sector, rice farmers' income still showed low improvement (Republic of Kenya, Basic report on well being in Kenya, 2007). The high prices of chemical and petroleum products erode farmers' profits. The problem of milled rice market glut caused by imported rice from East Asia negatively affects the paddy produce prices. Thus, assessing the effects of import policy of rice in Kenya vis-à-vis marketing of Mwea irrigated rice poses a challenge and is the problem.

1.6 Objectives

If a country fails to maintain its market share in a given market, the competitiveness of its products will be declining. This indicates that the relative price increase for that country's produce is greater than for its competitors. Competitiveness in crop production system entails low production cost per unit area, high quality grain, low processing cost per unit weight, and sustainable supply in local market. Using PAM approach, a system is defined competitive if its total costs are less than the value added consequently resulting to a Domestic Resource Cost (DRC) and Private Resource Cost (PRC) of less than unity. DRC and PRC are derived from social and private prices, respectively.

The overall objective of this study was to assess competitiveness of rice production in Kenya with Mwea Irrigation Scheme as a case study. The specific objectives were:

1. Assess the production costs of rice produced in Mwea Irrigation Scheme
2. Estimate profitability of rice produced in Mwea Irrigation Scheme
3. Determine social profits of rice produced in Mwea Irrigation Scheme

1.7 Hypotheses Tested

The following hypotheses were tested:

1. That rice production in Mwea Irrigation Scheme was cost effective and assessed at Kshs 29,813 per acre per crop year.
2. That rice production in Mwea Irrigation Scheme was profitable and estimated at Kshs 33.66 per kg of white milled.

3. That rice production in Mwea Irrigation Scheme was socially profitable at Kshs 23.56 per kg of white milled.

1.8 Justification

Rice is a very important food security strategic cereal in the world, mainly Asia, Africa and Kenya. Rice supplied the world with calories per capita of 576, which was a share of 20.5%. In Africa, from total calories per capita of 2,434, rice contributed 178 which was a share of 7.3% in 2000. In Kenya, per capita rice consumption almost increased to twofold from 4.6 kilograms in 2001 to 8.1 kilograms in 2006 (Republic of Kenya, Economic Survey, 2007).

Rice was the third major cereal widely consumed after maize and wheat in Kenya during the study period. Rice had largely developed as an irrigation crop though little amounts were produced under rain-fed conditions (Republic of Kenya, Economic Review of Agriculture, 2006). As a way of promoting rice growing under irrigation, the National Irrigation Board (NIB) was established as a parastatal to develop irrigation schemes. This qualified the justification of assessing competitiveness and stability of output and input prices for different stages of rice production system.

The input factors like low water level, constant acreage of land, high interest on credit, high cost of fertilizers, insecticides and machinery negatively affected rice production. This justified the documentation of production constraints. The rationale of documenting the constraints were strengthened by rise in rice consumption per capita, food security enhancement, and reduction of food poor population, among others. The ranking of rice

as number one food security grain in Asia, its high demand in Africa, and its rank as number three cereal in Kenyan justified the study for the interest of 46 per cent poor population (Republic of Kenya, Basic report of well being in Kenya, 2007).

Apart from assessing competitiveness, the study further sought to identify patterns of incentives with and without policy, and new and efficient policy interventions. The results could be used to (i) identify interventions that could assist in economic growth, (ii) measure social profits for rice production system compared with public investment costs to determine the efficiency of expanding the activity to other regions, (iii) provide measures of the cost of market failure, (iv) evaluate effects of policy distortions, and (v) serve as input into policy debates about the desirability of tradeoffs between efficiency and non-efficiency objectives. This enormous information and analysis was an added knowledge to rice production system. The replication of the results of this study to other food commodities would be an added advantage to policy analysts and policy makers for interventions addressing policy and market imperfections. The area was chosen for study due to the fact that MIS is the largest producer of paddy rice in comparison with other irrigation areas in the country, and thus the information could be used to improve other schemes.

CHAPTER 2 – LITERATURE REVIEW

2.1 Agricultural Policies and Policy Analysis Matrix (PAM)

Agricultural policies are Government decisions that influence the level and stability of output and input prices, public investments affecting agricultural revenues and costs, and allocation of research funds to improve farming and processing technologies. Some are specific like fertilizer subsidies and tariffs on cereals among others.

Nyangito *et al* (1999) study on the impact of recent policy changes on the agricultural sector and agricultural research in Kenya documented a long list of agricultural policies. The policies implemented between 1991 and 1997, which directly affected the rice sub-sector were: (i) market liberalization of rice paddy, (ii) legal policy and institutional changes arising from the review of the cooperatives, (iii) reviewing role of cooperatives in liberalized agricultural sector, (iv) abolishment of specific duties on cereal imports, and (v) decontrol of inputs prices mainly chemical fertilizer, machinery and agro-chemicals. This study assessed the impact of the above policies vis-à-vis nonexistence of all of them.

The assessment was done using the Policy Analysis Matrix (PAM) approach. The approach was a product of two accounting identities: profitability as the difference between revenues and costs; while the divergences measured the effects of distorting policies, market failures and their inefficiency. Divergences are the differences between local market observed parameters and world market parameters. World market parameters are the social prices that would exist if local policies were inexistent.

2.2 Effects of Agriculture Policies in the rice sub-sector

Kenya long term policy framework, Vision 2030, is anchored on three pillars: economic, social and political. The country's agricultural share of GDP was about 24% while 66% of employment was under agricultural-related activities. Agricultural development focuses on (i) food self-sufficiency, (ii) food surplus, (iii) employment creation, (iv) raw materials for agro-processing industries, and (v) improvement of the living standards of the majority of rural small scale farmers and alleviation of poverty (Republic of Kenya, Economic Recovery Strategy, 2003-2007).

The effects of policies implemented in 1991-1997 changed significantly the prices of producers especially prices at farm gate level as shown in Appendix 7-3, the cost of processing and profit margins of marketing participants. In 1987-1997, the prices of Basmati paddy rice were as low as between Kshs4-15 per kilogram as bought by the only buyer and facilitating organization NIB. The rise of prices in early 1990 was an effect of input and output market liberalization policy gazette in 1992. In 1998-2006, producer price of paddy rice shot-up selling at Kshs 25-30 per kilogram through the Mwea Multipurpose Rice Growers (MMRG). In this short-run period, input and output price liberalization policy implementation affected the paddy rice prices in favor of the farmers.

A study in Taiwan, Taipei 1970s, showed that rice farmers were receiving 80% of the consumer price per kg (0.8). This meant that paddy rice milled for a kilogram of white

rice paid to rice farmers was 0.8 times consumer retail prices per kilogram. In United States of America, Japan and Nigeria the same study showed producers receiving 43%, 70% and 54% of the consumer price per kilogram, respectively. The rice marketing in Taiwan was more efficient in 1970s than USA, Japan and Nigeria. The factors evaluated in marketing were labor, packaging, containers, rent and utilities (water and energy), advertising, selling expenses, depreciation allowances and interest charges.

This study observed that the producer prices for paddies in MIS were marketed at Kshs 25 to 30 per kilogram and below. Ahmed *et al.* (1987) observed that marketing costs for milled rice was 30%-70% of the consumer price per kilogram in developing countries. The Kenya National Bureau of Statistics (KNBS) through monthly consumer price data collection observed that market price for white milled aromatic basmati in December 2006 was Kshs 75 per kilogram (Appendix 7-3). Therefore, by derivation, paddy price should be in the range of retail consumer price multiplied by a margin of market costs of 30-70%. The maximum of Kshs 53 per Kg paddy rice in December 2006 would have been paid to farmers. This would have translated to 75% rise on producer prices. Again, a similar observation in December 2007 of retail consumer price showed Kshs 120 per kilogram Pishori white rice. In derivation, farmers ought to have been paid a maximum of Kshs 84 per Kg paddy rice. The rate of price adjustment upstream to the benefit of producers was slow and low in MIS. The study therefore was to identify constraining, distorting or restrictive policy undermining and reducing profitability and productivity of rice in MIS.

This study has tried to identify some constraints mitigating rice farmers to market their paddy rice at a price within the lower quadrant of Kshs 22.50 to 30.00 per paddy equivalent and not at the higher quartile of Kshs 45.00 to 52.50. The short-run constraints were (i) oversupply of paddy rice during harvest period, (ii) lack of storage facilities to control supply, and (iii) demand of money to service credits among others. Despite the achievement of liberalization on increased producer prices for other food crops, paddy rice cost between Kshs 22.50 and 30.00 per kilogram or less. Thus, the effect of policies enacted prior to this study resulted to gains in divergences and transfers to non-farmers. Thus, the economic gain of profitable rice production system in MIS was being lost to non-farmers.

Since 1966, rice production system in MIS was heavily subsidized by the Government. The Government through NIB supplied extension and machinery services, chemical fertilizers, seed and financial credit among operations, research and logistic management as the indirect services. The founding principle of NIB was to facilitate farmers in rice production at no-profit by the facilitating institution (NIB). In 1992, the Government liberalized marketing of agricultural inputs and outputs. This enabled farmers to buy their inputs and sell their paddy produce to a competitive bidder. The transition from NIB facilitation to liberalized marketing in rice production created uncertainty to rice farmers. The fear farmers, policy makers and researchers had was whether rice production would be viable, affordable and sustainable during this period of market liberalization (Appendix 7-1 &7-2, 2001/02). Voluminous data and information was necessary to justify and convince stakeholders that rice production in MIS was cost effective,

sustainable and competitive. In light of this, a study to assess the production cost, estimate the financial and social profitability and its comparative advantage became a necessity for policy makers, researchers and other stakeholders like creditors and SACCOs.

2.3 Measuring and modeling competitiveness

Biswajit Nag (2009a, 2009b) in drivers and modeling of competitiveness defined and presented comprehensively different levels of competitiveness. In production, low cost of production, high quality product and production at a relatively short period are the variables addressed in assessing, measuring and modeling price/cost competitiveness across the board.

International competitiveness is said to occur whenever the economic welfare of a nation is advanced through an increase in the flow of trade or through an alteration in the conditions of trade starting from a presumed initial equilibrium. It is influenced by capital flows, terms of trade (TOT), and exchange rates in both short and long term.

Competitiveness at the national level is measured by the growth of the nation's standard of living, the growth of aggregate productivity (the output of the economy per unit of labor and/or capital employed), and the ability of the nation's firms to increase their penetration of world markets through exports or foreign direct investment. This is achieved through sustained continual improvements in productivity, either through achieving higher productivity in existing businesses or through successful entry into

higher productivity businesses. At the most basic level of economic development, competitive advantage is determined by resources, such as low-cost labour and access to endowment of natural resources. A nation's competitiveness is the gain or maintenance of a market share. If a country fails to maintain its market share in a given market, the competitiveness term will be negative. This indicates that the relative price increase for that country is greater than for its competitors. Export performance measures the extent to which countries gain and lose market share on foreign markets. If a country's exports are growing faster than the weighted average demand (imports) from its partners, it is gaining market share.

At the industry level, competitiveness is the ability of the nation's firms to achieve sustained success against (or compared to) foreign competitors, without protection or subsidies. This includes the overall profitability, the favourable trade balance and rise in foreign direct investment, which directly measures cost and quality competitiveness at the industry level.

A firm's competitiveness is the ability to provide products and services as or more effectively and efficiently than the relevant competitors. This includes sustaining firm's export quotient, regional or global market share and profitability. In the traded sector, this means sustained success in international markets without protection or subsidies provides a direct measure of the firm's competitiveness. Competitiveness usually refers to advantage obtained through superior productivity.

Thus, crop (rice) production system competitiveness is measured by low production cost, high quality harvest, relatively short growth period, and sustainable and/or gain of local world market share. The price and/or cost competitiveness is usually checked through real exchange rate and relative export and import prices.

Competitiveness Index

The competitiveness index (CI) is an indirect measure of international market power, evaluated through a country's share of world markets in selected export categories. The index is the share of total exports of a given product from the region under study in total world exports of the same product.

$$CI = \sum X_{is} / \sum X_{dw} * 100$$

Where **i** is the sector of interest, **s** is the country of interest, **dw** are the set of all countries in the world, and **x** is the commodity export flow. In words, it is the share of country **s**'s exports of good **i** in the total world exports of good **i**.

Revealed Comparative Advantage

Perkins (1987) and Nag and Nandi (2006) identified revealed comparative advantage as one of the underlying economists' explanations for the observed pattern of inter-industry trade. In theoretical models, comparative advantage is expressed in terms of relative prices evaluated in the absence of trade. Since these are not observed, in practice we measure comparative advantage indirectly. Revealed comparative advantage (RCA)

indices use the trade pattern to identify the sectors in which an economy has a comparative advantage, by comparing the country of interests' trade profile with the world average.

The RCA index is defined as the ratio of two shares. The numerator is the share of a country's total exports of the commodity of interest in its total exports. The denominator is share of world exports of the same commodity in total world exports. RCA takes a value between 0 and +∞. A country is said to have a revealed comparative advantage if the value exceeds unity.

$RCA_{ij} = (x_{ij}/X_{it}) / (x_{wj}/X_{wt})$ .....1, where values lie between 0 and +∞

Where x_{ij} and x_{wj} are the values of country i's exports of product j and world exports of product j and X_{it} and X_{wt} refer to the country's total exports and world total exports.

A value of less than unity implies that the country has a revealed comparative disadvantage (RCDA) in the product. Similarly, if the index exceeds unity, the country is said to have a revealed comparative advantage in the product. Note the identity RCDA = 1-RCA.

Constant Share Market Analysis

The intrinsic norm of this analysis is that a country's export share in a given market should remain unchanged over time. Keeping the market share constant, the model expresses the competitiveness term as negative or positive to adjust the actual change in

market share. The difference between the actual export growth from a member country into a given market and the unchanging export share implied by the 'constant market share norm' is attributed to the following three factors: (i) the effects of a general increase in demand for imports in the given market, (ii) commodity composition, and (iii) changes in competitiveness.

The three effects can be explained by the following equation.

$$X(t)-X(0) = m\,X(0) + \Sigma\,\{(mi - m)\,Xi(0)\} + \Sigma\{Xi(t) - Xi(0) - mi\,Xi(0)\}$$

Where X: exports of country A to country B;

Xi: commodity i exports of country A to country B

m: Percentage increase in country B's total imports from period 0 to period t

mi: Percentage increase in country B's imports of commodity i between period 0 to period t.

$X=\Sigma Xi$.

The right hand side can be divided into three components: (i) the general rise in country B's total imports, (ii) the commodity composition of country A's exports to B in period 0, and (iii) an unexplained residual indicating the difference between country A's actual exports increase to country B and the hypothetical increase if country A maintained its share of exports of each commodity group in country B.

Shift Share Market Analysis

The gains or losses of world market shares by individual countries are often considered as an index of their trade competitiveness. Given changes in demand, the relative medium-term inertia of geographical and sectoral specializations partly affects such outcomes. For a given period, the model distinguishes the impact of a country's initial position in different markets relative to its capacity to adapt and to its competitiveness.

The export growth of a given country is divided into (i) global demand effect, (ii) sectoral composition effect, (iii) geographical composition effect, and (iv) the competitiveness effect captured by the residual term.

The change in country i's exports from time 0 to t is expressed as follows:

$$X^t_{i..} - X^0_{i..} = r\, X^0_{i..} + \Sigma_k (r_k - r)\, X^0_{i.k} + \Sigma_k \Sigma_j (r_{jk} - r_k)\, X^0_{ijk} + \Sigma_k \Sigma_j \{X^t_{ijk} - X^0_{ijk}(1 + r_{jk})\}$$

Where j denotes the trading partner; k is the product or sector; r the global trade growth rate (all countries in the sample except i); r_k the global growth rate for product k; and r_{jk} the global growth rate for product k and country j. Countries that had good market shares in products that grew the more benefit from a favourable sectoral effect, while those having good positions in the most dynamic import countries benefit from a favourable geographical effect.

Organization for Economic and Cooperation Development (OECD) measures of price/costs competitiveness

A relative export price country's i = domestic export price/export price of competitors (all expressed in common currency) where the price of competitors is a weighted average of the price of competitors on each export market *p* with weights based on country *i*'s export pattern. On a given export market, *p*, the competitors' export price, is a weighted average of all competitors' export prices with weights based on country *p*'s import pattern.

The OECD model produces indicators of relative competitiveness based on the export unit values of manufactures, unit labour costs in manufacturing, and consumer price indices. The OECD also produces indices of effective exchange rates. This is defined by a particular characterization of the links between foreign trade variables (export and import volumes) and the measures of price competition influencing them. In breaking down tradeable goods by place of production and product category (food, manufactures, etc), the model draws up for each type of tradeable good, equation of market share for each exporting country. This is a function only of the differential between the export and the market price. By explaining the change in total demand for this good on a market as the outcome of an income effect and a product-substitution effect, it is possible to derive equations for the demand for these goods. By aggregating these equations of bilateral flows for a given product for all markets or producers, global export and import equations may be derived for each country.

The competitiveness variables that appear in such equations are explicitly defined price (or cost) differentials based on a weighted average whose weighting pattern is imposed by the model. It is these weights that underline the construction of the OECD's indicators. The OECD calculates indicators of overall competitiveness which provide an average measure of countries' competitive position on their home markets as well as on their export markets.

In the overall model, two factors effectively go to explain changes in exports: growth of export markets and changes in export market shares as a result of changes in countries' price competitiveness.

Gravity Model

The gravity model is perhaps the most widely used econometric model of international trade patterns. An econometric model uses historical data to try to estimate (and test the robustness of) a hypothesized economic relationship. Once estimated, an econometric model may also be used to try and extrapolate to cases outside of what has been experienced, i.e. as a predictive policy device. The model is very easy to set up with simple econometric tools. Earlier, gravity model was faulted for lack of a theoretical foundation. However, views are changing. The development of the 'new' trade theory helped to provide stronger theoretical foundations for the specification, and it is now recognized that a reduced form gravity equation can be derived from most models of international trade that incorporate transportation costs.

In order to estimate the gravity model, a double logarithmic specification is usually used, relating the bilateral trade flows of each country pair (the dependent variable) to the product of their GDP and the distance between them (the independent variables), plus an error term to capture the random component in the data. In most applications, additional independent variables are also often included in the model to improve the fit. These may include measures of openness, remoteness, common language or currency, a common border, and of course the presence or absence of a regional trading agreement. The variables may be continuous (e.g. some measures of openness) or qualitative measures represented by dummy variables (e.g. a country pair is assigned a 1 if they share a common language, a 0 otherwise) As a single equation linear model, the gravity model can be estimated easily using ordinary least squares (OLS), although other methods (e.g., generalized least squares) may be helpful if the data exhibits heteroscedasticity. If the data from which the model is estimated is a panel (i.e. is composed of both time series and cross-sectional elements) then pooled OLS, fixed effects or random effects models may also be used.

Nag and Nandi (2006) modeled on India's major trade partners and SAARC countries using panel data (cross-sectional data and time series) during the period of study 1990-2000. The multiplicative interactive forms for GDP and per capita GDP have been used to consider continuous cross influence by sample countries. The model was estimated by fixed effects panel data estimation technique, and Egger (2000) has justified the use of fixed effects model. The model below is inspired from Matyas (1997).

$Log\ (X_{ind\ j\ t}) = \alpha_{ind} + \gamma_j + \lambda_t + a_1 \log (GDP_{ind} * GDP_j) + a_2 \log$ (per capita GDP_{ind} * per capita GDP_j) + $a_3 \log$ (distance ind_j) + $a_4 \log$ (nom□exchange $rate_{ind}$ / nom-exchange $rate_j$) + $a_5 \log$ (exp price $index_{ind}$ / world exp price index) + $a_6 \log$ (consumer price $index_j$ /consumer price $index_{ind}$) + $u_{ind\ jt}$.

Where ind = India; j = 1, 2...16, India's top 10 export destinations and six SAARC countries); t = 1, 2...11; (1990–2000); and X_{ind} = India's total export.

The Economic Competitiveness of Dairy Systems across USA

Thomas S. Kriegl (2009) consistently revealed differences in financial performance between Great Lakes states and between dairy systems in the northeast quarter of the United States. The perception that small dairy systems are uncompetitive (less economically efficient, lack economies of scale and are high cost producers) is assessed. Four main dairy systems represented in this comparison are: **(i)** small confinement, (ii) large confinement, (iii) management intensive rotational grazing, and (iv) organic. Several measures should be examined to assess competitiveness in all four main dairy systems. No single measure tells the whole story. Net farm income from operations (NFIFO) as a percent of farm revenue based on accrual adjusted income and expenses is dependable. A similar measure is used in the non-agricultural business world. Driven mainly by large variations in the milk price received and in the pounds of milk sold per cow, multiple years simple averages were calculated for all systems and all of the data was compared in the same period.

The competitive measure index computed and compared was NFIFO as a percentage of farm revenue with all labour paid and with all labour unpaid. Most dairy systems retained a very similar ranking from one measure to the other.

The results indicated that the economies of scale (lowest cost of production per unit) occurred to a much smaller size than expected (somewhere less than 100 cows per farm).

There existed a large consistent differences in NFIFO/ revenue between many states (Wiscosin, Maryland, Newyork, among others) and systems (confinements, graziers and organic). Graziers have typically attained more NFIFO/ revenue than other dairy systems in their states while Wisconsin dairy systems have often attained more NFIFO/ revenue than similar dairy systems in other states. Small dairy systems have typically attained more NFIFO/ revenue than large dairy systems in the same state. The largest farms tend to generate more dollars of total NFIFO per farm and per owner compared to the smallest farms.

Measuring competitiveness through revealed comparative advantage, constant share analysis and shift share market analysis depended heavily on share of local/ export market sustainability and penetration. Using OECD measures, export unit values of manufacturers, unit labour costs in manufacturing, consumer price indices and effective exchange rate are the key indicators. In gravity model, an econometric model using historical data on trade, GDP, per capita GDP, consumer indices, exchange rates is developed. Lastly, the Net Farm Income From Operations (NFIFO) as a percent of farm

revenue and PAM assesses the competitiveness of a whole system of production, transportation, processing and marketing in totality.

The author chose construction of PAM to assess competitiveness of rice production in MIS because (i) it does not require time series historical data of prices and marketed quantities, which were often difficult to obtain in the developing country setting (as required in gravity model, constant and shift share market analysis), (ii) it uses data from representative farms, (iii) it facilitates easy interpretation of the results to analysts and policy makers (Maithya *et al.*, 2006), (iv) it facilitates varying degrees of disaggregating (Mohanty *et al.*, 2003); (v) it provides a preliminary test on market inefficiency, and (vi) it compared production competitively from different technologies, crops, geographical areas and years.

2.4 Theory of PAM

The theoretical basis for PAM was the general equilibrium model of international trade rather than some social welfare function, and the matrix focused attention on the identification of efficient patterns of production and prices. This restricted approach to the identification of the optimum policy set was more facilitative to inform policy debate, than were analyses based on a priori inferences about the proper roles for efficiency and non-efficiency objectives of agricultural policy. The theory draws heavily from Monke and Pearson (1989).

Several studies have used this approach of PAM with computation of prime indicators, results discussion, conclusions, recommendations and lessons learnt. The applications assessed competitiveness and comparative advantage in various countries for production of crops applying different technologies.

In economic analysis of maize marketing in Kenya, a case study of Nandi District by Ndirangu (1992), the author adopted a modified PAM as a method of measuring market efficiency. In this case, marketing of maize was the third activity of the maize production system. It became modified because of excluding (i) the phase of production PAM which would have included inputs and outputs of maize production, and (ii) the phase of transportation and processing PAMs. He made interpretation using third activity PAM elements as decision making elements to measure market efficiency and comparing at different channels. The findings were that financial profit was positive while social profit became negative.

In analysis of competitiveness on the basis of international price formation, Nyoro (2002) allowed a comparison of the domestically produced commodity delivered to a common wholesale market with the imported commodity from an international market to the same wholesale market. A detailed crop production schedule within the import-export parity band was constructed. The domestic production price competed with the world prices.

The two studies discussed and reviewed market efficiency. The divergences in the fourth phase of maize marketing in Nandi district by Ndirangu (1992) reflected elements of

market failure. The positive estimated financial profit difference between local market observed prices on wholesaling and social market computed prices quantified the inefficiency.

A study on trade liberalization and its impact on the rice sector of Sri Lanka by Rafeek *et al.* (2000) constructed PAM to elaborately examine trade liberalization policies and the factors of market inefficiency. The paper evaluated (i) the level of protection, (ii) competitiveness of the rice sector, (iii) the impact of liberalization of domestic prices, and (iv) the social welfare impacts of trade liberalization. The indicators computed were (i) degree of protection by estimating Nominal Protection Rate of Output (NPR=100(NPCO-1) and Effective Protection Rate (EPR) given EPR = 100(EPC-1), (ii) competitiveness by estimating Coefficient of Competitiveness (CC) given by CC=1/DRC, (iii) domestic prices and production impacts, and (iv) estimating the welfare effects. Secondary data was mainly used in the study from Department of Agriculture and National Planning Department. The results showed that one rupee worth of resources was used to provide 56 cents worth of rice valued in foreign exchange. The rice production system in Sri Lanka indicted a comparative disadvantage at national aggregate level. However, comparative advantage may exist in some regions with high production potentials.

In a paper examining the competitiveness of cereal production in selected European Union countries, Thorne (2005) measured competitiveness using (i) total costs as a percentage of the value of output, (ii) margin over total costs per 100 kg of production volume, and (iii) margin over total costs per hectare of cereal production. The author

observed that for competitiveness in a system, production phase must be cost-competitive. Cereal production in Italy had the lowest average total costs as percent of output and Ireland had the second lowest. Total costs in France, Germany and the UK were quite similar to the Irish position over the study period. Denmark had considerably higher average total costs as percent of output than the other countries examined.

The measure of competitiveness underscored by Rafeek *et al.* (2002) and Thorne (2005) reviewed the comparable computations and ratios commonly upheld when PAM approach is undertaken. The study therefore prefers assessing competitiveness using degree of protection and coefficient of competitiveness computed from PAM indicators. The computation of margins over total costs per 100kg and per hectare of production could form basis for a new study.

In assessing the competitiveness of Indian Cotton Production, Mohanty *et al.* (2003) employed Policy Analysis Matrix (PAM) approach for different crops, mainly cotton, rice, sugarcane, wheat, rapeseed, groundnut and corn. The construction of PAM was done for different states, namely, Punjab, Haryana, Maharastra, Gujarat and Andhra Pradesh. The data required for construction of PAMs were yields, input costs, marketing prices for inputs and outputs. Transportation costs, port charges, storage charges, production subsidy, import/export tariffs and exchange rate were used to compute social prices. Results on Domestic Resource Cost (DRC) in various states showed that domestic cotton production systems in Punjab, Haryana, Gujarat and Andhra Pradesh had a comparative advantage. Their DRC values were 0.65, 0.96, 0.55 and 0.78, respectively.

Yao (2005) constructed PAMs for the years 1992 to 1995, for different agricultural production systems showing the evolution of Estonia's agriculture. This assisted the agricultural policy makers to identify competitive products with a comparative advantage worldwide. The products were wheat, rye, barley, oats, potatoes, beef, pork, poultry and milk. The decline of agriculture share of GDP was realized due to crop output after full market liberalization. This was mainly attributed to unaffordable input prices, collapse of output prices, withdrawal of state subsidies and the rigid exchange rate policy. NPCs, EPCs and DRCs for wheat, rye, barley, oats, potatoes, beef, pork, poultry and milk were computed. Wheat, rye, barley, oats, potatoes and milk showed their DRCs<1 which implied that they have a comparative advantage over beef, pork and poultry. Pork and poultry had their NPCs>1 which implied policy implemented were protecting pork and poultry, making them uncompetitive, while other products are unprotected and competitive at world market. With EPCs>1 for pork and poultry, the production systems were uncompetitive while other production systems considered had EPCs<1.

The issue of comparative advantage in production of agricultural outputs was comprehensively applied by Yao (2005) and Mohanty *et al.* (2003). These studies tabulated diverse multiple variable use and comparison of PAM indicators successfully. The diverse multiple variables were the states and crops in Mohanty *et al.* (2003) while Yao (2005) study had technologies in different years. Apart from growing rice in MIS, other alternative agricultural crops like French and Soya beans could form a basis for identifying comparable advantage of different outputs in different years. An intensive and

comprehensive comparison of various alternative crops in substitute of rice in MIS as well as comparative advantage evaluation could form another study.

In analysis of economic efficiency and competitiveness of the rice production systems of Pakistan's Punjab, Nadeem Akmal *et al.* (2006) recommended for the removal of existing policy distortions in the structure of economic incentives to enhance economic efficiency and attain farm level competitiveness in rice production. The results indicated that Basmati, the aromatic long-grain rice, had DRC of 0.51 and PCR of 1.03 during 1995/96 to 1999/00. This implied that Basmati had a comparative advantage despite non-competitiveness at farm level.

Maithya *et al.* (2006) constructed PAMs for six production systems. The objective was to determine the profitability of agro-forestry based and *minjingu* Rock Phosphate as soil fertility enhancement technologies for smallholder food production. The findings were that the maize-bean intercrop production system was financially and socially profitable. Hence all the system utilized resources efficiently.

A study to compare the competitiveness of two different technologies by Jasna *et al.*, (2006) used PAM approach. A farming technology A in Croatia for production of strawberry in two years and technology B in Germany for production of the same in one year were compared. This enabled the researchers to compute Domestic Resources Cost (DRC) ratio. The sample sizes from Croatia and German were five family farms from each country. The results showed that technology B of one year maturity applied in

Germany had a DRC 0.64 while Technology A of two years maturity applied in Croatia had a DRC equal to 1.01. Application of Technology B had a comparative advantage over Technology A. Other computable PAM indicators were Nominal Protection Coefficient of tradable inputs (NPCI), Nominal Protection Coefficient of output (NPCO), and Effective Protection Coefficient (EPC), among others.

The review on comparing productivity in respect to different technologies applied was appropriately analyzed by Maithya *et al.* (2006) and Jasna *et al.* (2006). The studies constructed PAM and computation of PAM indicators facilitated decision making on organic or inorganic fertilizers and technologies which could be preferred for increased agricultural output.

CHAPTER 3 – METHODOLOGY

This section discusses the methodology of estimating the PAM elements, mainly revenues and costs both tradable and non-tradable in local and world markets. The author draws heavily from Mukumbu *et al.* (1990) and various working papers of Monke *et al.* (1990).

3.1 Area of Study

The Mwea Irrigation Scheme is home to 4,029 farmers who cultivate rice on more than 15,451 acres. Water is the key input and the water flooding method on paddy rice areas is used. MIS is in Mwea Division, Kirinyaga District in Central province, about 116 kilometres northeast of the capital city Nairobi under the slopes of Mt. Kenya. Figure 3.3 shows the Kirinyaga District Administrative units, with the dark shaded being Mwea Irrigation Scheme sub-locations.

Mwea Irrigation Scheme (MIS) is segmented into five sections, namely, Tebere, Mwea, Thiba, Karaba and Wamumu. The sections are further subdivided into 19, 18, 12, 8 and 7 units, respectively. The 64 units have varying number of farmers from 11 to 146. All sampled sections are in Thiba and Tebere locations in Mwea Division. Tebere has four sub-locations, namely, Mathangauta, Mahiga-ini, Kiarukungu and Gathigiriri while Thiba has Nguka, Thiba, Kiandegwa and Wamumu as their sub-locations. Segmentation is mainly for identification and administrative purposes.

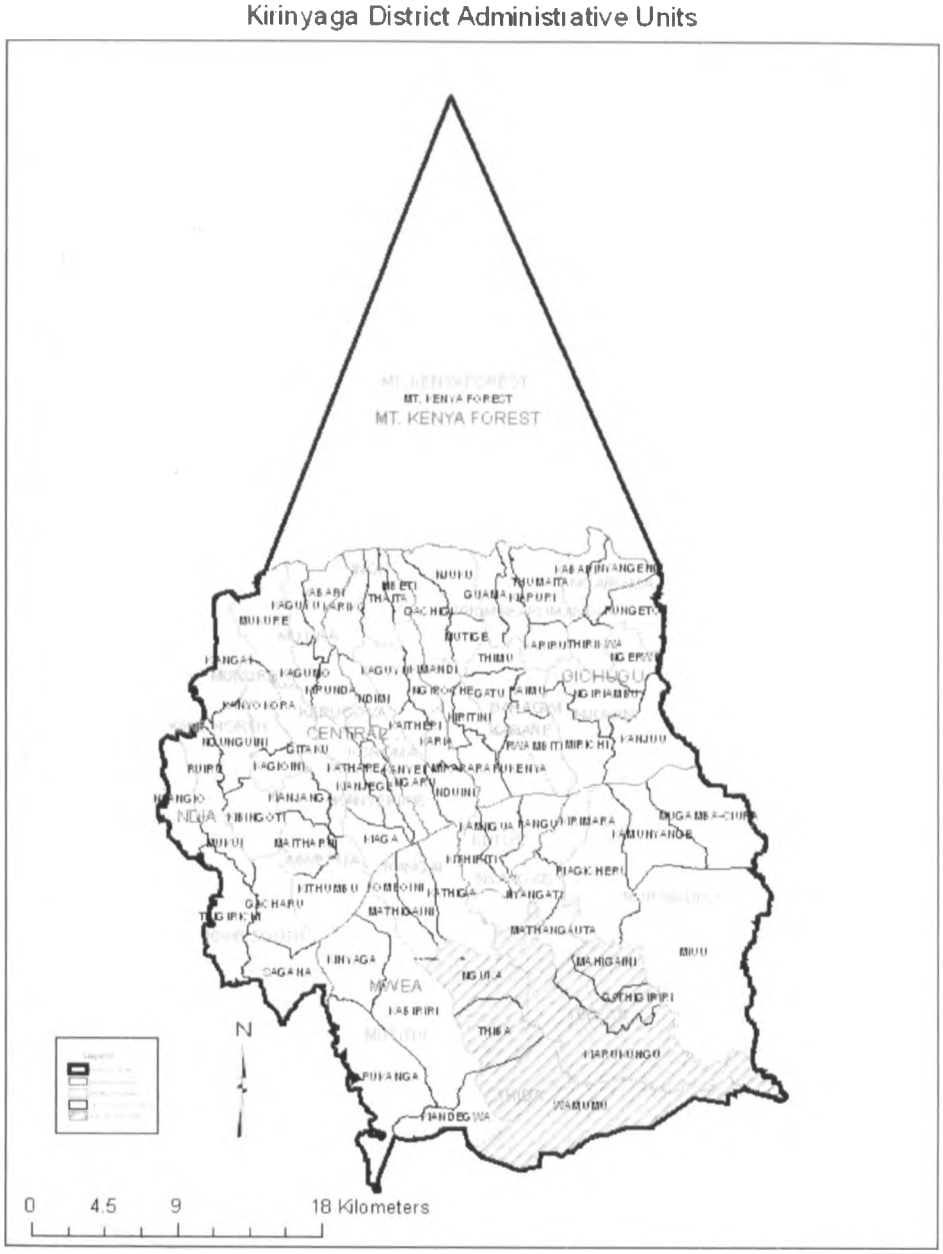

Figure 3-1: Kirinyaga District
Source: Kenya National Bureau of Statistics-Cartography

3.2 Data Sources, Collection and Analysis

The author used both primary and secondary data. Primary data was collected using structured questionnaires designed for farmers (producers), transporters, processors and marketing participants (traders). The comprehensive structured questionnaire was developed and pretested for data collection (Appendix 7-10). The basic information compiled for PAM was yields, input requirements per acre, and market prices of inputs and outputs. Data on transportation, processing and storage costs was also gathered. The secondary data on production/input subsidies and import/export tariffs were gathered from Kenya Revenue Authority (KRA) to derive the social prices.

3.3 Primary data Collection

3.3.1 Sampling Procedures

3.3.1.1 Farmers

In selection of rice farmers to be administered the comprehensive questionnaire, the study preferred purposeful sampling technique selecting randomly one or two farmers from each of the total 64 units. A complete list of 4,029 Mwea Irrigation Scheme farmers consolidated from both National Irrigation Board and Mwea Multipurpose Rice Growers made the study's sampling frame. The MIS was segmented into five sections, namely, Tebere, Mwea, Thiba, Karaba and Wamumu comprising of 868, 812, 818, 723 and 808 farmers, respectively. Further, Tebere, Mwea, Thiba, Karaba and Wamumu sections were subdivided into 19, 18, 12, 8 and 7 Units, respectively. A unit comprised of 11-146

farmers. In Tebere, Mwea, Thiba, Karaba and Wamumu sections, the number of farmers selected was 22, 22, 20, 16 and 13, respectively. Therefore the study had a sample of 93 farmers selected from 64 units in 5 sections cultivating 379.5 acres. The distribution of total acreage was 3654, 3228, 2961, 2715 and 2893 for Tebere, Mwea, Thiba, Karaba and Wamumu, respectively. The rationale of sample selection was based on (i) the assumption that units are homogenous and one or two farmers were representative, (ii) research funds were inadequate for complete coverage.

The primary data on production (output) was gathered in terms of harvested bags per acre which were converted to kilograms and its value at local market rate. The amount of capital borrowed and borrowing interest rate, hired labor and its value (including that of family workers) were recorded. The data on volume and value of inputs, intermediate tradable (fertilizers, oils/diesel) applied by the 93 farmers in 2006/2007 crop year was important to assess the cost of production.

3.3.1.2 Transporters

The list of transporters was compiled by research assistants. This was done with aid of the interviewed farmers to identify the "farm gate to processor" transporters. A list of 68 transporters mainly donkey cart, bull cart, and one tonne to seven tonnes lorry was prepared. All the 68 transporters from various MIS villages, NIB and MMRG were interviewed by administering a transporters' questionnaire.

In the case of transportation of paddy to the milling site, the data from the 68 transporters was collected in Kenya Shillings per kilometer. Transportation cost, handling cost, hired direct labor and pre-processing storage cost was assessed in totality to estimate the cost of paddy transportation. This was captured for those who hired transport and those who owned transport.

3.3.1.3 Processors

The Processors were identified through transporters and door-to-door visits in Kimbembe, Wanguru and Mutithi shopping centres. A list of 37 processors comprised the sampling frame. All the 37 processors were selected for interview.

In processing of paddy rice to either white or brown rice, the cost of processing enquired was on processing labour, processing charges, and cost of processing fuel and/or electricity. The questionnaire was administered to 37 processors within the MIS jurisdiction. The processors were charging their customers in bags (of approximately 85 kgs). Conversion of bags to kilograms content was done to enable estimation of charges of milling per kilogram, selling of bran, husk and broken chicken rice.

3.3.1.4 Traders

Similarly, like in the listing of transporters and processors, the list of traders was gathered by enquiring from the processors who their main customers (traders) were. The second part of the list was done by the research assistants enlisting all the wholesalers in

Kimbembe, Wanguru and Mutithi shopping centres. A list of 32 traders was made. All the 32 traders were interviewed.

In marketing of white and brown rice, 32 wholesaling marketing stores listed were interviewed. The structured questionnaire administered to them comprehensively assessed all marketing costs. The marketing costs included storage, water and electricity, hired labor, cost of borrowed capital for marketing, and insurance.

3.4 Secondary Data Collection

The secondary data were sourced from National Irrigation Board (NIB), Mwea-Multi Purpose Rice Growers Society (MMRG), Economic Surveys (KNBS), National and District Development Plans (MOPND&V2030). Ministry of Agriculture and Kenya Revenue Authority were visited to collect data on subsidies, tariffs and taxes. The data included foreign exchange rate; c.i.f. price of rice; and fertilizers prices transportation and handling cost to Mwea, Central Kenya. The base year for the PAM study was 2006/07.

The data was entered in Census and Survey processing system (CSpro) data entry programme. It was then exported to Microsoft excels spreadsheet tabulating all variables in revenue, output, tradable inputs and domestic factors.

3.5 Empirical model of PAM and description of elements

The empirical PAM model is the simplest logical framework designed to analyze the pattern of incentives influencing producers, transporters, processors and traders. It provides quantitative estimates of the impacts of policies at the microeconomic levels of

production, transportations, processing and marketing. It uses the concept of economic profit. Table 3-1 shows the elements and analytical structure of PAM.

Table 3-1: Structure of PAM

	Revenues	Costs		Profits
		Tradable inputs	Domestic factors	
Private prices	A	B	C	D
Social Prices	E	F	G	H
Effects of Divergences	I	J	K	L

Source: Monke and Pearson (1989)

Letter A represents the value of revenues at local market prices, B is the value of inputs at local market prices and available in world markets, while C is the non-tradable. The private profit is D. The computation of the individual revenue and cost elements E, F, and G is an exercise in efficiency pricing. Efficiency prices for tradable output E and inputs F are represented by the world prices. Efficiency prices of domestic factors G are defined as prices that would prevail if the factors were employed so as to maximize national income. Factor prices are implicitly linked to world market prices even though primary factors are not traded internationally.

Private prices or market values row in the PAM are the observed domestic market prices. Revenues are the total sales of the total quantity of the commodity at the existing local market values. Costs of tradable inputs are costs incurred during production,

transportation, processing and marketing which are sold at the international markets. The inputs are chemical fertilizers, herbicides, gunny bags and petroleum products. Domestic factor costs are land, labor and capital. Others considered under that category are electricity, water and transportation services. These inputs are usually available only in domestic markets. Profit is defined as the difference between revenues and costs i.e. the value of the outputs less the costs of all inputs.

Social prices or efficiency values row in the PAM is intended to show what private costs and returns would be without domestic policies. This row in PAM analysis assesses all policies that affect producer incentives. Desires to alter outcomes in commodity markets are pursued through commodity price policies, namely, taxes, subsidies and quantitative controls (tariffs) that apply to domestic production or trade of the commodity. Another category of policies are macro-policies that affect the whole economy rather than just commodity markets. Macro-policies directly influence prices of labor, land and capital domestically; exchange rates affected domestic prices of international traded commodities relative to non-tradable; and interest rates influence distribution of purchasing power between Government and private sector. Social profit is the difference between total social revenue and total social input costs all measured at social efficiency prices. The relevance of world prices as efficiency prices comes from international trade theory stating that, setting domestic prices equal to world prices allows the economy to exhaust potential gains from trade and realize maximum national income. Maximum national income involves the production of commodities at world prices.

Market failure must be considered if efficiency prices were to represent the prices that would generate maximum total income. Market failures were in three categories: (i) imperfect competition, in which a small number of sellers or buyers are able to influence aggregate supply or demand and therefore exert some influence on market prices; (ii) externalities such as pollution, transport and communications infrastructure, such that producers are unable to charge consumers for the full value of the things that they produce or producers do not pay all the costs associated with production; (iii) institutional failures, where markets were inadequately developed or do not exist due to lack of rules and regulations to ensure fair play. This was recognized significantly in factor pricing (labor, land and capital).

Effects of divergences (policy distortions and market failures) row in the PAM are the differences between the private market value and the social efficiency value defined as the net effect of divergences. From the third row (Table3.1), an analyst or policy maker can identify the most distorting policies and how one distortion complements or contradicts other distortions affecting the agricultural activity. When the values of divergences are dominated by policy distortions, the final row of the matrix is the effect of policies.

The aggregate impact of divergences on the incentives facing the producer is represented in two ways: (i) as the difference of the elements in the third row, and (ii) as the difference between private and social profits. The results determined the source of

competitiveness, whether the activity was profitable because of the support of policy or because of natural comparative advantage.

Private profits (D) equals to the revenue at market prices (A) less value of tradable inputs (B) and domestic factors (C) while social profits (H) is given by the social revenue (E) less tradable inputs at world prices(F) and domestic factor (G) at social prices. Output Transfers (I) equals to the difference between revenues at local and world market prices while Input Transfers (J) equals to the value of tradable inputs at local market (B) less its value at world market (F). Domestic Factor Transfers (K) is given by the difference between the value of domestic factors at local (C) and world (G) market prices. Net Transfer (L) is either the difference between private profits (D) and social profits (H) or output transfers (I) less total costs transfers (J+K).

3.6 Rice Production Microeconomic Stages

The identified stages in the rice production system are production, farm gate to processing, processing, and marketing of wholesale processed rice. Figure 3-2 is the microeconomic stage PAMs, where the summation of stage PAMs produced the composite rice production system PAM whose results assessed the profitability and competitiveness of Mwea rice production.

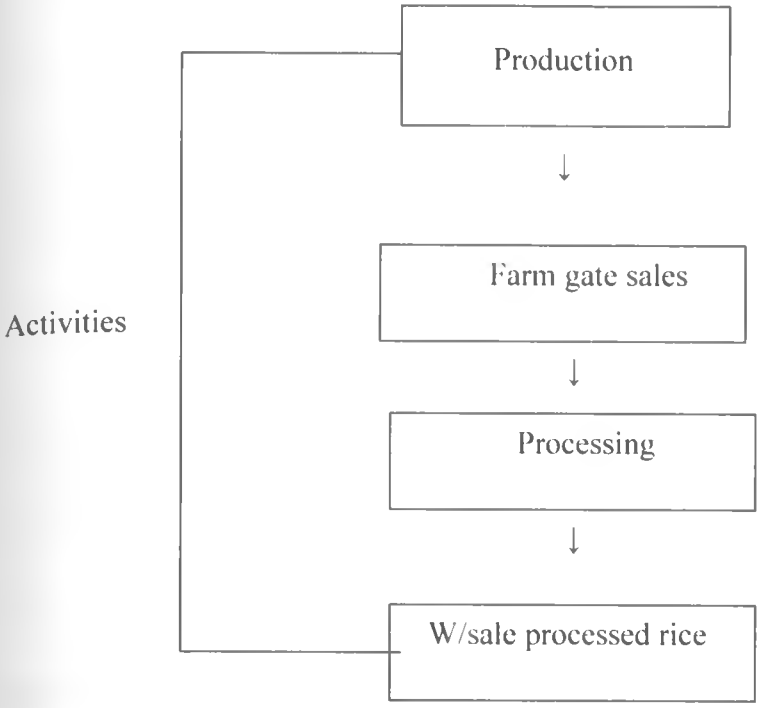

Figure 3-2: Micro-Economic Stages
Source: E. Monke and S. Pearson (1989).

Figure 3-3 illustrates the micro-PAMs and their units. PAM 1 structure entails costs of inputs and values of outputs of production of paddy rice in Kshs/acre, while PAM 2 consolidates transportation costs from farm gate to milling services of paddy rice in Kshs/paddy bag. PAM 3 estimated the processing costs of paddy rice (Kshs/kg), while PAM 4 showed the marketing outlay of milled rice (Kshs/kg). The final PAM formed the composite or summed up costs of the rice production system. L>0 estimated the profitability of the rice production system.

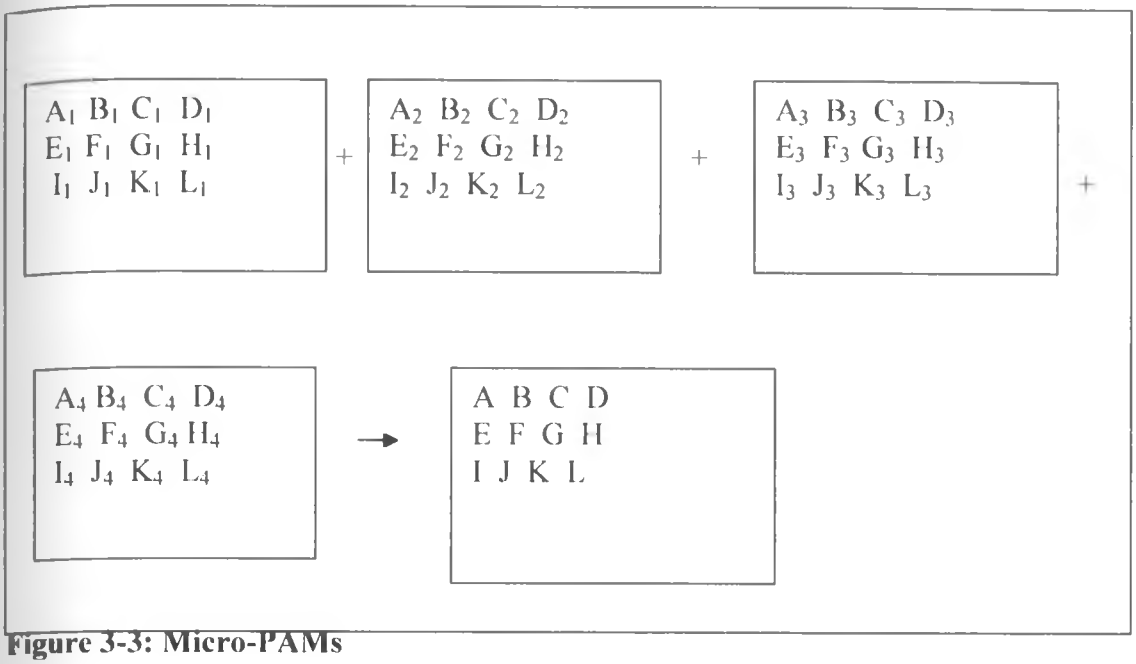

Figure 3-3: Micro-PAMs

Source: E. Monke and S. Pearson (1989).

The Composite PAM was achieved by using conversion ratios to a common unit of measure. Table 3-2 illustrates the conversion ratios of various units during the study so that the four micro-PAMs results are comparable in Kshs/kg of milled rice.

3.7 Estimation of World prices for tradable output (=E)

The world market prices for rice in Mwea was estimated as Px=Pcif*ER+IC, where Px is the parity import price of rice, Pcif is the Cost insurance freight (cif) price for rice at the port of Mombasa, ER is the foreign exchange rate to convert world prices to domestic currencies, and IC are internal handling costs, mainly port handling charges, storage costs and transportation costs. Computation of Parity Import Price for Rice in MIS for 2006/07 is shown in appendix 7-7.

Table 3-2 Conversion ratios

Activity	Original units of Measure for activity	Conversion ratios for activity and secondary product revenues	Adjusted units of measure for activity
Farm	Kshs/acre	(Acres/kg paddy)*(kg paddy/kg rice)	Kshs/kg rice
Farm Gate-to-Processor	Kshs/kg paddy	(kg paddy/kg rice)	Kshs/kg rice
Processing	Kshs/kg paddy	(kg paddy/kg rice)	Kshs/kg rice
Marketing	Kshs/kg rice	none	Kshs/kg rice

Source: Researcher's computation

3.8 Estimation of World Prices for Tradable Commodity input

The tradable input commodities (F) were gunny bags, chemical fertilizers, herbicides, diesel, petrol, lubrication oil and grease. The fertilizers were Double Ammonium Phosphate (DAP), Sulphate of Ammonia (SA), Tri-super Phosphate (TSP) and Urea. The tables of parity import price for chemical fertilizers are in appendix 7-8 while those for fuel and oil are in appendix 7-9.

3.9 Estimation of Efficient Prices of Domestic Factors

One way of arriving at the social price equivalent of non-tradable input was by adding subsidies and subtracting taxes from its private price (Morris, 1989). A rule of thumb

presupposes private market costs can be decomposed evenly into one third capital, one third tradable and one third labour. The social prices for domestic factors (land, labor and capital) were represented by opportunity cost (Morris, 1989). In principle, the social value of land should be equal to its highest alternative productive use. It could also be estimated from its rental value where a competitive market for leasing or renting land existed. During the period covered by the study, the leasing or renting rate per acre was an average of kshs 22,827.96 per year. In this study, cost of land was excluded, mainly because (i) it would overestimate domestic factors and minimize the reported profit, and (ii) paddy fields are rice-specific fixed asset.

For capital items, the social price was the opportunity cost of capital, which was estimated by the real interest of borrowing from lending institutions (Monke and Pearson, 1989). The interest rate was the payment for use of capital. The real interest rate was nominal interest rates (observed interest rate) less the rate of inflation in the country. The following formula 3.1 would have been used to estimate the real interest rate.

$Ir = \{(1+In)/(1+f)\}-1 \ldots (3.1)$

Where, Ir = real interest rate; In = nominal interest rate; and f = inflation rate.

In Kenya, interest rates were liberalized in 1993; the nominal interest rate was 13.74% per annum (Republic of Kenya, Economic Survey, 2008).

An agricultural labor market structure would be said to be competitive if the following assumptions were fulfilled: (i) there exists a large number of sellers and buyers; (ii) product homogeneity; (iii) free entry and exit of firms; (iv) the goal was profit maximization; (v) no Government regulation; (vi) perfect mobility of factors of production; and (vii) perfect knowledge. The observed daily wage rate would be the shadow price of labor. Generally, in a perfectly competitive economy, the shadow price of labor would be equal to the wage rate. The average wage rate in MIS was Kshs 200 per day including lunch meal. Place *et al.* (2000) have shown that agricultural labor market in Kenya was competitive; thus, the average observed wage rate during this study reflected supply and demand conditions.

3.10 Sensitivity Analysis

PAM analysis method for assessing the Government intervention, market failures, and efficiency of input utilization had advantages of: (i) does not require time series data, and (ii) it quantified the divergences with the applicable currency among others. PAM framework gave results that are static in nature. To overcome this shortcoming, sensitivity analysis was carried out. The analysis provided a way of assessing the impact of changes in assumptions on profitability. In a liberalized economy, the value and costs of the output and the inputs were most likely to fluctuate. The effects of varying output values and input costs above or below within a range of about 10% would show the economic stability of the system. For example, if the price of output fluctuated by 10 per cent above or below, the paddy price per kg would increase or decrease from the initial observed private prices.

CHAPTER 4 – RESULTS AND DISCUSSION

This section discusses the results obtained and computed indicators from the MIS case study. The rice production system in MIS during 2006/07 crop year was profitable both in local and world market at Kshs 33.66 and Kshs 23.56 per kg, respectively. The policies implemented prior to cultivation influenced increase in producer prices in 2001 to 2006 (Appendix 7-3). Traces of market inefficiency were evident due to inconsistent social parity prices of tradable inputs from Schedule I and schedule II shown in Table 4-1.

4.1 Descriptive Analysis

The observation from all the sampled rice farmers was that, storage of paddy rice was not practiced. This developed a market glut during harvest season, consequently lowering the paddy price per bag. Paddy rice storage and hoarding would regulate the paddy rice supply in the market by reducing fluctuations in supply. The demand and supply market forces would raise the farm gate prices.

The main activities assessed in production phase were cost of leasing and labour, ploughing, transplanting of seedlings, weeding and harvesting as shown in Table 4.2. The cost of production ranged from Kshs 25,000 to Kshs 56,520 with an average of Kshs 36,736 per acre. Farmers' output was an average of 26 paddy bags per acre with revenue earnings of Kshs 66,541 per acre per crop year. The tradable input costs of gunny bags, smithion, Di-ammonium Phosphate (DAP), Sulphate of Ammonia (SA), Urea and Tri-sulphate Phosphorous (TSP) was estimated at Kshs 4,962 consisting 16.6% of the total cost.

Table 4-1: Prices used for valuation of outputs and inputs

	Private	Social	
Output/inputs	Kshs/kg	Kshs/kg	
Gunny bags	31.5	22.23	
White rice Broken	30	17.52	
White rice Pishori	67.7	44	
Chemical Fertilizers		Schedule I*	Schedule II**
DAP	31.25	24.35	31.25
SA	24.19	24.35	24.19
Urea	25.57	20.41	25.57
TSP	30.14	21.72	30.14
Herbicides			
Smithion	820	780.95	
Petroleum Products		Schedule I*	Schedule II**
Diesel	65	0	52
Petrol	75	0	44.38
Lubrication Oil	129.99	0	93.52
Grease	200	0	143.88
Memorandum items			
Exchange rate	1US $= 72.05	1US $= 72.05	Exchange rate
Interest rate	13.74	13.74	Interest rate

Source: Researcher's computation

* Schedule I entailed import/export parity table listing total internal handling costs, levies and adding profit margin as shown in Appendix 7-7 to 7-10.

** Schedule II displays the addition of subsidies and subtraction of exercise duty, custom and value added taxes.

The un-tradable input costs, which mainly consisted of labour, water and ploughing were valued at Kshs 24,851 per acre. The un-tradable input costs share of 83.40% was predominantly from the leasing cost which contributed 80.50%. The profit at market price was computed as Kshs 29,805 per acre per crop season, hence Mwea rice production is a cost effective and a profitable activity.

Table 4-2 Rice Production costs per Acre

	Leasing	Ploughing	Transplanting	Weeding	Harvesting activities
Mean	22,827.96	2,461.40	1,570.81	3,099.89	6,775.96
Standard Error	304.49	14.48	42.76	173.86	207.16
Median	22,000	2,500	1,500	2700	6670
Mode	20,000	2,500	2,000	2,000	5450
Standard Deviation	2,936.37	139.62	412.37	1,676.63	1,997.78
Minimum	20,000	1,800	0	750	2,450
Maximum	30,000	3,000	2,400	9,600	11,520

Source: Researcher's computation

The cost of transporting a paddy bag (approximately 85 kg) ranged Kshs 50-120 with an average of Kshs 58.40 as shown in Table 4.3. The revenue earned by transporting a paddy tonne was estimated at Kshs 1,014 with a tradable and un-tradable input cost of Kshs 66 and Kshs 335 per tonne, respectively. The tradable inputs were petrol, diesel, lubrication grease and oil, while the un-tradable inputs comprised labour and maintenance of the carrying cart or vehicle. The activity was profitable with an estimate of Kshs 613 per tonne.

Table 4-3: Paddy transportation Cost per bag (KShs)

Mean	58.38
Standard Error	2.97
Standard Deviation	24.53
Minimum	0
Maximum	120

Source: Researcher's computation

The costs of activities during processing phase are shown in Table 4.4. In processing of rice, the input costs had an average of Kshs 34,730.22 per month. The milling earnings ranged from Kshs 60 to 207 per bag with an average of Kshs 96.37 per bag. The earnings per bag were estimated at Kshs 134.19, which included earnings from bran and chicken broken rice. The tradable and un-tradable costs incurred by processors were Kshs 16.94 and Kshs 41.50 per bag, respectively. The profit from the milling activity was Kshs 75.74 per bag, or 56.40% of earnings (Kshs 134.19).

Table 4-4: Rice milling costs incurred by processors (Kshs)

	Milling cost/bag	Fuel-Electricity/Month	Oil/Month	Machine Operator/Month	Security/ Month	Operational days/Month
Mean	96.37	24,767.11	1,301.13	4,629.53	4,008.34	24.11
Standard Deviation	28.84	22,583.4	1,760.85	30,85.36	14,017.62	5.22
Minimum	60	1800	0	0	0	8
Maximum	207	93,600	9,120	17,840	87,450	30

Source: Researcher's computation

The revenue of traders from processed rice was estimated at Kshs 11.03 per kilogram. The tradable and un-tradable input costs were Kshs 0.47 and Kshs 4.34 per kilogram which was a 42.6% of the earnings. The profit was Kshs 6.22 per kilogram, more than 50% margin of the revenue. Table 4-5 assessed the recurring expenditure on store rent monthly.

Table 4-5: Traders Store rent per Month (market participants)

Mean	26,335.63
Standard Deviation	65,504.60
Minimum	0
Maximum	360,000

Source: Researcher's computation

4.2 Sensitivity Analysis

The analysis provides a way of assessing the changes in fluctuation of profitability. In a liberalized economy, the value and costs of the output and the inputs are most likely to fluctuate. In Table 4-6, the increase or decrease of farm gate price of 10 per cent showed respective increase or decrease of the financial profitability of rice production of a similar margin. Similarly, an increase or decrease of costs at the same 10 per cent margin showed respective decrease or increase of financial profitability at 10 per cent. The financial profitability is the direct income for rice farmers. The profit change is higher with decrease or increase of output prices at a simulation level of 10% than decrease or increase of input costs. This therefore shows that financial profitability of rice in MIS is highly sensitive to changes in output prices and input costs.

Table 4-6: Simulated Effects of Change in input /output prices

Rice Production per acre (Kshs)				
Simulations	Revenue	Costs	Profits	%change
Paddy Price				
Initial	66,541	29,813	36,728	0
Decrease of paddy price/kg at 10%	59,894	29,813	30,081	-18.1
Increase of paddy price/kg at 10%	73,189	29,813	43,376	18.1
Costs				
Initial	66,541	29,813	36,728	0
Decrease of Costs at 10%	66,541	26,832	39,709	8.12
Increase of Costs at 10%	66,541	32,794	33,747	-8.12

Source: Researcher's Computations, 2007

The Tables 4-6(a), (b) and (c) shows the revenues, costs and profits of the farmers, transporters, processors and traders of the rice production system in Mwea Irrigation Settlement Scheme. Table 4.6 (a) showed the observed market prices of all the rice production system phases. In production phase, a farmer made a profit of Kshs 36,728 per acre per crop season while transportation gains were Kshs 613 per tonne. Milling rice was profitable at Kshs 75.74 to an 85 kg paddy bag while traders realized a profit margin of Kshs 6.22 per kg.

Table 4-6(a) Private Prices of Rice Production System in 2006/07

Activities	Private Prices			
	Revenue (**A**)	Tradable inputs (**B**)	Domestic Factors (**C**)	Profits (**D**)
Production level in Kshs per acre	66,541	4,962	24,851	36,728
Farm Gate to Processing mills in Kshs per paddy tonne	1,014	66	335	613
Processing in Kshs per paddy bag (approx. 85kg)	134.19	16 94	41.5	75.74
W/Sale Processed rice in Kshs per kg.	11.03	0.47	4.34	6.22
Rice Production System in Kshs per kg	60.57	4.28	22.63	33.66

Source: Researcher's computations 2007

The social prices of rice production system are shown in table 4.6 (b). These were the prices computed excluding tariffs and subsidies prevailing in the Kenyan market, that is, the world market prices that would prevail if no intervention policies were instituted. The social profit of producing rice was Kshs 25,515 and transportation profit was Kshs 444 per tonne. Thus both profits were lower by a margin of 31% and 28%, respectively. In processing and trading phases, social profits were again lower than observed private prices.

Table 4-6(b) Social Prices of Rice Production System in 2006/07

Activities	Social Prices			
	Revenue (**E**)	Tradable inputs (**F**)	Domestic Factors (**G**)	Profits (**H**)
Production in Kshs per acre	47,408	4,188	17,705	25,515
Farm Gate to Processing mills in Kshs per paddy tone	723	40	239	444
Processing in Kshs per paddy bag (approx. 85kg)	95.61	13.48	29.57	52.56
Wholesale Processed rice in Kshs per kg	7.86	0.31	3.09	4.45
Rice Production System in Kshs per kg	43.17	3.48	16.13	23.56

Source: Researcher's computations, 2007

Table 4.6 (c) shows divergences between private and social prices, which were all positive. The observed private prices of all phases, namely, production, transportation, processing and marketing were higher than the computed social prices.

Table 4-6(c) Effects of Divergences on Rice Production System in 2006/07

Activities	Effects of Divergences			
	Revenue (I)	Tradable inputs (J)	Domestic Factors (K)	Profits (L)
Production in Kshs per acre	19133	774	7146	11213
Farm Gate to Processing mills in Kshs per paddy tonne	292	26	96	169
W/Sale Processing rice in Kshs per kg.	38.58	3.47	11.93	23.18
W/Sale Processed rice(Kshs/Kg)	3.17	0.16	1.25	1.76
Rice Production System in Kshs per kg	17.4	0.8	6.51	10.09

Source: Researcher's computations, 2007

4.3 PAM Indicators

The composite PAM constructed to assess the competitiveness of Mwea Rice Production system in Kenya is presented in Table 4-7. The elements in this table are used to compute the concluding indicators for informed decision-making.

Table 4-7 Rice Production System in MIS (Kshs per kg)

	Revenues	Costs		Profits
		Tradable inputs	Domestic factors	
Private prices	60.57 A	4.28 B	22.63 C	33.66 D
Social Prices	43.17 E	3.48 F	16.13 G	23.56 H
Effects of Divergences	17.40 I	0.80 J	6.50 K	10.10 L

Source: Researcher's Computation, 2007

4.3.1 Net Transfer (=L)

This was the principal result of the PAM approach. The Net transfer denoted by L and expressed by an identity (D-H) = (I-J-K) equal to 10.10>0 in the rice production system in MIS. The value showed the inefficiency in the system. The market inefficiency contributed a large source of the net transfer, thus price, investment and regulation policies would require long-term Government effort to permit the economy to operate efficiently. The financial profit (D = 33.66>0) implied the system generated profits under the current policy, and thus market conditions were competitive. The social profit (H = 23.56>0) was positive, which implies that the system made profit even without benefiting from subsidy or tax constraints, and the system therefore has comparative advantage.

4.3.2 Domestic Resource Cost (DRC)

DRC was the cost in domestic resources of earning a dollar (in value-added) of foreign exchange divided by the exchange rate. DRC was computed as domestic factor cost at social prices/Value added measured at social prices (G/E-F). Domestic Resource Cost

was equal to 0.41<1. This meant that the system in MIS cost less than a dollar of domestic resources to earn a dollar of foreign exchange. The Coefficient of Competitiveness (CC=1/DRC= 2.46) indicated that one shilling worth of resources were used to produce Kshs 2.46 worth of rice valued in foreign exchange and therefore had a comparative advantage. DRC was a social cost-benefit ratio, which helped determine the desirability of domestic rice production system in MIS relative to the international market in terms of economic efficiency. Domestic factor cost was the opportunity cost of the domestic resources involved in the production of rice. The benefit was the value-added generated by the resources measured at social prices.

4.3.3 Private Cost Ratio (PCR)

The ratio of domestic factor costs (C) to value added in private prices given by PCR =C/A-B of 0.40<1 shows that the system was competitive. The private cost ratio showed that the system could afford to pay domestic factors and still remain competitive earning normal profits, where A-B-C=D=0. The entrepreneurs in the system earned excess profits (D>0) by reducing factor and tradable input costs.

4.3.4 Nominal Protection Coefficient on Tradable output (NPCO)

NPCO (A/E) was defined as the ratio of the domestic market price to the border parity of a commodity. NPCO provided a summary indicator of all the Government's interventions on the system of rice production that prevents equality between the domestic price and the border parity price of rice. NPCO was equal to 1.40>1, i.e.

private price of output was greater than the social price. The degree of protection based on the estimated Nominal Protection rate of output (NPR=100(NPCO-1) was 40%. This result showed that the country's trade–restrictive policy had permitted the private price to be 40 per cent higher than without policy.

4.3.5 Nominal Protection Coefficient on Tradable input (NPCI)

NPCI allowed the author to contrast the effects of distorting policies on tradable-input costs in two or more agricultural systems that produces either identical or dissimilar tradable outputs. NPCI (B/F) was defined as the ratio of the domestic market price to the border parity of the tradable input. NPCI was equal to 1.23>1, i.e. the private price of the tradable input was greater than the social price. This NPCI greater than 1 denoted a negative transfer because input costs were raised by the policy.

4.3.6 Effective Protection Coefficient (EPC)

Effective Protection Coefficient ((A-B)/ (E-F)) measured the total effects of intervention in both the output and input markets. It was defined as the ratio of value-added measured at private prices to that at social prices. Effective Protection Coefficient was equal to 1.42>1, while Effective Protection Rate (EPR = 100(EPC-1)) was 42%. This meant that the net impact of policies allowed value added in private prices to be 42 per cent greater than the value added without policies. The overall impact of the existing commodity and factor price policies resulted in a net positive incentive and a higher protection rate in production of rice at MIS at the expense of consumers.

4.3.7 Profitability Coefficient (PC)

The Profitability coefficient (D/H) was equal to 1.43>1. This measured the degree to which net transfers have caused private profits to exceed social profits. Either policy transfers or capital market failures have caused private profits to be 43 per cent higher than social profits. This provided an indication of the total incentive effect of policies including those influencing factor markets.

4.3.8 Subsidy Ratio to Producers (SRP)

The subsidy ratio to producers (L/E) was equal to 0.23<1. It was the ratio of the net transfer to the social value of revenues. This showed how large the net transfer from divergences was in relation to the social revenues of the system. The smaller the subsidy ratio to the producers, the less distorted the agricultural system. Rice production system was highly distorted at 23 per cent. Secondly, it also meant that the output tariff-equivalent required to maintain the existing private profits if all other policy distortions and market failures were eliminated was 23 per cent. Subsidies of value greater than 20 per cent on farm output in developing country like Kenya would be interpreted as high.

CHAPTER 5 – SUMMARY, CONCLUSIONS AND RECOMENDATIONS

5.1 Summary

Rice consumption in Kenya has been increasing, with two-thirds of the national demand being filled by imports. The production was decreasing mainly because of input factors whose supply was expensive, and low in quantity and quality. In marketing rice, MIS was open for all since liberalization was instituted eighteen years ago. This brought changes with the price of paddy rice doubling and consumer prices rising significantly.

The study identified various policies which were directly or indirectly related to the consumption, marketing and production of rice in the country. Their outcome led to market inefficiency with an impact of uneven distribution of earnings to farmers, transporters, processors and market participants.

The Policy Analysis Matrix (PAM) approach of assessing the competitiveness of rice production system in MIS provided a reliable and relatively accurate method. This was due to the fact that it compared the observed prices at local market with the computed social prices. The prices observed also reflected the effects of market imperfections and policy distortions while social prices had no domestic influence.

The results showed that rice production in MIS was protected although procurement of inputs and marketing of output was liberalized. The liberalization objective was to promote high production and sufficiently provide food for Kenyans. Even with entry of Yala swamp rice irrigation which produced 5,000 MT in 2006/07, the objective was not

met due to the fact that consumption of rice per capita was rising faster than production of rice in the country.

5.1.1 Market inefficiency

The producer prices are the result of concurrent domestic conditions, including government policies and transaction costs, and a variety of factors contributed to inefficient production and factor allocation in MIS. These included (a) lack of a functional basic transport infrastructure including roads within the paddy fields, (b) the precarious state of input/output distribution channels, and (c) inadequate institutions providing competitive services and market and technological information to farmers.

Despite those detrimental factors, rice production system in Mwea Irrigation Settlement Scheme (MIS) was financially and socially profitable. The financial and social profitability reflected market imperfection. This was supported by the fact that (i) profit margins assessed in the four phases of the system were relatively high; and (ii) financial and social profits were not equal to zero. The MIS farmers are taxed by their inadequate business environment in which they operated and traded.

5.1.2 Macro and trade policies

The macro and price policies implemented by the Government were positive incentives for rice farmers to increase their production. The effective policies implemented were liberalization of farm input and output prices, exchange rate, interest rate, and low import

tariff on cereals, among others. The effects of policies on tradable inputs (mainly fertilizers, petroleum products) had negative impact on rice producers. This was identified by observing that private prices were higher than social prices in the system, and consequently deriving a positive transfer to importers due to the distorted policies. The two kinds of policies causing divergences were product-specific and exchange-rate.

5.2 Conclusion

Using various modeling methods, the study established that low cost of production, efficient processing and share in either constant or shift market analysis are useful measures of competitiveness. In reference to Appendix 7-1, the share of rice production in the country is on decline while imports carry the larger share at 84%. This observation leads to conclusion that MIS production system is **not competitive**. With the use of OECD and gravity method, the data in rice export volumes and prices needed to facilitate regression analysis were not available, and such a model was therefore not applied. *Dairy excel* of Ohio University documented 15 measures of competitiveness with a strong emphasis on Net Farm Income From Operations (NFIFO) as a percentage of farm revenue with all labour paid and not paid. In crop production, this is applicable although it does not clarify the cut-off level for identifying competitiveness and vice versa.

In PAM approach, a PCR of $0.40<1$ meant that the system could afford to pay domestic factors and still remain **competitive**, earning excess profit $D>0$. Similarly, a DRC of $0.41<1$ meant that the system is **competitive**, costing less than a dollar of domestic resources to earn a dollar of foreign exchange. In contrary, an NPCO of $1.40>1$, NPCI of

1.23>1 and EPC of 1.42>1 reveals that rice production system in MIS is highly protected by a degree of 42%. Thus, despite the fact that rice farmers in MIS are making profits in the local market and it costs less than a dollar to make one dollar, rice produced in Mwea is not able to sustain its market share and hence cannot sell in the world market (**non-competitiveness**).

5.3 Recommendations

Based on the findings from the study, the following recommendations are suggested for the sub-sector to expand: -

1. Kenyan market is high in competition with marketed basmati rice imported from various rice producing countries of the world. Mwea irrigation scheme basmati rice must be produced, transported, processed and marketed competitively (relatively low cost and of high quality). The available technology demands that during the vegetative phase and spikelet development, rice seedling must be flooded with water for a healthy and better harvest. Water is the main input to competitive production and hence water supply must be competitively supplied (at low cost), which also implies enough water supply and storage. This warrants development of a water reservoir upstream to improve supply of water flooding in increased number of paddy fields (in Ng'othi, Kiarukung'u and Kiamanyeki out growers) consequently operationalizing rice production system competitively. In long run, no protection of any magnitude will be necessary to boost ability of water payment by the farmers. The water charges levied by the NIB can be reviewed down way which will embrace a competitively sustainable rice production system in Mwea irrigation Scheme.

2. Relaxation of the current restrictive policy on imported broken rice and Basmati type to enable price stability in the market. This would reduce the effects of high protection in the rice production System and permit the private price to be less than 40 per cent higher than without policy.

3. The study revealed that the effects of policies and market inefficiency in the Kenyan market led to input transfers to a level of **23%**. In order to encourage investment into the market and promote rice production, a balance must be struck between the interests of farmers and traders. A policy in favour of investors must be instituted so that investments can make a minimum excess economic profit of **10%** for sustainability. In addition, an introduction of **13%** subsidy on tradable inputs (chemical fertilizers and herbicides) be implemented to cushion farmers on observed high input transfers to importers. This would increase rice production and sustainably avoid input shortages hence enhancing competitive production.

4. For the rice production system to be competitive in the Kenyan market, both tradable and none tradable inputs must be competitively acquired. The competitiveness of inputs includes the price of money required to procure fertilizers, machinery, petroleum products among others. For cost of money to be competitive, promotion of an agricultural-based financial institution with incentives for farmers is critical. This low cost of credit would inherently contribute to low cost expenses in all phases of the rice production system. The introduction of Rice Farming Fund would

competitively stabilize the price of credit and in turn enhance competitiveness in the rice production system. Rice Farming Fund management would be bestowed on parastatal and or quasi-Government banks, namely, Agricultural Finance Corporation, Kenya Commercial Bank, Cooperative Bank, Consolidated Bank and National Bank of Kenya. This would also expand the financial market and reduce market inefficiencies, and thus lubricate the pricing mechanism of credit to rice farmers. In the long run, protection of rice farmers in Mwea will be retrogressive if credit facility as envisaged above is sustainably and competitively supplied.

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Appendix 7.1: Rice Production and Importation 2001-2006

		2001	2002	2003	2004	2005	2006
Production	Milled Rice(MT)*	32,843	10,455	23,850	31,750	41,785	41,991
Importation	Broken Rice(MT)	18,610	24,573	25,571	47,907	125,222	129,306
	Milled Rice (MT)	87,082	112,793	111,848	143,508	97,960	98,900
Total Consumption (MT)		138,535	147,821	161,269	223,165	264,967	270,197
Kenya Population projected (mns)		30.2	30.9	31.5	32.2	32.8	33.4
Per capita rice consumption (Kg/person)		4.587	4.784	5.12	6.931	8.078	8.09

*1kg paddy rice processed produces about 2/3 kg milled white rice.

Source: FAO country trade importation data, Economic Survey 2006, Statistical Abstract 2006.

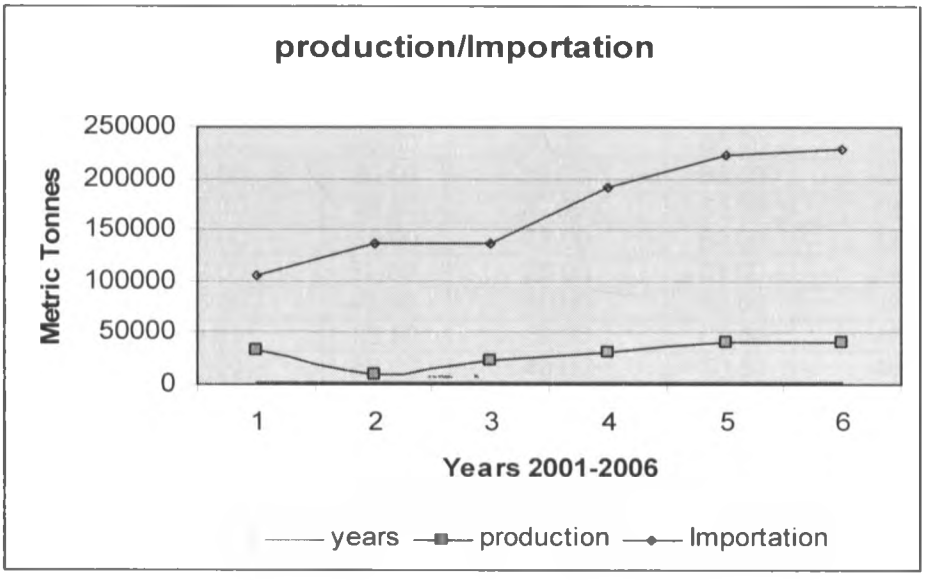

Figure 7-1

Source: Appendix 7-1

Appendix 7-2: Mwea Irrigation Settlement Scheme (production, area and payments)

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Area cropped (Ha)	10,590	6,054	15,800	10,000	10,000	10,332
Plot-holders (no.)	3,381	3,835	3,200	3,400	5,400	5,400
Gross value of Output (Kshs mn.)	1,238	183	889	1,250	1,786	1,775
Payments to plot holders (Kshs mn.)	00	00	573	776	1,066	1,009
Total Paddy (Tonnes)	45,810	14,802	35,550	46,875	59,520	57,422

Source: Economic Surveys 2006, Statistical Abstract 2006.

Appendix 7-3 Trend of Average Annual Rice Prices

	Producer prices per kg		W/sale prices per kg		Retail prices per kg	
Years	Basmati	BW 196/IR2793	Basmati	BW 196/IR2793	Basmati	BW 196/IR2793
1987	4.00	3.00	50.00	30.00	60.00	35.00
1988	4.00	3.00	50.00	30.00	60.00	35.00
1989	5.00	3.10	50.00	30.00	60.00	35.00
1990	5.40	3.70	50.00	30.00	60.00	35.00
1991	5.40	3.70	50.00	30.00	60.00	35.00
1992	6.50	4.50	50.00	30.00	60.00	35.00
1993	7.40	5.20	50.00	30.00	60.00	35.00
1994	7.40	5.20	50.00	30.00	60.00	35.00
1995	7.40	5.20	50.00	30.00	60.00	33.25
1996	15.00	10.00	50.00	30.00	60.00	39.50
1997	15.00	10.00	50.00	30.00	60.00	37.50
1998	25.00	15.00	55.00	30.00	65.00	40.50
1999	30.00	15.00	55.00	30.00	65.00	43.50
2000	30.00	22.00	55.00	30.00	65.00	42.20
2001	25.00	15.00	55.00	22.00	62.00	32.50
2002	25.00	12.00	57.00	28.00	61.00	34.50
2003	27.00	15.00	46.00	30.00	62.00	35.50
2004	27.00	20.00	62.50	40.00	65.00	49.15
2005	30.00	17.00	66.00	40.00	70.50	48.25
2006	30.00	15.00	66.00	40.00	75.00	49.00

Source: NIB, MMRG and Consumer Price Index Section (KNBS)

Appendix 7-4 F.o.b. Price for Rice Asia Ports

	Fob. Bangkok
Years	US $/ton
2001	297
2002	299
2003	305
2004	307

2005	311
2006	313
Total	1832
Average	305

Source: http://www.foodmarketexchange.com/data center/product/grain/rice on 30-11-2007 Division of Agriculture, University of Arkansas.

Appendix 7-5 Average Exchange rate for 1US$

Average Months	Kshs
Jan-06	71.982
Feb-06	73.198
Mar-06	71.872
Apr-06	71.158
May-06	72.270
Jun-06	73.880
Jul-06	73.617
Aug-06	72.624
Sep-06	72.679
Oct-06	72.020
Nov-06	69.948
Dec-06	69.397
Average	72.054

Source: Central Bank of Kenya

Appendix 7-6 F.o.b. Price for Chemical Fertilizer Black sea Ports

	F o b. (DAP,SA)	F o b. (UREA)	F o b. (CAN/TSP)
Years	US $	US $	US $
2001	122	96	119
2002	100	94	111
2003	185	139	140
2004	228	175	167
2005	241	220	186
2006	246	223	211
Total	1122	947	934
Average	187	158	156

Source:

http://www.yara.com/en/investor_relations/analyst_information/fertilizer_prices/index.html 10-11-2007 .

Appendix 7-7: Estimation of Import Parity Price in Kshs of Rice in Central Kenya, 2006	
Fob Thailand(five year average from 2006)	305
Freight rate to E/Africa US$(10% of F.O.B.)	31
Insurance (1% of C and F)	3.1
c.i.f. Mombasa (US$/ton)	339.1
Exchange rate (twelve month average)	72.054
Estimated c.i.f. Mombasa (Kshs/ton)	24,433.50
IDF fees (2.75% of C and F) (Kshs/ton)	671.9
Stevedoring (Kshs/ton)	1,954.68
KPA shore handlings (Kshs/ton)	12,210.68
Bagging (Kshs/ton)	317.4
Transport to warehouse (Kshs/ton)	245.19
Storage and handling charges(Kshs/ton)	98.08
Fumigation charges (Kshs/ton)	119.03
Agency fees (Kshs/ton)	81.73
Incidental charges (1% of C.I.F)(kshs/ton)	244.35
Ports and Customs overtime(Kshs/ton)	19.84
Trade levy (Kshs/ton)	11.11
Landed into store Mombasa (Kshs/ton)	29,418.49
Cost per 50kg bag	1470.92
Road haulage to Mwea Market (Kshs/ton)	2500
Import parity price; Central Kenya (Kshs/50kg bag	1595.92
Retail price in Central Kenya (10% margin per bag)	1755.51
Import parity price; Central Kenya (Kshs/kg)	35.11
fob = free on board	
c.i.f. =cost, insurance and freight	
IDF = import declaration form	
KPA = Kenya Ports Authority	

Source: Authors computations 2006

ppendix 7-8: Estimation of Import Parity Price in Kshs of Chemical Fertilizers in Central Kenya, 2006

	DAP	SA	Urea	TSP
b (Black sea)(six year average from 2006)	187	187	158	156
rate to E/Africa (US$/ton)	33	33	24	33
rance (1% of C and F)	1.87	1.87	1.58	1.56
Mombasa (US$/ton)	221.87	221.87	183.58	190.56
rate (twelve month average)	72.054	72.054	72.054	72.054
mated c.i.f. Mombasa (Kshs/ton)	15,986.62	15,986.62	13,227.67	13,730.61
fees (2.75% of C and F) (Kshs/ton)	439.63	439.63	363.76	377.59
er of Credit 2% of C.I.F.	319.73	319.73	264.55	274.61
S levy 0.2% of C.I.F.	31.97	31.97	26.45	27.46
ing (Kshs/ton)	1771	1771	668	1771
and Forwarding	60	60	60	60
to warehouse (Kshs/ton)	290	290	290	290
age Cost (Kshs/ton)	96	96	96	96
re house handling charges	116	116	116	116
st of Bags for rebagging	0	0	446.8	0
nsit Loss 0.5% of C.I.F	79.93	79.93	66.14	68.65
dental charges (0.5% of C and F) (Kshs/ton)	79.93	79.93	66.14	68.65
al Mombasa ex-ware house (Kshs/ton)	19270.81	19270.81	15691.51	16880.57
tal Mombasa ex-ware house (Kshs/50kg)	963.54	963.54	784.58	844.03
ad haulage to Mwea Market, (Kshs/ton)	2500	2500	2500	2500
rt parity price; Central Kenya (Kshs/50kg bag	1088.54	1088.54	909.58	969.03
tail price (10% profit margin per bag)	1197.39	1197.39	1000.53	1065.93
tail price and transport cost to the farm	1217.39	1217.39	1020.53	1085.93
rt parity price; Central Kenya (Kshs/kg)	24.35	24.35	20.41	21.72
= free on board				
f =cost, insurance and freight				
= import declaration form				
A = Kenya Ports Authority				

Source: Authors computations 2006

Key

DAP= Diammonium Phosphate, SA= Sulphate of Ammonia, TSP= triple Super phosphate

Appendix 7-9: Estimated social prices for inputs and outputs

	Gunny bags	Smithion	DAP	SA	Urea	TSP	Diesel	Petrol	Lubric. Oil	Grease	Rice Broken	Rice Basmati
	bag	litre	kg	kg	kg	kg	litre	litre	litre	kg	kg	kg
Private prices	31.50	820.00	31.25	24.19	25.57	30.14	65.00	75.00	129.99	200	30	66.44
Subs.	0	0	0	0	0	0	0	0	0	0	0	0
Exercise duty	0	0	0	0	0	0	9%	53%	0	0	0	0
Custom duty	45%	5%	0	0	0	0	0	0	23%	23%	35%	35%
VAT	16%	0	0	0	0	0	16%	16%	16%	16%	16%	16%
Social Prices	19.57	780.95	31.25	24.19	25.57	30.14	52.00	44.38	93.52	143.88	17.52	44.00

Source: Authors computations 2006

Confidential

Start interview time ----------

Questionnaire for Farmers (Crop Year 2006/07)

A. General Information

i) Name and number of the NIB registered farmer ----------

---

ii) Location----------

iii) Sub-location----------

iv) Unit and Village----------

v) Name of interviewer----------

vi) Date----------

Activities of Production

B. Preparation – Paddy fields

Land

1. Fixed input

i) Is the cultivated paddy field ever rented out?

(a) Yes

(b) No

ii) If yes, how much was the rental value per acre crop year? ----------

iii) How common is rental, out of 100, 2006/07 rice farmers in your unit, how many have rented from the designated MIS tenants?

iv) How common are the sales of land, out of 100, 2006/07 rice farmers in your unit, how many are new buyers from MIS tenants?

v) Can the rice paddy field within MIS be sold?

(a) Yes

(b) No

vi) If yes, how much is the selling price per acre? ----------

vii) Did you engage any financier to fund the buying of MIS paddy field?

(a) Yes

(b) No

viii) What was 2006/07 size of your paddy field in acres: ----------

ix) How many acres were flooded with water? ----------

Rotary plough tractor

(x) Is the rotary plough tractor owned by the farmer?

(a) Yes

(b) No

xi) If yes, then:

(a) What was the purchase date? ----------

(b) What was the purchase price? ----------

(c) What is the current value? ----------

(d) Expected useful life? ----------

(e) What is the salvage value? ----------

(f) Estimated replacement cost? ----------

Sub-Total ----------

Hired Rotary plough tractor

xii) How many acres were rotary ploughed by the tractor? ----------

xiii) How much did you pay for rotary plough tractor per acre? ----------

Total ----------

2. Direct labor

i) How much did you pay for clearing your feeding canals? ----------

ii) Did you engage any casual labor during water flooding?

(a)-Yes

(b)-No

iii) If Yes, how much did you pay casual labor? ----------

iv) Did you engage any family labor during water flooding?

(a)-Yes

(b)-No

v) If yes, who was engaged (a) Head

(b) Spouse

(c) Son (7-17 years)

(d) Daughter (7-17 yrs)

vi) Did you engage any casual labor during the rotary plowing activity?

(a)-Yes

(b)-No

vii) If yes, how much did you pay the casual labor? ----------

viii) Did you engage any family labor during the rotary plowing activity?

(a)-Yes

(b)-No

ix) If yes, who was engaged (a) Head

(b) Spouse

(c) Son (7-17 years)

(d) Daughter (7-17 yrs)

Total ----------

3. Intermediate inputs

i) What was the cost of water?

Cost of Irrigation water	
	kshs
Acre 1	
Acre 2	
Acre 3	
Acre 4	
Acre 5	
Acre 6	
Acre 7	
Total	
Average/acre	

ii) If rotary plough was owned by the farmer:

(a) How much fuel did you use in plowing for the season? ----------

(b) How much oil did you use in plowing? ----------

(c) What was the cost of the fuel? ----------

(d) What was the cost of the oil? ----------

(e) What was the maintenance cost? ----------

Sub-Total ----------

D. Preparation - Nursery

1. Fixed inputs

i) Did you buy fork Jembe and/or any other implement?

(a) Yes

(b) No

ii) If yes, how much did it/they cost? ----------

iii) What is the life span of the fork Jembe and other implements if any? ----------

iv) What is the salvage price of the fork Jembe and other implements if any? ------

Total ----------

2. Direct Labor

i) Did you engage any casual labor during the preparation of nursery?

(a)-Yes

(b)-No

ii) If yes, how much was paid to casual labor for:

(a) Leveling? ----------

(b) Spread of seed? ----------

(c) Scaring of Birds? ----------

iii) Did you engage any family labor during preparation of nursery?

(a)-Yes

(b)-No

iv) If yes, who was engaged (a) Head

(b) Spouse

(c) Son (7-17 years)

(d) Daughter (7-17 yrs)

Total ----------

3. Intermediate inputs

i) What variety of rice seed did you use?

(a) Basmati

(b) BW 196

(c) IR 2793

(d) Other (specify)

ii) How many Kilograms did you buy for your paddy field? ----------

iii) What was the cost of your rice seed? ----------

iv) Did you apply any fertilizer in your nursery?

(a)-Yes

(b)-No

v) What type of fertilizer did you apply?

(a) Urea

(b) DAP

(c) Sulphate of Ammonia (SA)

(d) Other (specify)

Vi) How many kilograms of fertilizer were spread in the nursery? ----------

vii) How much was paid for fertilizer? ----------

viii) How much was paid for Transportation of fertilizer? ----------

Total ----------

E. Transplanting of seedlings to Paddy Fields

2. Direct Labor

i) Did you engage any casual labor during the uprooting (transferring) of the seedling from the nursery?

(a)-Yes

(b)-No

ii) If yes, how much was paid for casual labor in uprooting (transferring) the seedling from the nursery for transplantation? -----

iii) Did you engage any family labor during uprooting of the seedling?

(a)-Yes

(b)-No

iv) If yes, who was engaged (a) owner

(b) Spouse

(c) Son (7-17 years)

(d) Daughter (7-17 yrs)

v) How much was paid for casual labor (taking the seedlings to the trans-planters from the nursery and supervising) in transplanting the seedling per acre? ----------

Total ----------

3. Intermediate inputs

i) What type of fertilizer was applied on paddy fields before transplanting?

(a) Urea

(b) DAP

(c) SA

(d) Other (specify)

ii) How many kilograms of fertilizer were applied in the paddy field per acre? ----------

iii) How much was paid for fertilizer? ----------

iv) How much was paid for transplanting the seedling per acre?

Transplanting of Rice seedlings	
	Expenses(kshs)
Acre 1	
Acre 2	
Acre 3	
Acre 4	
Acre 5	
Acre 6	
Acre 7	
Total	
Average/acre	

Total ----------

F. bullock leveling

1. Fixed inputs

(i) Did you own the bullock leveling hardwood log?

(a) Yes

(b) No

(ii) If yes, what was the price of the Heavy Nailed Wood for leveling? ----------

(iii) What is the life span of the Heavy Nailed Wood for leveling? ----------

(iv) What is the salvage price? ----------

v) Did you own the bulls (drafts)?

(a) Yes

(b) No

vi) If yes, what was (a) the cost of the herd's boy for the crop period? ------

(b) Cost of spraying animal pests for the crop period? ----------

(c) Cost of veterinary drugs during the crop period? -------

vii) How much was paid for bullock leveling the paddy field per acre? ----------

Total ----------

2. Direct Labor

i) Did you bullock level your paddy field?

(a)-Yes

(b)-No

ii) If yes, how much was paid for casual labor during bullock leveling of your paddy field? -------

iii) Did you engage any family labor during bullock leveling of your paddy field?

(a)-Yes

(b)-No

iv) If yes, who was engaged?

(a) Head ----------

(b) Spouse ----------

(c) Son (7-17 years) ----------

(d) Daughter (7-17 yrs) ----------

Total ----------

G. Weeding

1. Direct Labor

i) How much was paid for weeding?

Weeding activities	
	Expenses(kshs)
Acre 1	
Acre 2	
Acre 3	
Acre 4	
Acre 5	
Acre 6	
Acre 7	
Total	
Average/acre	

Total ----------

2. Intermediate inputs

i) Did you apply fertilizer after weeding?

(a)-Yes

(b)-No

ii) What type of fertilizer did you apply after weeding?

(a) Urea

(b) DAP

(c) SA

(d) Other (specify)

iii) How many kilograms of fertilizer were applied per acre? ----------

iv) What was the cost of the fertilizer per acre? ----------

Total ----------

M. Harvesting

Output

1. Fixed inputs

Equipment	Cost	Expected lifespan	Spread Cost/crop
i) Sickle knife	---------	----------	----------
ii) Bags	----------	----------	----------
iii) Sisal thread	----------	----------	----------
iv) Bag needles	----------	----------	----------
v) Water paint	----------	----------	----------
vi) Number plate	----------	----------	----------
vii) Canvas	----------	----------	----------

viii) Others (specify) ---------- ---------- ----------

Harvesting of Paddy rice						
	Cutting & threshing cost	Winnow Cost	Bagging cost	Cost of Transport to Homestead	Total costs	Number of bags
Acre 1						
Acre 2						
Acre 3						
Acre 4						
Acre 5						
Acre 6						
Acre 7						

Total ----------

2. Direct Labor

i) How much did you pay for casual labor of scaring birds away for the crop before harvesting? ----------

Total ----------

J. On-farm storage

1. Fixed inputs

i) Did you practice on-farm storage?

(a) Yes

(b) No

ii) If yes, what costs did you incur?

Activities Costs incurred

---------- ----------

---------- ----------

---------- ----------

iii) Did you incur any loss in on-farm storage?

(a) Yes

(b) No

iv) If yes, at what rate?

v) Why did you practice on-farm storage? ----------

---

vi) How much of the harvested paddy rice was sold? ----------

vii) When was your paddy rice sold?

During harvest (month) Cost/unit after harvest (month) Cost/unit

---------- ---------- ---------- ----------

Total ----------

2. Direct Labor

i) Did you incur unloading and arranging cost during on-farm storage of your paddy rice?

(a) Yes

(b) No

ii) If yes, what costs did you incur? ----------

iii) How much was paid for the labor drying the paddy bags if any? ----------

Total ----------

3. Intermediate inputs

i) what chemical did you use in your rice store?

Chemical Quantity Price/unit

---------- ---------- ----------

---------- ---------- ----------

---------- ---------- ----------

Total ----------

K. Marketing paddy rice

1. Fixed inputs

i) Who bought your paddy rice?

Buyer Cost/unit

a) MMRG ----------

b) NIB ----------

c) NCPB ----------

d) Private companies ----------

e) Others (specify) ----------

ii) What means of transport did you use to bring your paddy rice to the buyer?

(a)-Matatu (b)-Bus (c)-Bicycle (d)-Donkey/bull cart (e)-Own Vehicle (f)-Others (specify)

iii) If the means of transport is owned by the producer, then:

(a)What is the purchase date? ----------

(b)What is the purchase price? ----------

(c)What is the current value? ----------

(d)Expected useful life? ----------

(e)What is the salvage value? ----------

(f)Estimated replacement cost? ----------

iv) If the producer uses public means (i.e. buses, matatus, etc.):

How much were you being charged? ----------

vi) What containers did you use to handle your paddy rice?

(a) Modern bags

(b) Other (Specify)

vii) What were their Bags

(a) Purchase price ---------

(b) Purchase date ---------

(c) Expected useful life ----------

(d) Salvage value ---------

(e) Estimated replacement cost ----------

viii) What other equipment did you use in transportation and sale of milled rice?

Equipment	Purchase date	Purchase price	Expected life
----------	----------	----------	----------
----------	----------	----------	----------
----------	----------	----------	----------
----------	----------	----------	----------

Total ----------

2. Direct Labor

i) Did you incur loading cost during marketing of your paddy rice?

(a) Yes

(b) No

ii) If yes, what costs did you incur? ----------

Total ----------

L. Working capital

i) Did you require working capital?

(a)-Yes

(b) - No

ii) If yes, where did you borrow it from?

(a) Commercial Banks

(b) MRGM

(c) NIB

(d) Mwea Farmers' Sacco

(e) Equity Bank

(f) Other (specify)

iii) How much did you receive?

Capital Interest rate/annum

(a) Land leasing ---------- ----------

(b) Preparation ---------- ----------

(c) Transplanting ---------- ----------

(d) Weeding ---------- ----------

(e) Harvesting ---------- ----------

(f) Marketing ---------- ----------

Total ----------

Enquiries:

1. Who transports your paddy to the millers? ----------
2. Who is (are) your miller(s)? ----------

Ending interview time ----------

Confidential

Start interview time ----------

Questionnaire for Transporters, Farm gate to Processor (Crop Year 2006/07)

A. General Information

i) Name of the participant (paddy trader) ----------

ii) Location of their activity ----------

iii) Sub-location----------

iv) Village----------

v) Name of interviewer----------

vi) Date----------

Main Information

B. Transportation

1. Fixed inputs

i) How many bags were bought from the farm to the processing plant? ----------

ii) What means of transportation did you use to the processor?

(a) Man's back

(b) Bicycle

(c) Motor cycle

(d) Donkey/ bull cart

(e) Public transport (matatu, bus, train)

(f) Own vehicle

(g) Other (specify)

iii) If own vehicle, what was (a) the purchase price? ----------

(b)Purchase date? -------

(c) Salvage value? -------

(d) Expected lifespan? ---------

(e) Replacement cost? ---------

iv) What share of cost can be attributed to paddy rice transportation?

v) What were the charges for transportation per paddy rice bag? ----------

vi) How many kilometers from the farm gate to the processing unit? ----------

Total ----------

2. Direct labor

i) How much was paid for labor loading the transporter? ----------

ii) Did you engage conductors?

(a) Yes

(b) No

iii) If yes, how many truck conductors? ----------

iv) How much did you pay them per month? ----------

v) How much was paid for labor unloading the paddy bags to the processing store? ------

Total ----------

3. Intermediate inputs

i) If the means of transport was owned by the trader, what were expenses per month on?

(a) Fuel ----------

(b) Oil ----------

(c) Maintenance cost ----------

Total ----------

Enquiries:

1. Give names of the millers you regularly unload customer's paddy rice to? -------

Ending interview time ----------

Confidential

Starting interview time ----------

Questionnaire for Processor (Crop Year 2006/07)

A. General Information

i) Name of the processor ----------

ii) Location of their processing plant ----------

iii) Sub-location----------

iv) Village----------

v) Name of interviewer----------

vi) Date----------

Main information - processor:

B. Storage of paddy rice

1. Fixed input

i) Did you store paddy rice before milling?

(a) Yes

(b) No

ii) If yes, what were the storage costs?

Store rent/month Water & Electricity/month Security (watchman)/month

---------- ---------- ----------

iii) what other equipment did you use in processing and storage of paddy rice?

Equipment Purchase date Purchase price Expected life

Moisture meter ---------- ---------- ----------

Drying Canvas ---------- ---------- ----------

---------- ---------- ---------- ----------

---------- ---------- ---------- ----------

iv) If the store was owned by the processor,

(a) what was the cost of the store and the land? ----------

(b) Building date ----------

(c) Expected life span ----------

(d) Maintenance cost ----------

Total ----------

2. Direct labor

i) Had you engaged a man or woman who was a full time storekeeper

(a) Yes

(b) No

ii) If yes, what was his or her pay? ----------

Total ----------

C. Processing Inputs

3. Intermediate inputs

i) Fuel-Electricity/month Oil/month Machine Operator/month Security/month

---------- ---------- ---------- ----------

b) How many days are you operational per month? ----------

c) How many shifts if any have you scheduled per day? ----------

d) How many machine operators are engaged by the mill on fulltime basis (8hrs/per adult man)? ----------

e) What is the milling capacity of your plant?

Paddy bags/hour Paddy bags/day

---------- ----------

f) What are the charges of milling one 90 kg paddy bag? ----------

g) Did your mill remain operational for 8 hours daily for a whole month?

(a) Yes

(b) No

h) If No, what was your average milled bags per day each month? ----------

j) How long have you been in the rice milling business? ----------

Total ----------

Revenue- Outputs

D. Processing outputs

i) By milling 90kg paddy rice bag, what are the shares of the output products?

(a)----------kg of grade 1

(b)----------kg of grade 2

(c) ----------kg of chicks broken rice

(d)----------kg of bran

(e) ----------kg of rice husk

ii) Who owns the paddy rice milling by-product (e.g. bran, husk among others)?

(a) processor

(b) paddy rice customer

iii) What are the selling prices of the by-products?

By-product Cost/ Kg Cost/bag

(a)Chicks broken rice ---------- ----------

(b) Bran ---------- ----------

(c) Rice husk ---------- ----------

Total ----------

E. Capital Equipment

1. Fixed input

i) (a) What is the current replacement cost of the capital equipment? ----------

(b) What was the cost of the capital equipment? ----------

(c) Date of buying the capital equipment ----------

(d) Expected lifespan ----------

(e) Salvage value ----------

ii) If store owned by the miller,

(a) what was the cost of the store building and the land? ----------

(b) Purchase date ----------

(c) Expected life span ----------

(d) Maintenance cost ----------

iii) If owned by the miller,

(a) what was the cost of the Mills' building and the land? ----------

(b) Purchase date ----------

(c) Expected life span ----------

(d) Maintenance cost ----------

Total ----------

F. Working Capital

i) Did you require working capital during your processing?

(a) Yes

(b) No

ii) If Yes, How much did you borrow? ---------- .

iii) What interest rate were you charged? ----------

iv) If No, how much of your working capital did you spend? ----------

v) What is the average market interest rate over the 2006? ----------

vi) Upon brake-down of your milling machine(s), do you access spare parts conveniently?

(a) Yes

(b) No

Total ----------

G. Storage Milled rice

1. Fixed inputs

i) Did you store milled rice?

(a)-Yes

(b)-No

ii) Where did you store this rice?

(a)-Granary

(b)-Modern store (rented)

(c)-Own house

iii) If own house or granary, what was the construction cost of the structure where you stored the rice? ----------

iv) What was the construction date? ----------

vi) If you were to construct another structure, how much would it cost you? ----------

vii) If modern store rented, what was the rent per month? --------

viii) How do you store your rice?

(a) in bags (modern)

(b) in polythene paper bales (24 kg)

(c) No bagging done

(d) Others (specify)

ix) If bagging was done, what was:

(a) The purchase price of the bag? ----------

(b) Purchase date? ----------

(c) Current price of the bag? ----------

(d) Salvage value? ----------

(e) Expected useful life? ----------

x) Other fixed inputs used in storage (specify)

Input	Purchase date	Purchase price	Salvage value	Current price	Expected useful life

Total ----------

2. Direct Labor

i) Did you engage store man/woman who was not engaged in no other work except managing the store?

(a)-Yes

(b)-No

ii) If Yes, how much did you pay him or her? ----------

iii) How long did he/she work per day? ----------

iv) If No, did you engage part-time labor?

(a)-Yes

(b)-No

v) If yes, how much did you pay for the part-time labor? ----------

vi) If no, did you engage family labor?

vii) If yes, who was engaged: (a) Head

(b) Spouse

(c) Son (7-17) years

(d) Daughter (7-17) years

viii) Did you engage handlers in your store?

(a)-Yes

(b)-No

ix) If Yes, how many were they? ----------

x) How much did you pay them? ----------

xi) How long did they work per day? ----------

Total ----------

3. Intermediate inputs:

i) what chemical did you use in your rice store?

Chemical Quantity Price/unit

---------- ---------- ----------

---------- ---------- ----------

ii) what was the cost of maintaining your store? ----------

iii) what are the storage losses? ----------

Total ----------

Enquiries:

1. Give names of whole sale traders who are your regular milling customers.

Ending interview time ----------

Confidential

Starting interview time ----------

Questionnaire for Traders (Crop Year 2006/07)

A. General Information

i) Name of the traders ----------

ii) Local market/urban centers ----------

iii) Location of the market ----------

iv) Name of interviewer----------

v) Date of Accounting Year ----------

B. Main Information-Traders

1. Monthly purchase and sales- rice- April 2006 – March 2007

Basmati (aromatic) Monthly Purchase and sales (April 2006 – March 2007)						
Months	Purchases Cups/tins*	Unit cost (Kshs/unit)	Total purchases(kshs)	Sales (kg)	Unit cost (Kshs/unit)	Total sales(kshs)
April 2006						
May 2006						
June 2006						
July 2006						
August 2006						
September 2006						
October 2006						
November 2006						
December 2006						
January 2007						
February 2007						
March 2007						

Total ---------- ----------

*1Buying Cup = ------kg and 1Buying Tin = -----kg

i) Where do you buy your milled rice? ----------

ii) what is the distance of the above place to selling centre in kilometers? ----------

iii) Where do you sell your milled rice? ----------

C. Transport, Packing and Loading to the market:

1. Fixed inputs

i) What means of transport did you use to bring your milled rice to the market?

(a)-Matatu (b)-Bus (c)-Bicycle (d)-Donkey/bull cart (e)-Own Vehicle (f)-Others (specify)

ii) If the means of transport is owned by the trader, then:

(a)What is the purchase date? ----------

(b)What is the purchase price? ----------

(c)What is the current value? ----------

(d)Expected useful life? ----------

(e)What is the salvage value? ----------

(f)Estimated replacement cost? ----------

iii) If the trader uses public means (i.e. buses, matatus, etc.):

How much were you being charged? ----------

iv) What containers did you use to trade your rice?

(f) Modern bags

(g) Extended Modern Bags

(h) Polythene paper bales

(i) Other (Specify)

v) What were their Bags Polythene Bags

(a) Purchase price --------- ----------

(b) Purchase date --------- ----------

(c) Expected useful life ---------- ----------

(d) Salvage value --------- ----------

(e) Estimated replacement cost ---------- ----------

viii) What other equipment did you use in transportation and sale of milled rice?

Equipment Purchase date Purchase price Expected life

Sealer ---------- ---------- ----------

Tape ---------- ---------- ----------

---------- ---------- ---------- ----------

Total ----------

2. Direct labour

i) Do you employ people to help you in pack, load, transporting and selling of rice?

(a)-Yes (b)-No

ii) If Yes, how many people did you employ? ----------

iii) How much did you pay them?

(e) Packers and loaders at the processing unit ----------

(f) Drivers if the means of transport is owned by the trader ----------

(g) Those involved in selling ----------

(h) Others(specify-*Gutaha*) ----------

iv) How many hours per month each worker engaged in his/her work?

(a) Packers and loaders ----------

(b) drivers ----------

(c) sellers ----------

(d) others ----------

v) How much pay was given to each worker engaged in his/her work

(a) Packers and loaders

(b) drivers

(c) sellers

(d) others

vi) Did you engage family labor?

vii) If yes, Who was engaged (a) Head

(i) Spouse

(j) Son (7-17) years

(k) Daughter (7-17) years

Total ----------

3. Intermediate inputs

i) If means of transport is owned by the trader:

(a) How much fuel did you use in transporting rice only? ----------

(b) How much oil did you use in transport? ----------

(c) What was the cost of the fuel? ----------

(d) What was the cost of the oil? ----------

(e) What was the share of maintenance cost contributed by transporting rice? ----------

ii) Other intermediate inputs (specify)

Input Cost/unit

---------- ----------

---------- ----------

Total ----------

D. Storage Costs:

1. Fixed inputs

i) Did you store rice that was waiting to be sold?

(a)-Yes

(b)-No

ii) Where did you store this rice?

(a)-Granary

(b)-Modern store (rented)

(c)-Own house

iii) If own house or granary, what was the construction cost of the structure where you stored the rice? ----------

iv) What was the construction date? ----------

vi) If you were to construct another structure, how much would it cost you? ----------

vii) If modern store rented, what was the rent per month? --------

viii) How do you store your rice?

(a) in bags (modern)

(b) in polythene paper bales (24 kg)

(c) No bagging done

(d) Others (specify)

ix) If bagging was done, what was:

(f) The purchase price of the bag? ----------

(g) Purchase date? ----------

(h) Current price of the bag? ----------

(i) Salvage value? ----------

(j) Expected useful life? ----------

x) Other fixed inputs used in storage (specify)

Input	Purchase date	Purchase price	Salvage value	Current price	Expected useful life

Total ----------

2. Direct Labor

i) Did you engage store man/woman who was not engaged in no other work except managing the store?

(a)-Yes

(b)-No

ii) If Yes, how much did you pay him or her per month? ----------

iii) How long did he/she work per day? ----------

iv) Did you engage packers in your store?

(a)-Yes

(b)-No

v) If yes, how many are they? ----------

vi) How much did you pay them per month? --------

vii) Did you engage handlers in your store?

(a)-Yes

(b)-No

viii) If Yes, how many were they? ----------

ix) How much did you pay them per month? ----------

x) How long did they work per day? ----------

Total ----------

3. Intermediate inputs:

i) what chemical did you use in your rice store?

Chemical Quantity Price/unit

---------- ---------- ----------

---------- ---------- ----------

---------- ---------- ----------

ii) what was the cost of maintaining your store? ----------

iii) what are the storage losses? ----------

Total ----------

E. Miscellaneous

i) Electricity charges? ----------

ii) Water charges? ----------

iii) Market charges? ----------

(iv) Security charges (watchman)? ----------

(v) Others (specify) ----------

Total ----------

Ending interview time ----------