Evaluation of Livelihoods and Economic Benefits of Water Utilization in the Great Ruaha

Rice Production Economics at the Local and National Levels: The Case of Usangu Plains in Tanzania

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1. Introduction

Rice production in Usangu plains and its impacts on the local and national economies is one of the research areas addressed by RIPARWIN project.[1] It is covered under the research topic "Evaluation of Livelihoods and Economic Benefits of Water Utilization (ELEBWU). The topic aims at providing a body of information, which will enrich understanding by river basin stakeholders of: a) water related livelihoods, economic benefits, net and gross demands for irrigated agriculture and other sectors, under different management, climatic and seasonal scenarios; b) means and potential to transfer water between sectors; and c) the impacts arising from water transfer away from irrigation. This is deemed as an important step for laying down water management and allocation strategies that ensure sustainable livelihoods and economic benefits from water utilization. The step is also critical and absolutely crucial for addressing problems related to social and economic inequities, which result from imbalanced use of water resources.

This paper provides a summary of the major findings reported in one of the RIPARWIN reports: a working report titled "*Rice Production Economics at the Local and National Levels: The Case of Usangu Plains in Tanzania."* The paper intends to elicit a fruitful debate on the role of rice production in Usangu and its implications on the local and national economies.

2. The situation in Usangu

- The maximum irrigated land under paddy (in Usangu plains) amounts to about 42 000 ha.
- The core-irrigated area found in a dry year is estimated at 24 500 ha.
- Land for rain-fed agriculture varies between 50 000 ha and 65 000 ha depending on the amount and distribution of rainfall in the area.
- The use of fertilizers, pesticides, herbicides or manure is rare (about 3% of farmers apply fertilizers – mainly farmers within the NAFCO systems). These inputs are commonly not used because they are too expensive. Even if many farmers could afford to purchase them, the extra financial investment involved may expose them to greater economic risk should the rains, and therefore their paddy crop, fail. Use of manure is also uncommon because it is difficult to carry sufficient quantities to the distant paddy fields.
- Land renting is common and its cost varies with location of the irrigation system and relative location along the furrow (top-end or tail-end).
- The costs of renting land range from Tsh 10,000 to 20,000 per acre.
- Annual paddy production (for the whole of Usangu) is estimated to average at 105,000 tonnes per annum.
- Mbarali district (part of Usangu basin) is the largest producer of paddy both in Usangu area and in Mbeya region making the region to be a major contributor to the national rice production. The share of the district to the regional paddy production is estimated at 60%. The remainder is considered to be

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[1] 'RIPARWIN' stands for **R**aising **I**rrigation **P**roductivity and **R**eleasing **W**ater for **I**ntersectoral **N**eeds. It is a research project funded by DFID and implemented by the University of East Anglia and Sokoine University of Agriculture, through the Soil-Water Management Research Group (SWMRG). The project is based in the Usangu Plains in Tanzania. It runs from July 2001 to March 2004. Fore more information about the project (*Please check our website:* http://swmrg.suanet.ac.tz/riparwin.html)

coming from Kyela (about 20%), Ileje and Mbozi (mainly from the Naming'ong'o Irrigation Scheme) (about 15%) and other areas in the region (5%).

- Paddy production in Mbeya region had almost doubled that of the nearest rival region (Mwanza) in 2000/01. During that particular year, paddy production in the region has amounted to 121,500 tonnes.
- As for Mbarali district, paddy production at the regional level has generally increased with time (correlation coefficient = 0.93, $P < 0.01$).
- In Mbarali district, paddy production (for the period from 1992/93 to 2001/02) has increased over time while real prices have declined with time (correlation coefficient for paddy production and real prices = -0.584, $P < 0.10$). On average, annual paddy production has amounted to 59,990 tonnes for the period from 1992/93 to 2001/02. The highest production was recorded in 2001/02 (85,200 tonnes) and the lowest in 1998/99 (30,510 tonnes).
- In the district, producer and wholesale prices for paddy and rice have increased only in nominal terms, but decreased in real terms resulting into falling trends for real values of paddy production (figure 1).

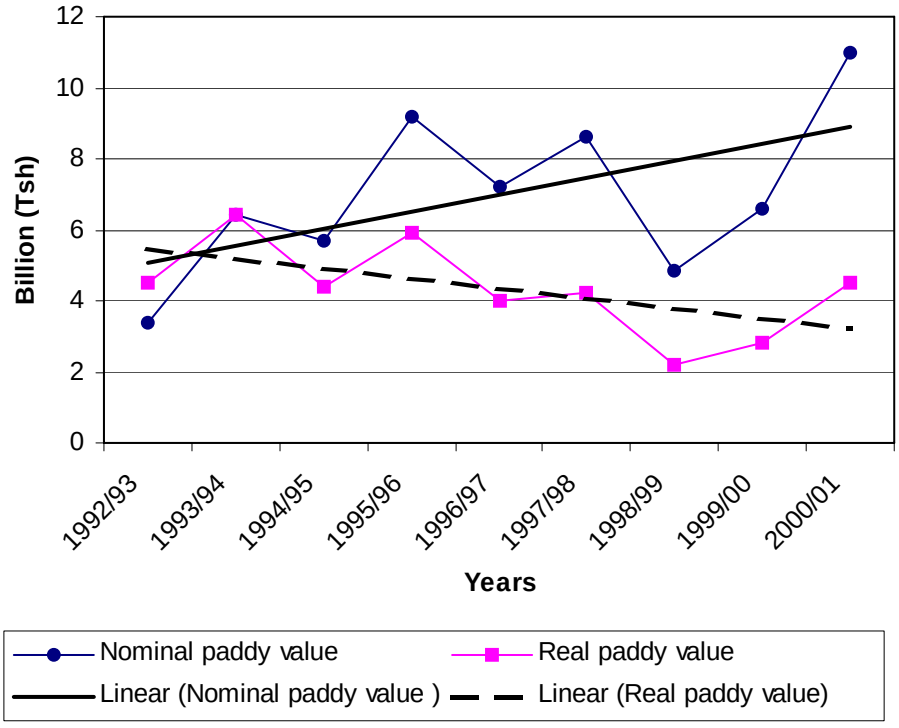

Figure 1: Mbarali district: Values of paddy production

- The nominal producer prices for paddy have ranged from the minimum of Tsh 4,800 to the maximum of Tsh 27,000 per bag for the period from 1992/93 to 2001/02.[2] The Official Exchange Rates (mean selling rates) for the period from 1997 to 2001 have averaged at Tsh 764.4922 per US Dollar.
- Average real producer prices for paddy (at the district level) have declined by 22% from Tsh 10,000 in 1994 to Tsh 7,789.29 per bag in 1995. The prices have also decreased by 32% from Tsh 7,742.49 in 2000 to Tsh 5,279.40 per bag in 2001.
- Productivity of irrigation water (for the whole of Usangu basin) is estimated at 0.18 kg per m^3 or Tsh 28.13 per m^3 (equivalent to US $ 0.027 per m^3 of irrigation water) (table 1).

[2] Prices from 1992/93 to 1996/97 were controlled prices (Cooperative prices), 1bag = 85 Kgs; after which period (1997/98 – 2001/02) prices have largely depended on the market forces and bags are currently modified to carry more weight (1bag = 96 Kgs).

Table 1: Usangu basin: Amount and value of water used in irrigated paddy

Estimated water abstraction for paddy irrigation	= 46 cumecs
Average annual depth of water applied in paddy field (Gross demand)	= 1850 mm
Mean annual rainfall	= 669 mm
Effective annual rainfall	= 479 mm
Irrigation annual demand	= 1850 – 479 = 1371 mm = 1.371 m
Mean wet season irrigated area (paddy)	= 42,000ha
Annual volumetric demand (water use) for 42,000ha	= 42,000 x 10^4 m^2 x 1.371 m = 576 x 10^6 m^3 = 576 Mm^3
Annual volumetric demand (water use) per hectare	= 0.013731 Mm^3 = 13731.43 m^3 = 1373143 litres
Average yield per hectare	= 2.5 tonnes
Estimated irrigation paddy productivity	= 0.18 Kg per m^3 = Tsh 28.13 per m^3 = US $ 0.027 per m^3

3. The situation at the national level

- The bulk of the national paddy (about 70 to 80%) is produced from five regions: Mbeya, Shinyanga, Mwanza, Morogoro and Tabora. These regions are also the major sources of surplus rice in the country.
- At the national level, paddy production for the period from 1984/85 to 2000/01 has generally increased over time.
- Average real producer prices for paddy have declined by 4% from Tsh 134.14 per kg in 1992/93 to Tsh 128.62 per kg in 1993/94. The prices have also declined by 28% from Tsh 102.03 per kg in 1996/97 to Tsh 72.38 per kg in 1997/98.
- Average wholesale real prices for rice have declined by 20% from Tsh 17,191.09 per bag in 1997/98 to Tsh 13,698.18 per bag in 1998/99 (figure 2). The prices have also declined by about 1% from Tsh 15,137.00 per bag in 1999/00 to Tsh 14,999.23 per bag in 2000/01.
- Rice consumption for the period from 1972/73 to 2000/01(figure 3) has generally shown an increasing trend (R^2 = 80.2%, $P < 0.01$ and growth rate = 4.52%).
- The national rice consumption for the same period (1972/73 to 2000/01) is estimated to average at 350,460 tonnes per annum. This is 15.8% relatively higher than the average domestically supplied quantity of rice (302,600 tonnes per annum), implying that the shortfall had to be made up by imports.

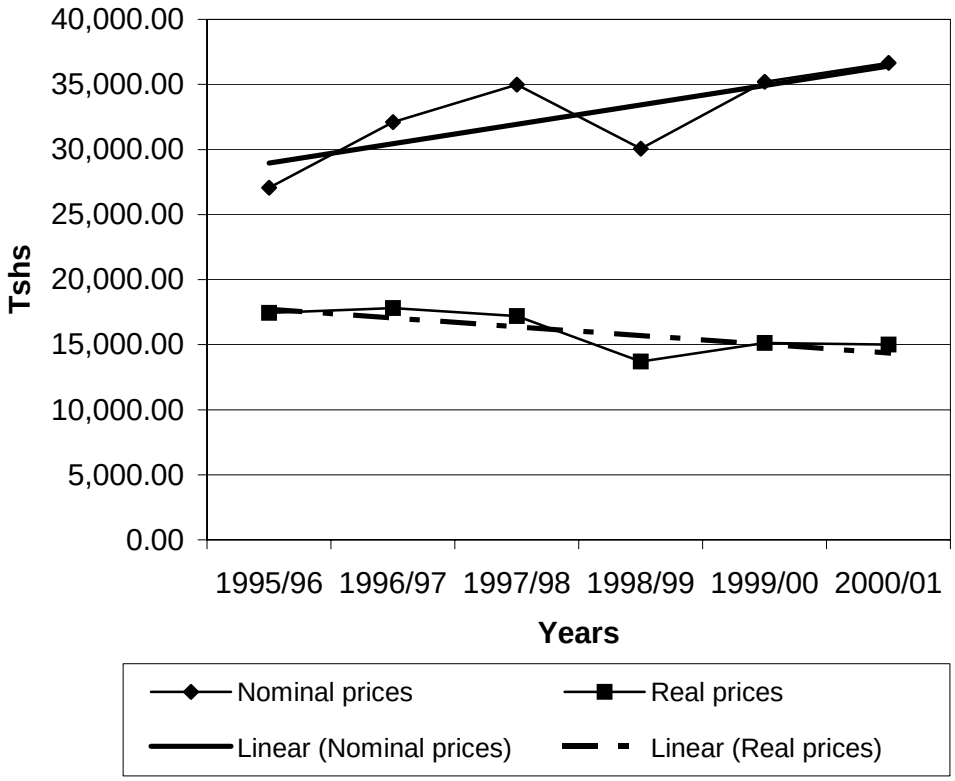

Figure 2: Average wholesale prices for rice in major regional markets, 1995/96 – 2000/01

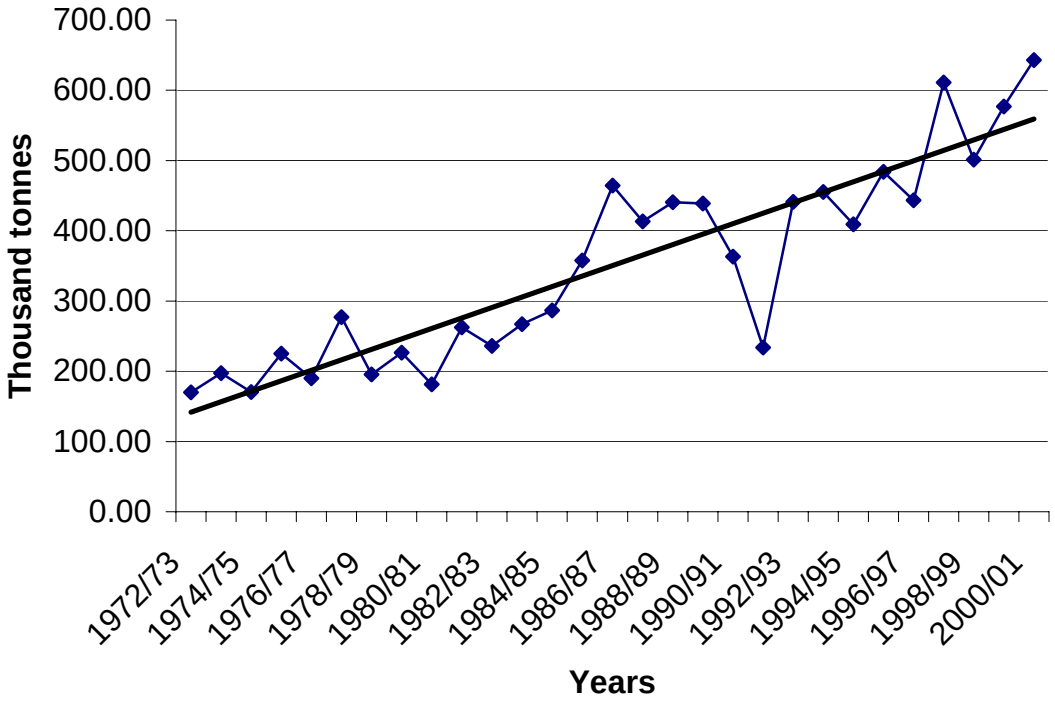

Figure 3: Rice consumption trend at the national level, 1972/73 – 2000/01

4. Comparative analyses

- Average yields per hectare at the national, regional and district levels have averaged at 1.52, 2.93, and 2.11 tonnes respectively, from 1993/94 to 1999/2000.
- Paddy yields at both district and regional levels are therefore, higher than that of the national average.
- Returns to labour, profit margins and productivity of irrigation water were compared for four systems of paddy production and two types of rice traders (local and inter-regional traders – see table 2).
- Productivity of irrigation water (in paddy production) was also compared with those of other developing and developed countries.
- The analysis showed that returns to labour for a smallholder farmer who irrigated his/her paddy field and used tractor, fertilizer and hired labour was higher (Tsh 826.99 per manday) than any of the other three systems of paddy production.
- The smallest return to labour (Tsh 490.46 per manday) was obtained by a smallholder farmer cultivating rain-fed paddy using hand hoe and family labour. This implies that family labour is the only cheapest labour for the poor agrarian households under this category of farming systems.
- On average, however, these farmers (smallholder farmers cultivating rain-fed paddy using hand hoe and family labour) obtained the highest gross margin per hectare (Tsh 101,525), while smallholder farmers who hired NAFCO farms/plots and cultivated irrigated paddy using tractor, fertilizer and hired labour obtained the least gross margin per hectare (Tsh 77,600). The lower gross margin in the latter system is associated with relatively higher production costs.
- Similarly, productivity of irrigation water (paddy produced per drop) was lower [0.12kg or Tsh 18.75 (US $ 0.018) per cubic meter of water] for smallholder farmers within the NAFCO systems than for their counterpart smallholder farmers outside the NAFCO systems [0.13kg or Tsh 20.31 (US $ 0.020) per cubic meter of water].
- Productivity of irrigation water for smallholder farmers within the NAFCO systems was also lower than the overall productivity in the whole of Usangu basin [estimated at 0.18kg of paddy or Tsh 28.13 (US $ 0.027) per cubic meter of irrigation water].
- Comparing the average productivity for Usangu (0.18kg/ m^3) with that of the whole of Sub-Saharan Africa (SSA) the former can be ranked as the average value for the region. Water productivity of rice for the region is reported to range from 0.10 to 0.25 kg per m^3, with average yield of 1.4 metric tonnes per hectare and water consumption per hectare close to 9,500 m^3.
- Among developing countries, China and some Southeast Asian countries have higher water productivity for rice, ranging from 0.4 to 0.6 kg per m^3; however, the average for the developed world (0.47 kg/m^3), is higher than that for the developing world (0.39 kg/m^3).
- Between the two categories of traders compared in this study, the local trader buying paddy and selling rice within Usangu - along the Mbeya to Dar es Salaam main road received a higher margin per kilogram in 2001/02 (Tsh 15.00 per kg) against Tsh 12.75 per kg for an inter-regional trader buying paddy in Usangu and selling rice in Dar es Salaam.

Table 2: Comparison of profit margins, returns to labour and values of irrigation water in paddy production and rice trading, 2001/02

Activity	Farm size ha	Paddy yield* Kg/ha	Gross margins			Return to labour Tsh/manday	Irrigation water productivity** Kg/m^3	Irrigation water value Tsh/m^3
			Tsh/ha (paddy)	Tsh/kg (paddy)	Tsh/kg (rice)			
I	0.3	788	101,525	128.84	257.68	490.46	0.00	0.00
			(98.57)	(0.13)	(0.25)	(0.48)		(0.00)
II	0.5	1500	94,075	62.72	125.44	514.07	0.00	0.00
			(91.33)	(0.06)	(0.12)	(0.50)		(0.00)
III***	6.0	1600	77,600	48.50	97.00	760.78	0.12	18.75
			(75.34)	(0.05)	(0.09)	(0.74)		(0.018)
IV	0.7	1800	93,450	51.92	103.84	826.99	0.13	20.31
			(90.73)	(0.05)	(0.10)	(0.80)		(0.02)
V				7.50	15.00			
				(0.007)	(0.015)			
VI				6.38	12.75			
				(0.006)	(0.012)			

Activity I = Smallholder farmer cultivating rain-fed paddy, using hand hoe and family labour
Activity II = Smallholder farmer cultivating rain-fed paddy, using tractor, fertilizer and hired labour
Activity III = Smallholder farmer hiring NAFCO farms/plots, cultivating irrigated paddy using tractor, fertilizer and hired labour
Activity IV = Smallholder farmer cultivating irrigated paddy, using tractor, fertilizer and hired labour
Activity V = Local trader buying paddy and selling rice within Usangu - along the Mbeya-Dar es Salaam main road
Activity VI = Inter-regional trader buying paddy in Usangu and selling rice in Dar es Salaam
*Average paddy yield for the whole of the Usangu basin is 2500 kg/ha (SMUWC, 2001)
** Average productivity of irrigation water (in paddy production) for the Usangu basin is estimated at 0.18 kg/m^3
*** Hired plots in the NAFCO (Kapunga) system are normally 6 ha in size
Numbers in bracket represent equivalent values in US $, calculated using April 2003 Exchange Rate of 1 US $ = Tsh 1,030

5. What are the implications if farmers in Usangu stop producing irrigated paddy?

- There will be a shrinkage in the annual paddy supply (both at the local and national levels) of about 105,000 tonnes (70% or 14.4% of the annual paddy production in Mbeya region or in Tanzania respectively).
- An opportunity cost of about Tsh 16.4 billion or US $ 15.9 million (gross revenue from irrigated paddy in Usangu) will be incurred annually. This is equivalent to gross revenue of Tsh 546,875 or US $ 531 per annum for an average household practicing irrigated paddy in Usangu.
- Assuming a cultivable season of work spanning 170 days including land preparation and harvest, this revenue amounts to an average daily household income of more than $ 3.12 per day, which implies that irrigated paddy plays a crucial part in lifting the Usangu's agrarian households out of poverty.
- The country's Gross National Product (GNP) or current account of the balance of payments will be affected by an average of 66,000 tonnes of rice (valued at US $ 15.9 million). The effect will either be in form of annual drop in rice exports or increase in imports of rice depending on the national supply and demand for rice.
- About 576 Mm^3 of water, which is currently annually consumed in irrigated paddy would be utilized in alternative ways, either as evaporation from seasonal swamps within the Usangu basin or made available for other intersectoral uses.

6. Concluding remarks

Preliminary findings in this study show that, although irrigated paddy (in Usangu basin) is asserted as utilizing too much of the available water resources, the same is also playing an important role in enhancing food security, income and livelihoods of the local people in the area. It also contributes a large share of paddy to the national production (about 14%).

Based on the above facts, one would suggest not abandoning irrigated paddy in Usangu basin but striving to increase irrigation efficiency and improve productivity (paddy produced per drop). The current average productivity figure for the basin (0.18 kg of paddy per m^3 of irrigation water) compares well with figures reported in many developing countries (e.g., 0.19 - 0.22 kg/m^3 for India). Water productivity of rice in Sub-Saharan Africa ranges from 0.10 to 0.25 kg per m^3. Elsewhere in the world, figures of up to 0.6 kg per m^3 are found but with intensive management. Thus the Usangu figures are approximately 30 – 67% of attainable productivity and there is a room for improvement if "wise use" of water resources is achieved.

NOTE: This paper is a summarized version of a full report titled "*Rice Production Economics at the Local and National Levels: The Case of Usangu Plains in Tanzania.* Being one of our key stakeholders we are pleased to send you a copy of the paper for your comments.[3] If you are interested in receiving the final version of the full report please inform us. Invitations for further discussion concerning the paper are also cordially welcome. Please, contact us at:

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[3] The findings presented in this paper are only meant for discussion and not as reference material.