THE PROFITABILITY AND INVESTMENT ANALYSIS OF THE DIFFERENT SEGMENTS OF THE RICE VALUE CHAIN IN EASTERN UGANDA

VECO EAST AFRICA

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ACRONYMS

MTIC	Ministry of Trade, Industry and Commerce
MFPED	Ministry of Finance, Planning and Economic Development
VC	Value chain
NPV	Net Present Value
IRR	Internal rate of Return
ROI	Return on Investment
UAI	Uganda Investment Authority
JPMFL	JP Management Foundation Limited
IRRI	International Rice Research Institute
GOU	Government of Uganda
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
CET	Common external Tariff
FGD	Farmer Group Discussion
URA	Uganda Revenue Authority
EAC	East Africa Community
BDS	Business Development skills

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

This study was commissioned by VECO East Africa to conduct an Investment and Profitability analysis of the Rice Value chain in Eastern Uganda. VECO East Africa works to support smallholder farmers and actors in the VC to build commercial competitiveness by stimulating investments and improvement of profitability along the rice value chain. The objective of the study is to provide information that stakeholders can use to make investment and financing decisions needed to increase the competitiveness of the rice value chain in Uganda and the East African community.

The rice sub-sector in Uganda has well documented challenges, despite the challenges, it has experienced tremendous growth in acreage and production over the last seven years. The GoU has identified Rice as one of the priority crops for national food security. Besides food security the GoU see the rice sub-sector as having a potential to increase Uganda's exports to the regional markets. To this effect government policy has been geared towards increasing access to; Seeds, Fertilizers, Mechanization, Water for Agricultural Production and Postharvest handling. The East African Community members under the CET have sought to stimulate local production of rice by discouraging rice imports through a common external tariff levy for rice coming from outside the EAC.

The study was done in the districts of Jinja, Iganga, Bugiri, Mbale, Butaleja and the rice trading hubs and warehouses of Kampala and Jinja. Analysis was done in the context of value chain upgrading as suggested by Trienekens (2011) with the help of descriptive statistics (measures of central tendency), tables, figures and gross margins. Investment feasibility indicators the NPV, IRR and ROI were determined to assess the competitiveness of the investments in the rice value chain. The approach used was a combination of desk document review and field level interviews to collect data on the performance of the different segments of the rice value chain. Rice production in Uganda has been growing steadily, the growth of Uganda's rice production has contributed to greater food security and a reduction in rice imports since 2005 leading to a saving of about US$30 million in foreign exchange earnings. Current production of rice is estimated at 237,000MT, GoU through MAAIF working with other stakeholders in the rice value chain is implementing a number of interventions to increase national rice production to 680,000MT by 2018. One of the major concerns however remains the degree of competitiveness of the local rice sub-sector against the imported rice brands.

The study considered the investment and profitability of the input, production, trade and milling segments of the value chain. The findings demonstrated that profit margins in the rice value chain are small, with the input and trade segments having the lowest margins. The production and small scale milling segment registered the highest margins, however the margins varied according to the production and milling models employed. The cooperative and semi-commercial farming models had a ROI that is commercially viable compared to the traditional individual or individual high input, low input production models. Similarly the small scale milling service model was more profitable, profitability was driven by capacity utilization and low overhead costs structure. Both the production and milling models registered a ROI above the market return of money estimated at the

commercial and rural savings rates of 28% and 36% per annum respectively. The Input and trade segments have the lowest ROI with unit margins below the market return rate of money. The findings demonstrated that the segments with low margins are largely dependent on high volume sales or turnover and cash turn around rates to realize a sustainable rate of return on investment. Innovations in the trade models employed in these segments is vital to create consolidation of demand for the input segment as a strategy to drive up sales volumes and to reduce transaction costs and farm gate prices to preserve existing trade margins or improve them to stay competitive against the pressure of imported brands. Table 1 below provides a summary of the ROI for different segments of the Rice value chain.

Table. A summary of the prevailing profit margins at different segments of the rice value chain.

SEGMENT	Low Margin	Mean Margins	Max. Margin
INPUTS	6.6%	18.8%	30.8%
PRODUCTION			
SEMI-COMMERCIAL FARMERS (2-3 Acres)	21%	54%	64%
OUT-GROWER FARMERS (1/4 -1/2 acre)	25%	28%	32%
INDIVIDUAL FARMER ON ¼ ACRE	-15.5%	15.6%	31%
INDIVIDUAL FARMER 1 ACRE LOW INPUT	7%	16%	34%
INDIVIDUAL FARMER HIGH INPUT- 1 ACRE	3%	10%	24%
COOPERATIVE FARMER 1 ACRE	23%	31%	41%
WHOLESALE/RETAIL TRADE	10.7%	18.5%	27.1%
SMALL SCALE MILLERS	31%	47%	44%

The three broad determinants of profitability in the rice value chain; the price, the production costs and the yield are affected by several systemic factors and business practices within the rice value chain which include, application of cost saving mechanical technologies, the use of improved and better yielding fresh seed as opposed to recycled seed, the agronomic practices, the individual vs group procurement and marketing

practices, the quality of the rice grain i.e level of breakage, Aromatic or non-aromatic properties of the rice and the national and EAC trade Policy framework.

These factors impact directly on the production segment and through which they exert a remote effect on the cost structure and profitability of the other segments in the rice value chain. The production segment is the turning point and fulcrum around which cost reduction and efficiency can be created in the rice value chain because it directly influences the costs structure and margins of the other segments of then value chain. Targeted investments in promoting sustainable cooperative or semi-commercial production models, semi-mechanization of rice production, better yielding varieties, farmer institutional capacity to take up innovations, new technologies and best practices are critical and will create a transformational effect across the entire value chain towards better competitiveness and market resilience.

1.0 Introduction

VECO East Africa is a member of Vredeseilanden, an international NGO based in Leuven, Belgium. It works to enable and support smallholder farmers to take up their role in rural poverty alleviation and to contribute to feeding a growing world population in a sustainable way. The VECO East Africa (EA) Uganda program, has integrated value chain development into its development strategy with a specific aim of ensuring that agricultural food chains in Uganda are sustainable and inclusive of small holder farmers. VECO East Africa is working in the rice value chain in Eastern Uganda, part of its interventions include stimulating investments and improvement of profitability along the rice value chain. In this respect JP Management Foundation Limited a consultancy firm was hired to conduct a profitability and Investment Analysis for all the segments of the rice value chain in Eastern Uganda. The report describes the findings from the study, recommendations and conclusions drawn from the study findings. The metrics generated from the study will provide vital information that stakeholders can use to make investment and financing decisions in the rice value chain. Rice production in Uganda has increased significantly in the last decade from 123,000MT in 2003 to 237,000MT in 2015. MAAIF working with other stakeholders under the National Rice development Strategy (NRDS) is implementing a number of interventions intend to increase national rice production to 680,000MT by 2018 in order to achieve national self-sufficiency.

1.1 Background

Uganda's rice sub-sector has experienced tremendous growth in acreage and production over the last seven years. Rice is one of the strategy priority crops identified by the GoU to improve food security, income for farmers especially smallholders, increase Uganda's exports to regional markets and to support the development of other related industries. Governments interventions have focused on increasing access to; Seeds, Fertilizers, Mechanization, Water for Agricultural Production and Postharvest handling. Government in collaboration with the EAC members under the CET has sought to stimulate local production by discouraging rice imports.

Rice is growing into one of the major food crops farmed in the Northern, Eastern, Southern and Western parts of the country. There are no credible statistics on the total acreage under rice in Uganda to date, however 80% of rice production is done by smallholder farmers cultivating under 2 ha each. About 5% of the rice producers are commercial scale producers with over 6 Ha. Much of the commercial scale production occurs in government schemes some like Doho and Olweny rice schemes involve a collection of smallholder farmers allocated in between 0.25 to 1 acre on the scheme. Unlike most of the food crops grown to satisfy household consumption and food security requirements, rice is consumed more in urban areas, where it is one of the major foodstuffs at homes, restaurants, functions, schools, hospitals and prisons. It is grown almost throughout the country, lowland rice is mainly in the Eastern and Western Uganda due to availability of lowlands with high moisture contents throughout the growing season, while upland rice is grown in the Northern and Southern regions. Despite the growing acreage and importance of rice as a food security crop in Uganda and the EA region, several studies cite the low level of investment in the critical segments of the rice value chain as major constraint to increase acreage, productivity and production to achieve the

NRDS target of 680,000MT per year by 2018. Lack of clear financial and investment metrics for the value chain is hindering efforts to stimulate private sector investment and financing of critical segments of the rice VC.

VECO East Africa commissioned this study to assess the profitability and Investment levels as well as potential for all the key segments of the rice value chain in eastern Uganda. The purpose of the exercise was to generate VC business metrics that can be used to influence policy and regulatory frameworks, market mechanisms, extension services provision, seed and input supply systems, credit for smallholder farmers and farmer organizations as part of the broader interventions in the rice sub-sector. The importance of Rice as a food security and a commercial crop in Uganda and the region can no longer be overlooked. A number of previous studies have indicated that Ugandan imports for rice contribute 40% of countries rice demand. In 2015/16 total rice imports were 85,634MT costing the country UGX 100,060,819,683. Imports included milled and semi milled rice. Uganda an enormous potential for local production; unfortunately Rice has not attracted the level of investment needed to attain self-sufficiency at the production level. Significant milling capacity is being created but this is not matched by production. Uganda also has the potential to create a comparative advantage in rice production and become a regional powerhouse. GOU recognizes the potential of rice as a food security crop, high potential for income for smallholder farmers, impact on the countries balance of payments through exports to regional markets and support development of other auxiliary industries. Uganda exported 51,808.77MT of rice worth UGX 75.45bn in 2015/16. The GOU under the NRDS has prioritized; Seed production, Fertilizer supply, Mechanization, Water for Agricultural Production (irrigation) and Postharvest handling as areas for investment in order to create local capacity to produce. These interventions are intended to ensure self- sufficiency by 2018 by tripling production to from the current 237,000MT to 680,000 MT annually.

This profitability and investment analysis is aimed to contribute towards the wider sub-sector interventions build on several value chain analyses and studies previously done by providing a comprehensive profitability and investment analysis in the selecting VC segments to inform investment and financing decisions aimed at expanding the production, processing and markets.

1.2 Objectives and scope of the work

Broadly, the objective of the study was to undertake an independent Profitability and Investment analysis at the strategic segments of the Rice value chain. The selected segments in the analysis were;

1. Input supply segment
2. Production segment

3. Assembly, consolidation and whole sale segment
4. The import and export segment
5. The retail market segment

The analysis also looked at some business models current deployed by rice value chain actors with the objective of evaluating the commercial value of these models. The major models identified for analysis were;

1. The smallholder farmer producer model.
2. The cooperative production and marketing model
3. The integrated cooperate rice production model
4. The trading model.

The report provides a comprehensive analysis of the business performance, investment opportunities and financial needs of rice producers and investors and to provide information to influence the business decisions. The study was guided by the following terms of reference (TOR);

1. To carry-out a profitability analysis at the selected segments of the rice value chain and make a business case to attract financial institutions to offer credit facilities to rice value chain actors as well as potential investors to invest in the sector.
2. Develop a business case for financial institutions, indicating the potential of increasing their outreach and broaden their clientele base if they venture into extending credit facilities to rice value chain actors.
3. Develop a business case for potential investors, indicating the potential market for rice in the region and how they can generate immense returns by investing in the different segments of the rice value chain
4. Facilitate a one-day workshop to disseminate the findings to stakeholders, majority of whom will be representatives of the financial institutions, potential investors etc.

1.3 Scope of the Study

The geographical scope of the study covered Eastern Ugandan districts of Jinja, Iganga, Bugiri, Butaleja, Mbale and Lira in Northern Uganda. The content scope as outlined in the TOR looked at the cost structure, profitability, investments and opportunities for investment along the different selected segments of the rice value chain. The study looked at business models and attempts to recommend financing and investment strategies to strengthen the capability and competitiveness of these business models to strengthen the rice value chain, build a frontier for self-sufficiency and a launch pad for regional trade.

1.4 Limitations and delimitations of the study

The study did not attempt to quantify volumes produced and traded at each stage of the value chain, but focused on estimation of revenue and cost structures at each stage of the value

chain, types of investment, profit margins and return on investment using selected profitability and investment indicators and to model the generic cash flow patterns at each segment.

3.0 STUDY METHODOLOGY

The consulting team first conducted a desktop research to have basic idea about rice farming as a business in the study area. An inception workshop was conducted to discuss the study methodology and TOR reference. This was followed by discussions with key informants who included the farmers' leaders, leading investor's in rice milling, and representative from government departments and organizations working to support the rice value chain. Focus group discussions were then carried out with farmer groups each containing 7-10 people. Each group was a representative of a single association or cooperative. FGDs were also dome with members of Doho and Olwenyi rice schemes in Butaleja and Lira respectively. Small Millers and traders; importers, wholesalers, input dealers, transporters, retailers and financial services providers (Post bank, Centenary, UDB and Abi Trust were interviewed individually for business confidentiality. FGDs were also conducted with 7-10 members of the rice traders associations. In addition, discussions with 3 groups of rice millers were conducted.

The interviews were conducted in the districts of Jinja, Iganga, Bugiri, Mbale, Butaleja and the rice trading hubs and warehouses of Kampala and Jinja. Analysis was done in the context of value chain upgrading as suggested by Trienekens (2011) with the help of descriptive statistics (measures of central tendency), tables, figures and gross margins.

4.0 CONTEXT ANALYSIS

Uganda's Gross Domestic Product is estimated to expand to 5.8% in 2016 up from 5.3% in 2015. The local currency has depreciated against the dollar by 12.4% over the same period which sparked a general fear that inflation will rise in 2016 with depreciation of the shilling against the dollar. Indicator so far show that headline inflation as at September had dropped down to 4.2%, but there remains a risk of it rising due to under par rainfall patterns. Agriculture is a key contributor to Uganda's GDP both directly and indirectly through agricultural related industry and services. It forms about half of the country's exports. While the greater part of the country is food secure, some areas continue to be prone to food insecurity as a result of dry spells. The population is growing at an unsustainable rate of 3.0% and calls for an increase in food production to avert challenges of food shortages. Population growth is seeing an increase in rural urban migration, and a large proportion of a young dependent population, rising unemployment among the youth with an average of 80,000 jobs created annually against an estimated demand of 700,000 jobs every year. Agriculture is increasingly being seen as one of the more sustainable vehicles for job creation in a country where nearly 75% of the work force is employed in agricultural related jobs, while 90% of the rural folks are employed in Agriculture. The food security burden is currently shouldered by the smallholder farmers, producing using rudimentary tools and traditional practices, associated with low productivity. Food production is further hampered by climate change, exacerbated by the

poor farming practices, limited access to finance, poor agro input use, low investments in the sector. The government of Uganda has put in place several initiatives aimed at increasing funding and private sector investment in the sector to enhance agricultural production and productivity, improve marketing as a strategy to guarantee food security. The government is implementing a number of interventions in collaboration and partnerships with donors such as Japanese International Cooperation Agency (JICA), the World Bank, Food and Agriculture Organization (FAO), to develop the rice sub-sector. These efforts are being complimented by development organizations both local and international like VECO East Africa together working to strengthen the national agricultural research system, providing farmers with extension services, technical support towards increasing capacity for disease detection and control of pests and diseases as well as value addition, access to markets, farmer institutional development, rehabilitation of rural infrastructure and strengthening regulatory systems and enforcement of food safety standards.

Rice also known as Oryaza spp. *Oryaza sativa* is a cereal that is grown in many countries throughout the world and is the staple diet for over half the world's population. Rice is an annual plant which means when planted, it grows and is harvested within a year. It is also semi-aquatic, which means that it can grow partly on land, and partly submerged in water. Rice plants start their life as tiny rice grains sown in wetlands, irrigated fields or upland fields and grow to become green, grassy plants about 60-100 cm tall. Each plant contains many heads full of tiny rice grains that turn golden when the rice plant is ready for harvest. Rice is the second most produced cereal in the world after maize, the United States Department of Agriculture (USDA) estimates that the world Rice Production in 2016/2017 will be 481.73 million metric tons, up from 471.69 million tons in 2015/16. This represents an increase of 2.13% in rice production around the globe. African production represents 6% of the world output, however rice is now becoming increasingly popular in Africa and the continent is estimated to supplement its own production through imports worthy $15billion annually to cover the supply gap. In Uganda the demand for rice is estimated to grow by 3.4% annually, but production is growing at a much slow rate.

In trade terms IRRI (2015) indicates that, a small amount of rice is traded globally compared with other crops such as wheat, corn (maize), and soybeans. However, after remaining stagnant for almost two and a half decades, rice trade expanded in the late 1980s in the wake of trade liberalization in many countries and the General Agreement on Tariffs and Trade in 1994. Global rice trade now stands at around 42 million tons compared with 10–12 million tons in the late '80s. The trade in 2012, accounted for nearly 9% of global production compared with 4% in the late '80s. In Africa demand for rice is growing faster than production with an estimated imports into the continent worth $15billion dollars annually. The rice export market is highly concentrated with the top five rice exporters accounting for 80% of global rice trade. Of the five top exporters, four (Thailand, India, Vietnam, and Pakistan) are from Asia. The middle-east and Africa are the fastest growing export markets with the imports in these regions doubling from

10million to 20 million tons in the past decade alone (http://irri.org/rice-today/trends-in-global-rice-trade).

Rice was introduced in Uganda by Indian traders as early as 1904 but did not gain popularity until the late 1940s (Wilfred, 2006). During the initial years, Indian traders imported paddy rice and milled it using Indian traditional stone mills. This increased its costs making it almost inaccessible to indigenous communities. Its consumption was limited to the top earning class. After the 1940s, rice cultivation started taking root at subsistence level by a few farmers sourcing seeds from Tanzania (Tanganyika), where rice growing was more developed than in Uganda. Rice production in Uganda picked up during 1950s, mostly focusing at feeding schools, prisons and hospitals and the Second World War veterans. Today rice has become a major food security crop as well as a cash crop in a number of districts in Uganda and its cultivation is increasing, especially with the introduction of upland varieties.

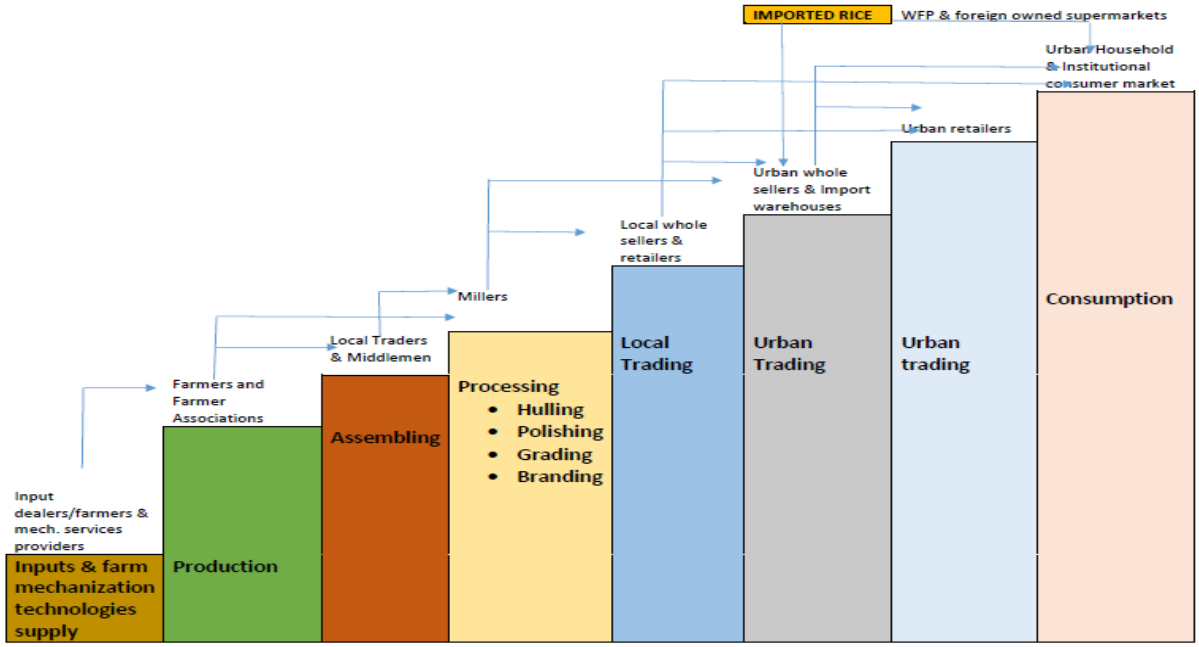
Today rice production is dominated by smallholder farmers farming 0.25 acres-2 ha, making up 84% of the rice production. Large scale production is largely spearheaded by the government facilitated rice schemes like Doho rice Scheme in Butaleja, Kibuku in Kasese districts and the commercial corporate organizations like Tilda and out growers affiliated to commercial millers like Eastern millers in Tororo, Kingom rice in Kampala and Upland millers in Jinja. About 70% of the rice produced in the eastern districts of Butaleja and Bugiri ends up in the trading hubs and warehouses in Kampala and Jinja. Mbale is a major rice trading hub in Mid-eastern Uganda and accounts for nearly 30% of the rice produced in
Manafwa and Butaleja districts. Rice imports estimated at 85.6MT, while the price of rice is variable across the country, imported rice from Vietnam, Pakistan, Indonesia and Cambodia is priced at an average of UGX 2,500 per kg, which is lower than the locally produced rice which retails at an average of UGX 3,000-4000. Premium imported brands like the Basmati rice retail at an average UGX 6500-8500 per kg retails at an average UGX2,500-however premium rice brands. The average import price for a kg of ordinary rice brands estimated from URA import data is UGX1, 168 compared to the average unit cost of production for a kg of local rice which is UGX1, 560, making it less competitive in the market place. The postharvest and handling and processing technologies used in milling further make Uganda's rice less competitive at home and in the regional markets. Generally aromatic rice varieties are preferred to non-aromatic and tend to cost more, bulging quality is preferred to the non-bulging type, non -sticky is preferred to sticky types while unbroken rice is preferred to the broken rice. These properties also influence the pricing of rice whether local or imported.

4.1 The Structure of the rice value chain

Rice is a political commodity in the majority of Asian countries and its price is an important barometer of government performance. Thus, it becomes imperative for policymakers to control rice trade flow for domestic rice market to be stable. State agencies are involved in controlling the flow of rice in and out of countries and, in many cases, they also take part in importing/exporting rice through government-to-government (G-G) protocols. The EAC Partner States identified rice in the list of sensitive products with potentials for domestic production and cross-border trade. It is considered that, the Importation of such products from outside the EAC could negatively affect domestic production and development of regional capacity to produce. The partner states agreed that the items would attract rates of over 25 percent and, in some cases, a mixture of specific duty and *ad valorem* rates.

Rice production in Uganda started in 1942 mainly to feed the World War II soldiers, but due to a number of constraints, production remained minimal until 1974 when farmers appealed to the then government for assistance. In response, government identified the Doho swamps and constructed the Doho Rice Irrigation Scheme. Today rice is grown mainly by small scale farmers almost throughout the country, but also with large scale farmers in few places such as Tilda. Rice is now widely grown in many parts of the country, especially in the eastern and northern regions due to the presence of lowland with high moisture content throughout the growing season and the introduction of upland varieties. The structure of the rice value chain in Uganda is illustrated in the fig.1 below;

Fig.1 The rice value chain in Uganda



In the last decade, Uganda has experienced a remarkable increase in acreage under rice supported by increased availability of upland and low land seed varieties, better farming practices, premium market prices, and favorable government policies aimed at stimulating large private sector investment in the rice sub-sector.

Area under Rice by region (second season 2008)

Region	Rice	Std error	C.I (95%)		CV
	Area (Ha)		Lower	Upper	
Central	1,000	179	649	1,352	17.9
Eastern	16,902	1,791	13,380	20,423	10.6
Northern	12,598	1,717	9,224	15,972	13.6
Western	8,303	869	6,595	10,011	10.5
Uganda	**38,803**	**2,635**	**33,624**	**43,983**	**6.8**

Area under Rice by region (first season 2009)

Region	Rice	Std error	C.I (95%)		CV
	Area (Ha)		Lower	Upper	
Central	1,637	400	851	2,423	24.4
Eastern	19,131	2,761	13,702	24,560	14.4
Northern	13,314	1,425	10,511	16,117	10.7
Western	2,201	556	1,108	3,294	25.3
Uganda	**36,282**	**3,182**	**30,026**	**42,539**	**8.8**

Source: UBOS Agricultural census (2010).

The growth of Uganda's rice production has contributed to greater food security and a reduction in rice imports. For instance, according to the Ugandan government, rice imports dropped between 2005 and 2008, which helped save the country about US$30 million in foreign exchange earnings. Current production of rice is estimated at 237,000MT. The MAAIF and other stakeholders in the rice value chain are implementing

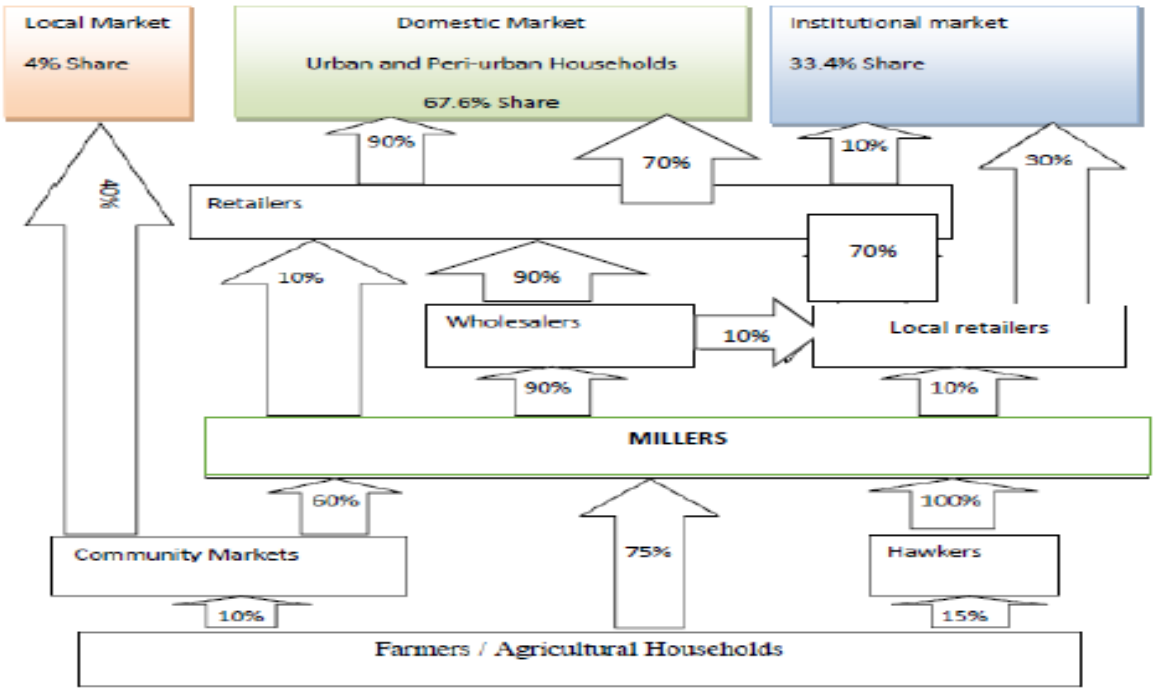
a number of interventions intend to increase national rice production to 680,000MT by 2018 in order to achieve national self-sufficiency in rice production.

5.0 FINDINGS

5.1 The domestic rice market structure

Rice is grown for two reasons; one for family income by small holder farmers and two for profit by commercial farmers. It's estimated that only 10% of the rice grown by smallholder farmers is retained for consumption by the households with the remaining 90% being sold to generate household income (*JP management & Africare Uganda 2011)*. The rice grown by the smallholder farmers is marketed both in rural and urban areas. Typical consumer preferences are guided by the rice characteristics i.e. aromatic to non-aromatic rice, sticky to non-sticky, unbroken to broken and bulging after cooking to rice that does not bulge, white milled rice to brown rice. Besides domestic production rice is also imported to supplement the local production. By end of 2008, rice was the third highest import by value into the country amounting to US$ 90 million. In spite of some exports Uganda remains a net importer of rice. Much of the local rice production is consumed within the country with limited quantities exported to the regional markets mainly by commercial producers like Tilda. A sub-sector map of the market flows of rice produced at smallholder levels is illustrated in Fig.2 below;

Fig 2. The rice market flows for smallholder farmer producers in Uganda.



Source: JP Management and Africare Market study (2011) updated (2016)

The rice trade is dominated by informal trade arrangements between buyers and producers with more formal trade transactions occurring among the institutional traders and the importers.

5.2 Functional roles and characteristics of the rice Value chain actors

Fig.1 above illustrates the key segments and primary actors at each segment of the rice value chain in Uganda. The market chain is composed of input suppliers, smallholder farmers, and brokers/transporters, milling machine operators, wholesale traders, retailers and consumers (individual and institutions). Besides the primary actors there are other service providers that offer services to the value chain actors, these include financiers, transporters, researchers, policy makers and development agencies. The actors in each of the segments play a distinctive role in the value chain although there are role overlaps among some individual players. Such role overlaps are dictated by the business models of the specific actors. The functional roles in each segment of the value have been summarized in the table below;

5.3 The input Segment

The input dealers play a primary role of distributing inputs for rice production. They link up with the seed and other input wholesale stores and stock key inputs for the benefit of the farmers. The main inputs stocked for sale to rice farmers are;

1. Certified seed
2. Fertilizers
3. Pesticides and herbicides
4. Farm implements; hoes, sickles, pangas, strings, bags, slashers etc.

Farmers obtain inputs from two main sources; 1) the commercial input dealers, 2) From among fellow farmers. Seed is often sourced from among fellow farmers or retained from previous crop through a careful selection process. Others may buy from fellow farmers and in rare occasions from commercial input dealers.

5.3.1 Profitability of the input segment

The analysis looked at the level of value addition made by the input dealers and their subsequent margins. It further looks at the viability assessment of the input business at the indicative profitability margins to determine the sustainability of the input business as a going concern. Table 2 below show the profitability estimates of the input business in the rice value chain.

Table 2: Gross margin analysis of the Input segment

Product Item Per Kg	Median Unit costs	Transportation Costs	Re-packaging cost	Median sales price	Median Margin	% Gross Margin
INPUTS SEED						
Certified rice seed	3,800	50	N/A	4,300	250	18.2%
Home saved seed	N/A	N/A	N/A		N/A	N/A
FERTILIZERS						
NPK	3050	50	70	3300	130	6.6%
UREA	2900	50	50	3100	100	6.7%
DAP	2900	50	50	3100	100	6.7%
FARM IMPLEMENTS						
Hand Hoes	10500			12000	1500	23.8%
Sickles	3200			3500	300	18.8%
Pangas	5000			6000	1000	30.0%
Slashers	6500			7500	1000	30.8%
Knapsack Sprayer	40000			45000	5000	25.0%

The gross margin analysis was done for the individual inputs at the retail end of the input distribution chain. The findings show that the gross margins for rice inputs are small and profitability of the segment is very low. The seasonality of demand and low overall turnover are disincentive factors for the input trade. The team did not manage to assess the profitability of the wholesale end of the input segment for lack of credible data from the dealers and the unwillingness to divulge sales information. The major suppliers of inputs to the tail end retailers are seed companies located in Kampala and importers based in Jinja and Kampala. This analysis can however be done through a price survey and extracting import data from URA which could not be done in (the timeframe and context of) this study, and then applying the relevant modeling assumptions to determine the gross margins. A case study of one of the major seed houses, showed a margin of 30-40% on seeds and between 20-25% on agro-chemicals. The presence of government subsidies and incentive schemes appear to benefit the top end of the input segment and little trickle-down benefit getting to the retail level.

The profits margin, for productivity enhancing inputs such as fertilizers and seed ranged from 6-18%, these profits levels are commercially unsustainable and below the market cost of money. Better margins are realized from sale of farm implements in the range of 23-30% which is marginally within the market return for money. This explains why rural retailers tend not to stock productivity enhancement inputs (seed, chemicals and fertilizers) and explains scarcity of these inputs in rural retail shops. *Volume sales to create economies of scale is a possibly viable strategy to create commercial viability from such small margins, unfortunately the current rural retail model cannot achieve this. Retail consolidation and demand aggregation (through cooperative sourcing) to create a platform for organized bulk sourcing of inputs. This will increase the through put from the retail trade, motivate retailers to improve stocking and availability of productivity enhancing inputs besides farm implements.*

This will also increase the trickledown effect of incentives extended by government, because it will strengthen the negotiating and competitive prowess of retailers when dealing with the seed houses and importers.

5.3.2 Current investments in the Input segment

The Input segment is one of the segments prioritized by government for investment. Current focus has been in research which has seen a number of upland varieties released with a number more not yet released. Released varieties include the K85, K98, WITA 9, NERICA 1, 4, 10 and the aromatic varieties like Supa. Besides investments in research, government and partners have investing in sstrengthening the Institutional framework, improve technology dissemination and capacity building to increase production, multiplication and dissemination of certified seed, Improve fertilizer marketing and distribution, sustainable soil management, irrigation and water management. Private sector investments have also weighed into the government initiatives led by seed companies in the areas of building seed multiplication, distribution infrastructure and research. Seed companies like Equator seed Ltd and Victoria Seed Ltd in Northern and North eastern Uganda have invested strongly in community based rice seed out-grower schemes/models to increase seed production multiplication and availability. This is a strategic shift to increase profit margins and seed production efficiency through lean operations. This contrasts with the current practice of seed companies operating large high capital intensive seed production farms with a heavy overhead cost structure resulting into lower gross margins and high seed prices. Outsourcing seed production eliminates many overheads and capital costs, leaving the company to focus on providing technical supervision to the seed out-growers. Government on the other is pushing for the production of fertilizers in Uganda as a strategy to increase availability, bring down costs and increase access to fertilizers. A fertilizer production factory is in the offing in Tororo in Eastern Uganda.

5.3.3 Investment Opportunities in the Input segment

There are significant opportunities for investment in the input sector in the areas of research to develop higher yielding varieties, fast maturing aromatic or hybrid varieties and seed multiplication. Less than 5% of the farmers interviewed actually use certified seed. Productivity of the current varieties is lower compared to yields from other rice producing nations especially from Asia. This is attributed to the genetic inferiority of current varieties. Ugandan yields average 1.5-2.7 MT per ha milled rice compared to 4-6 MT of milled rice per Ha in Asia and leading local firms like Tilda who use own imported or improved varieties. Kingdom Rice has equally considered and sourced new rice variety seeds from out of Uganda and is working with selected out-grower farmers, it will be interesting to monitor the performance of these varieties compared to the current ones in use from the Uganda market.

Milled Rice Yield by Country in MT/HA

Rank	Country	Yield (MT/HA)
1	Australia	10.00
2	Egypt	9.00
3	Peru	8.00
4	Turkey	8.00
5	United States	8.00
6	Uruguay	8.00
7	Korea, Republic Of	7.00
8	EU-27	7.00
9	Japan	7.00
10	Argentina	7.00
11	Chile	7.00
12	China	7.00
13	Mexico	6.00
14	Taiwan, Province Of China	6.00
15	Paraguay	6.0
16	Russian Federation	6.0
17	Viet Nam	6.0
18	Mauritania	5.0
19	El Salvador	5.0
20	Trinidad and Tobago	5.0
21	Ukraine	5.00
22	Niger	5.00
23	Korea, Democratic People's Republic Of	5.00
24	Brazil	5.00
31	Honduras	4.00
32	Kenya	4.00
33	Bangladesh	4.00
34	Colombia	4.00
35	Kazakhstan	4.00
36	Malaysia	4.00
37	Philippines	4.00
38	Pakistan	4.00
39	Nicaragua	4.00
40	Senegal	4.00
41	Suriname	4.00
42	Venezuela	4.00
43	Thailand	3.00
44	Uzbekistan	3.00
45	Nepal	3.00
46	Panama	3.00
47	Lao People's Democratic Republic	3.00
48	Sri Lanka	3.00
49	Madagascar	3.00
50	Mali	3.00
51	Myanmar	3.00
52	Costa Rica	3.00
53	Cuba	3.00
54	Afghanistan	3.00
55	Benin	3.00
56	Ecuador	3.00
57	Guatemala	3.00
58	Ghana	3.00
59	Guinea-Bissau	2.00
60	Cambodia	2.00
61	Haiti	2.00

Source: United States Department of Agriculture (2016)

A comparative analysis at the global productivity levels shows level Uganda has a long way to go to attain productivity levels in the realized by the top 20 countries. Egypt and Niger are the highest ranked African countries with yields of 9.0 and 5.0 of milled rice in MT /Ha respectively. Australia and Egypt are the top ranked countries in the world with Australia producing 11.0 MT/Ha of milled rice compared to Uganda's estimated yield is 2.0 MT/Ha of milled. In East Africa Kenya has the highest yield of 4.0 MT/Ha hectare, this is largely attributed to the introduction of hybrid rice and extensive use of fertilizers. The highest yields registered in the top countries are mainly coming from hybrid rice varieties, which underscores the need for Uganda to invest in developing suitable rice Hybrids as a strategy to boost productivity and increase overall production. ***The recommendation is to step up research in development of suitable rice hybrids as a priority, away from the conventional varieties in order to address productivity limitations. Counter arguments however point out that hybrids are not for smallholder farmers arguing on the need for new seed and input demands.*** In Kenya, Haryana India, Bangladesh and India hybrids have been demonstrated to yield up to 40-43% under the same good management practices than the conventional varieties.

Table 3: Comparative analysis of profitability levels of hybrids and open pollinated varieties.

YIELD	Mean Production Costs	Mean Incomes	Marketing costs	Other costs (postharvest loss)@10%	Mean profits with interest payments	Mean profits without interest payments	ROI with interest payment	ROI without interest payment
Hybrid high input	(3,483,384)	7,200,000	(280,000)	(720,000)	3,716,616	3,984,500	98%	114%
Conventional high input	(2,841,384)	3,000,000	(234,000)	(300,000)	(141,384)	126,500	-4.5%	4.5%
Conventional low input*	2,008,500	2,400,000	(126,000)	(240,850)	25,150	25,150	1.1%	1.1%

*Low input means no use of organic or inorganic fertilizers in prescribed levels, but threshing waste is added back into the field to decompose into manure.

Source: Field and secondary data analysis

The analysis shows that current rice varieties in the market are genetically limited for yield, farmers are unlikely to make any money but incur loss if they adopt high input production, because the gains in output do not justify the increase in financial investment. The analysis was done under the assumption that high input in the initial stages will

require the farmer to access external debt to finance acquisition of inputs and will incur an interest cost at a rate of 3% per month for six month from a local SACCO, the conventional low input is always based on own financing which does not attract interest. The analysis assumes a farm gate market price of UGX2, 000 per kg of milled rice.

The findings imply that, the current varieties of rice in the market with realizable yields of 1.5-2.0kgs i.e (The K-series, super and Nerica upland series) of milled rice may not sustainably justify the push for intensive, high input farming practices like the use of fertilizers, pesticides and good agronomic practices. The justification for this drive requires that farmers realize a minimum yield of ***2,600kgs/acre*** of milled rice. This would accrue a profit of ***UGX 1,354,818*** which is equivalent to a ***ROI of 36%***, in order to be profitable and competitive in the rice production business. This required rate of return of 36% is considered the magic rate because it represents the cost of capital (the cost at which farmers borrows from the local SACCOS) to invest in the farm business. ***The logic would be that any attempts to increase the volume of rice production at farm level must be supported by the input sector (research component) developing high yielding hybrid rice varieties if Ugandan farmers are to produce and market its rice competitively.***

5.3.3 Investment analysis of the Input segment of the rice value chain

The input business is a vital component for the effective performance and competitiveness of the production segment of the rice value chain. An analysis was done to determine the profitability and the viability of business dealing in input supplies to rice farmers. Two approaches were used to assess the viability of the business, in the first step, the value of inputs an input supplier can supply to a farmer with one acre of rice was determined, and the profit earned from such a supply was estimated. A return on investment for the input supplier from that supply was determined and compared with the cost of money (capital) based on the local borrowing rate from the SACCOs.

Table 4a PROJECTED INCOME STATEMENT FOR ONE ACRE

Supply Period	**Season 1**	**Season 2**	**Season 3**	**Season 4**	**Season 5**	**Season 6**
Sales Revenues	621,400	552,400	694,528	697,955	826,169	765,338
Cost of Goods	551,083	503,689	616,035	637,679	733,659	699,640
Gross Income	70,317	48,711	78,493	60,276	92,510	65,697
Operating gross margin	**13%**	**10%**	**13%**	**9%**	**13%**	**9%**
Overheads @ 10% of stock costs	5,511	5,037	6,160	6,377	7,337	6,996
Net estimated Margins	**64,806**	**43,674**	**72,332**	**53,899**	**85,173**	**58,701**
Net % Margin	**12%**	**9%**	**12%**	**8%**	**12%**	**8%**

The underlying assumption here is that a model input dealer is able to provide and one stop shopping point and build a loyal local customer base, thus each farmer buy the inputs from the local shop.

In the table above, the analysis indicates the profits earned by an input dealer supplying inputs for an acre of rice. Six seasons were considered in the analysis based on the assumption that rice is produced twice (two seasons) a year. We also assumed an input dealer contracted to supply the full range of inputs required to the farmer. Taking the example of season 1 an input dealer, will invest an estimated UGX551,083 to procure the inputs and earn a revenue of UGX 621,400 from selling these inputs to the farmer. The dealer will earn a profit of UGX64,806 which represent a 12% return on investment (ROI). Assume the input dealer has access to a bank loan at the current commercial lending rate of 28% which represents the market cost of money, it implies that the input dealer will be operating a none viable business and losses financial value which makes the business non-sustainable as demonstrated in the investment analysis in the table below.

Table 4b Net cash (Profits) from one acre supplies

	Investment	Year 1 Profits	Year 2 Profits	Year 3 Profits
Net cash flows	(551,083)	108,480	126,232	143,874
Discount rate	28%			
NPV	(130,689.99)			
IRR	16%			
Average ROI per year	22%			

The IRR is negative because the net cash flows/profits realized from supplying inputs to one farmer with one acre over the three years is less than the initial capital invested to make these supplies. The NPV is also negative indicating that the input dealer is losing value on his investment from doing this supply. A single acre supply is not viable as a business for the input dealers in the rice value chain, While it may not be easy to raise the profit margins, the input dealer can compensate for the low margins by increase sales turnover and realize greater profits from the use of the same level of capital investment by turning over cash faster to realize more profit in the year.

In the second step we estimated the level of sales turnover needed to achieve an acceptable and viable level of profitability. We approached this analysis by considering the break-even acreage a dealer must services to achieve a market return on investment equivalent to the cost of capital employed. Two scenarios were considered, in case 1 the cost of capital was set at 28% which represents the commercial lending rate at which input dealers borrow from commercial banks. In case II we considered the cost of capital at 40% which represents the rate at which rural cooperatives lend (i.e 36-40%). Theoretically a business operating in this financial environment must make a return on Investment of equivalent to the cost of capital to operate as a going concern. With these assumptions we calculated the break-even acreage needed to realize the sales turnover

that will return the profits needed to realize a ROI of 28% and 40% as illustrated in the table5 below;

Table 5 Projected sales turnover rate and profitability for an Input dealer selling rice inputs

Period	Year 1 Season 1	Year 1 Season 2	Year 2 Season 3	Year 2 Season 4	Year 3 Season 5	Year 3 Season 6
No. of acres required to attain required rate of return of 28%	2.4	3.2	2.6	3.8	2.8	4.2
Profits from the projected acreage	154,303	141,033	184,811	204,057	234,771	244,874
No. of acres required to attain required rate of return of 40%	3.4	4.6	3.4	4.7	3.5	4.8
Expected Income to realize desired return	220,433	201,476	246,414	255,072	293,464	279,856

In both cases below we looked at how much profits an input supplier should generate to earn a market financial rate of return. We looked at a three year two season period to determine the relevant profits returned and compute the viability or feasibility indicators as illustrated in the table 6a & b below. We assume an input dealer employing a working capital of UGX 551,083 will need to realize profits as indicated in **table 5** above**. Table 6a** which shows a summary of the projected business performance over a period of three years and the viability indicators;

Table 6a Break-even acreage to realize profits at a desired rate of return of 28%

Period	Initial Investment	Year 1	Year 2	Year 3
No. of acres required to attain required rate of return of 28%		5.6	6.4	7.0
Profits from the projected acreage	(551,083)	295,336	388,868	479,645
Discount rate	28%			
Net present value (NPV) of the investment	UGX 113,833			
Internal rate of return (IRR)	44%			
Average ROI per year	70%			
Required Cash turn around rate in a year	2.4 times			

Table 6b Break-even acreage to realize break-even profits at a desired rate of return of 40%

Period	Initial Investment	Year 1	Year 2	Year 3
No. of acres required to attain required rate of return of 40%		8.0	8.1	8.3
Profits from the projected acreage	(551,083)	421,909	501,486	573,320
Discount rate	28%			
Net present value (NPV) of the investment	UGX 279,684			
Internal rate of return (IRR)	68%			
Average ROI per year	90%			
Required Cash turn around rate in a year	3.4 times			

Table 6a and **6b** show that for an input dealer with a working capital of UGX 551,083 must turn around cash 2.4 times and 3.4 times respectively per year in order to realize a market rate of return. The analysis suggests that developing a rural input supply system should focus on both push and pull factors, at the pull end farmers should be encouraged to source for farm inputs from designated input dealers, while from the push side dealers should be encourage to stock a full range of farm inputs to ensure that they are able to build a one stop shopping point for farmers. The input business thrives on expanding volume of sales rather than high profit margins. Critical interventions to make this segment competitive would require organizing farmers through their cooperatives and associations to procure a full range of inputs from designated input suppliers so as to create the sales volumes needed to attain sustainable profitability levels.

BUSINESS INVESTMENT PROPOSAL AND CASHFLOWS FOR AN INPUT SUPPLY BUSINESS

BUSINESS: INPUT SUPPLY TO RICE FARMERS

LOCATION: BUTALEJA

GOAL: SUPPLY INPUTS FOR AT LEAST; 100 acres in year 1

150 acres in year 2

195 acres in year 3

NO.OF SEASONS: TWO RICE CROPING SEASONS

TARGET CUSTOMERS: RICE FARMERS OPERATING UNDER A COOPERATIVES

COMMERCIAL FARMERS WITH 2-3 ACRES

SALES STRATEGY: POSITION AS A ONE STOP SHOPPING CENTER FOR RICE FARM INPUTS AND SUPPLY A FULL RANG OF RICE FARM INPUTS AS

EXPECTED SALES TARGET:

YEAR 1	**YEAR 2**	**YEAR 3**
87,683,302	131,524,953	170,982,439

PROJECTED PROFITS:

YEAR 1	YEAR 2	YEAR 3
6,595,263	7,506,668	8,816,223

REQUIRED START UP CAPITAL: UGX 25,512,000

REQUIRED WORKING CAPITAL: UGX 55,000,000

FINANCING PLAN: PERSONAL SOURCES; UGX 25,512,000

CREDIT FINANCING UGX 29,488,000

ALTERNATIVE WORKING

CAPITAL GAP FINACING: 1. GRANTS

2. CUSTOMER ADVANCES

CREDIT FINANCING STRATEGY: NEGOTIATE FOR CREDIT SUPPLIES FROM SUPPLIERS OF STOCK ITEMS

ALTERNATIVE STRATEGY: SEEK COMMERCIAL CREDIT/BANK OVERDRAFT FROM A FINANCIAL INSTITUTION OR A BANK GUARANTEE TO CREDIT SUPPLY OF STOCKS

PERSONNEL PLAN: Three salaried staff; the business owner, the office attendant and the field extension officer

STAFF SALARY PLAN:

YEAR	YEAR 1	YEAR 2	YEAR 3
BUSINESS OWNER	1,440,000	1,584,000	1,980,000
SHOP ATTENDANT	1,260,000	1,386,000	1,732,500
FIELD OFFICER	900,000	990,000	1,237,500

PROJECTED INCOME STATEMENT;

INCOME STATEMENT

YEAR OD SALES	Yr 1	Yr 2	Yr 3
Sales Revenues	87,683,302	131,524,953	170,982,439
Total Revenues	**87,683,302**	**131,524,953**	**170,982,439**
Less			
Cost of Sales	86,777,590	121,488,626	151,860,783
Opening stock	0	17,858,400	29,466,360
Closing stock	(17,858,400)	(29,466,360)	(36,832,950)
Cost of goods sold	**68,919,190**	**109,880,666**	**144,494,193**
Gross Profit	18,764,112	21,644,287	26,488,246
Operating expenses			
Salaries & Wages	3,600,000	3,960,000	4,950,000
Rentals	1,800,000	1,980,000	2,475,000
Trading license	250,000	375,000	468,750
Transportation	3,469,768	4,163,721	5,204,651
Administrative expenses (meals, utilities)	2,472,228	2,966,674	3,708,342
Demonstrations	576,853	692,224	865,280
Total overhead costs	**12,168,849**	**14,137,619**	**17,672,023**
Net profit	**6,595,263**	**7,506,668**	**8,816,223**
ROI	26%	29%	34%
Net Profit margin	**10%**	**7%**	**6%**

PROJECTED 12 MONTHS SALES AND REVENUE PLAN

REVENUES	Q'TITY FOR 100 ACRES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL SALES REVENUE
		QTR 1			QTR2			QTR 3			QTR4			
SEED	2400	-	1,440,000	5,040,000	720,000	-	1,440,000	5,040,000	720,000	-	-	-	-	14,400,000
Hoes (Pc)	400	1,080,000	-	720,000	180,000	-	360,000	-	720,000	-	360,000	-	180,000	3,600,000
Panga (pc)	200	315,000	-	210,000	52,500	-	105,000	-	210,000	-	105,000	-	52,500	1,050,000
Sickles (pc)	200	-	-	-	275,000	275,000	-	-	-	-	440,000	110,000	-	1,100,000
String (m)	50	-	25,000	20,000	-	-	-	60,000	-	20,000	-	-	-	125,000
Slashers	100	450,000	450,000	-	-	-	-	450,000	450,000	-	-	-	450,000	2,250,000
NPK	2500	-	3,750,000	3,000,000	-	-	-	9,000,000	-	3,000,000	-	-	-	18,750,000
DAP	5000	-	3,750,000	3,000,000	-	-	-	9,000,000	-	3,000,000	-	-	-	18,750,000
Urea	5000	-	3,750,000	3,000,000	-	-	-	9,000,000	-	3,000,000	-	-	-	18,750,000
Manure	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Tarpulin	200	1,800,000	-	-	-	3,600,000	-	2,700,000	-	-	900,000	-	-	9,000,000
Bags	2500	600,000	-	-	-	1,200,000	-	600,000	-	-	300,000	-	600,000	3,300,000
Spray Pumps	50	-	-	600,000	1,200,000	-	-	-	-	1,800,000	2,400,000	-	-	6,000,000
Pesticide (mls)	12000	-	-	18,000	36,000	-	-	-	-	54,000	72,000	-	-	180,000
Fungicide (kg)	100	-	-	30,000	60,000	60,000	-	-	-	60,000	60,000	30,000	-	300,000
Herbicides (L)	100	1,350,000	900,000	-	-	-	900,000	1,350,000	-	-	-	-	-	4,500,000
Total sales revenue		**5,595,000**	**14,065,000**	**15,638,000**	**2,523,500**	**5,135,000**	**2,805,000**	**37,200,000**	**2,100,000**	**10,934,000**	**4,637,000**	**140,000**	**1,282,500**	**102,055,000**

PROJECTED 12 MONTHS PURCHASE AND STOCKING PLAN

PURCHASES	Q'TITY FOR 100 ACRES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL SALES REVENUE
		QTR 1			QTR2			QTR 3			QTR4			
SEED	2400	-	1,033,920	3,618,720	516,960	-	1,033,920	3,618,720	516,960	-	-	-	-	10,339,200
Hoes (Pc)	400	989,460	-	659,640	164,910	-	329,820	-	659,640	-	329,820	-	164,910	3,298,200
Panga (pc)	200	155,820	-	103,880	25,970	-	51,940	-	103,880	-	51,940	-	25,970	519,400
Sickles (pc)	200	-	-	-	192,500	192,500	-	-	231,000	-	308,000	77,000	-	1,001,000
Slashers	200	311,400	311,400	-	-	-	-	311,400	-	311,400	-	-	311,400	1,557,000
String (m)	50	-	17,300	13,840	-	-	-	41,520	-	13,840	-	-	-	86,500
NPK	5000	-	3,736,000	2,988,800	-	-	-	8,966,400	-	2,988,800	-	-	-	18,680,000
DAP	5000	-	3,498,750	2,799,000	-	-	-	8,397,000	-	2,799,000	-	-	-	17,493,750
Urea	5000	-	3,498,750	2,799,000	-	-	-	8,397,000	-	2,799,000	-	-	-	17,493,750
Manure	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Bags	2500	439,800	-	-	-	879,600	-	439,800	-	-	219,900	-	-	1,979,100
Tarpaulin	200	1,319,400	-	-	-	2,638,800	-	1,979,100	-	-	659,700	-	-	6,597,000
Spray Pumps	50	-	-	439,800	879,600	-	-	-	-	1,319,400	1,759,200	-	-	4,398,000
Pesticide (mls)	12000	-	-	10,539	21,078	-	-	-	-	31,617	42,156	-	-	105,390
Fungicide (kg)	100	-	-	20,100	40,200	40,200	-	-	-	40,200	40,200	-	-	180,900
Herbicides (L)	100	904,500	603,000	-	-	-	603,000	904,500	-	-	-	-	-	3,015,000
Total cost of goods		**4,120,380**	**12,699,120**	**13,453,319**	**1,841,218**	**3,751,100**	**2,018,680**	**33,055,440**	**1,511,480**	**10,303,257**	**3,410,916**	**77,000**	**502,280**	**86,744,190**

PROJECTED 12 MONTHS SALES OPERATIONS EXPENSE BUDGET FOR 100 ACRES

ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL SALES REVENUE
	QTR 1			QTR2			QTR 3			QTR4			
Salaries & Wages	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	3,600,000	3,960,000	10,560,000
Rentals	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	1,800,000	1,980,000	5,280,000
Trading license	-	-	-	-	-	-	-	-	-	-	250,000	375,000	625,000
Transportation	538,133	73,649	150,044	80,747	1,322,218	60,459	412,130	136,437	3,080	20,091	3,469,768	4,163,721	10,430,476
Administrative expenses (meals, utilities)	206,019	206,019	206,019	206,019	206,019	206,019	206,019	206,019	206,019	206,019	2,472,228	2,966,674	7,499,092
Demonstrations	-	-	-	288,427	-	-	-	-	-	-	576,853	692,224	1,557,504
Total overhead costs	**1,194,152**	**729,668**	**806,063**	**1,025,193**	**1,978,237**	**716,478**	**1,068,149**	**792,456**	**659,099**	**676,110**	**12,168,849**	**14,137,619**	**35,952,072**

PROJECTED CASH FLOWS

YEAR	Year 1	Year 2	Year 3
Opening cash balance	25,512,000	14,248,863	10,147,572
Cash Inflows from sales	87,683,302	131,524,953	170,982,439
Cash outflows from trading activities	(86,777,590)	(135,626,245)	(169,532,806)
Cash outflows from trading operations	(12,168,849)	(14,137,619)	(17,672,023)
Closing cash balance	**14,248,863**	**10,147,572**	**11,597,205**

INVESTMENT VIABILITY INDICATORS

Period	Yr 0	Yr 1	Yr2	Yr3
Investment Cash flows	(25,512,000)	6,595,361	10,036,474	19,121,848
	28%			
NPV	16,399,857			
IRR	32%			
ROI	47%			

Conclusion

The Investment plan has positive cash flows and a health return on Investment of (ROI) of 47%, results in value creation to the tune of UGX 18,676,560 with an internal rate of return of (IRR) of 87% which is above the cost of capital of 28% which was used as the discount rate for the cash flows and is the commercial bank lending rate.

5.4 The Production Segment

The production segment is dominated by the smallholder farmers farming 0.25-2 acres, these form 80% of the rice produced in Uganda. Much of the production is characterized by use of rudimentary technologies like the hand hoe and panga, poor harvest and post-harvest handling methods, poor milling processes resulting in poor quality rice with large quantities of broken rice. The primary role of the production segment is farming. Eastern Uganda produces mostly lowland rice, although some parts are now trying out upland varieties. The main costs elements in the production segment are;

1. Inputs costs
2. Farm equipment and mechanization plants
3. Operational costs
4. Marketing costs

The average acreage for rice in the eastern Ugandan region is skewed towards 0.5 acres, the high level fragmentation has challenges in attaining the required level of land consolidation needed to provide a viable opportunity for mechanized operations. However the opportunity for land consolidation in the wetlands exists by adopting the farm models of Doho rice scheme and Manafwa Basin Rice Farmers Association both in Butaleja. In these examples farmers have clearly demarcated rice blocks in an expansive land area which can be mechanized and the costs shared among the farmers according to the land size. This can best operationalized through an organized farmer institution like the cooperative or association procuring a block services and then passing on the cost to the individual members pro rata. This strategy is consistent with the proposed plan for contracting input suppliers through the farmer organization to create the required turnover. Overall collective action will provide a basis for access to cost reduction technologies and reduction of operational costs in the production segment in order to realize increased profitability.

5.5.1 Profitability of the production segment

There are four major types of farmers/producers in the production segments; 1) Individual farmers usually the case of most rural based smallholder farmer acting alone, 2) Cooperative farmers working in production groups and formal cooperatives and associations, 3) Irrigated scheme farmers the Doho Rice farmer cooperative and Manafwa Basin rice farmer association respectively and 4) commercial corporate organization/out-grower arrangements like in Tilda and Equator seed multiplication schemes. A Profit margin analysis was done to determine the cost structure, profitability, investments and investment opportunities in the production segment. Below is a brief description of the four models.

Model 1a. The Individual low input farmer with 1 acre of rice; where the farmers buys inputs at retail prices and does not benefit from quantity discounts, uses low input production approach[1]with 1 acre land size under rice and sells the rice as an individual and finances the production costs from own savings.

Model 1b. The Individual low input farmer with ¼ acre of rice; where the farmers buys inputs at retail prices and does not benefit from quantity discounts, uses low or high input production approach[2] in ¼ land size under rice and sells the rice as an individual and finances the production costs from own savings.

Model 2a. The individual high input with 1 acre under rice; where the farmers practices high input farming, procures inputs as an individual at retail prices and does not benefit from quantity discounts and proceeds to sell the rice as an individual and finances the production costs from own savings.

Model 2b. The individual high input with 2-3 acres under rice; where the farmers practices high input farming, procures inputs as an individual at retail prices and does not benefit from quantity discounts and proceeds to sell the rice as an individual and finances the production costs from own savings and part credit.

Model 3. The group/association or cooperative high input model; The farmers practice collective action, aggregate input demand and procure inputs and services collectively to benefit from quantity related discounts as a strategy to lower production costs. Besides input acquisition, they also bulk and market their produce collectively to negotiate for better prices, improve quality through internal quality management mechanisms. This model is not well developed but is currently practiced by Manafwa Basin Rice farmers Association and Olweny Rice Scheme. Doho Rice Scheme has also taken the initial steps to implement it.

Model 4. The integrated commercial corporate and out-grower model; Tilda in Bugiri is implementing this model, while Eastern Rice Millers in Tororo are already piloting the same model. No credible data was available to evaluate the profitability of these models largely because of the sensitivity and confidentiality concerns of the corporate firms implementing the model. We recommend this be evaluated in a different and independent feasibility study, which we believe could not be done in the context and scope of this study.

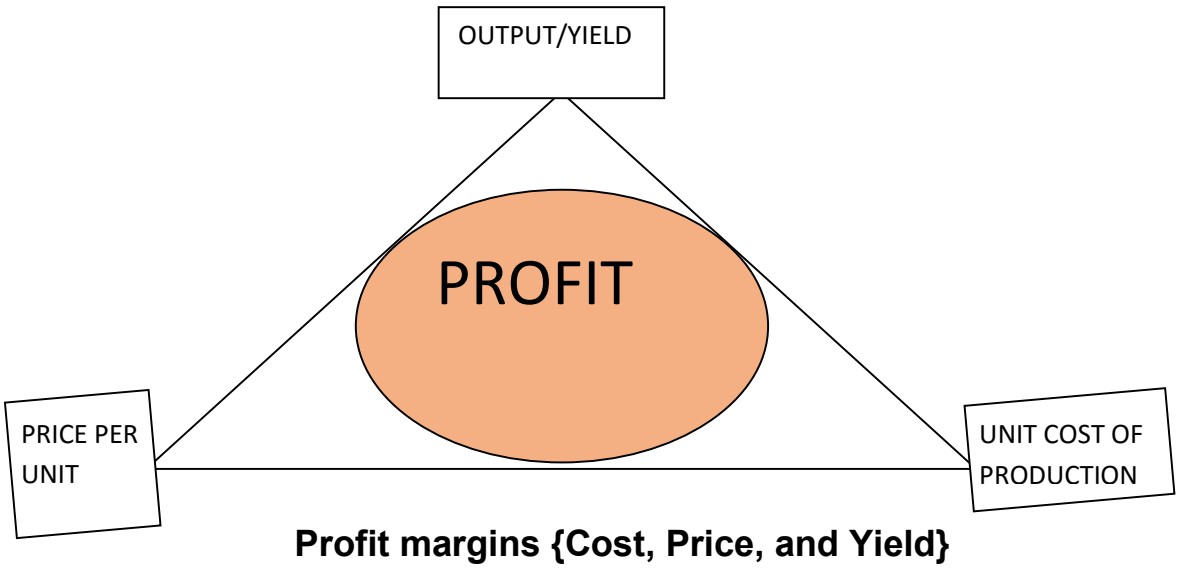
[1] Low input here refers to farming without applying organic fertilizer, its however standard practice to use pesticides and fungicides

[2] Low input here refers to farming without applying organic fertilizer, its however standard practice to use pesticides and fungicides

5.5.2 Basis of analysis

The Gross margin, costs and profitability analysis was modeled on three key scenario taking into account the yield and market price as determinants of unit cost of production and profitability.

The Gross Profit margin and the net profit margins were determined as a function of cost, price and yield/output profit triangle illustrated below.



Profit margins {Cost, Price, and Yield}

The above function, was applied to the three yield and price scenarios described below as applied to the producer models described above, under three different price scenarios.

1. **Yield Scenario 1:** In this scenario farmers' produce using traditional methods, they use home saved seed and do not applying inorganic fertilizers, but use organic fertilizers (Manure) from decomposed husks of the previous harvest. They however use pesticides and fungicides when necessity calls. Because of the "wait and see" approach they tend to apply these when damage has already occurred and therefore fail to gain the full benefit of the application. The median output under this scenario was **1,200 Kg** milled rice per acre. Production is financed with 10% credit from local SACCO (Includes VSLAs) or 100% own savings.

2. **Yield Scenario 2:** In this scenario farmers produce using traditional methods and use home saved seed but with good management practices, without applying inorganic fertilizers, but using organic (Manure) from decomposed husks of the previous harvest. They use pesticides and fungicides and apply these at the recommended stages of crop growth. Production costs are financed entirely from own funds and expensive credit is avoided. The median yield under this scenario was **1,500 Kg** milled rice per acre. Production is financed with 10% credit from local SACCO or 100% own savings.

3. **Scenario 3:** In this sce*n*ario farmers produce using traditional methods and home saved seed but with good management practices, without applying inorganic fertilizers, but use organic (Manure) from decomposed husks of the previous harvest. They use pesticides and fungicides and apply these at the recommended stages of crop growth. Production costs are financed entirely from own funds and expensive credit is avoided. The median yield under this scenario was **1,500Kg** milled rice per acre. Production is financed with 10% credit from local SACCO or 100% own savings.

The three scenarios described above were analyzed and the results presented in **Table 3** below. The analysis was done in the context of three predominant yield levels realized by farmers alongside the two prevailing price levels obtainable in the typical experience of the farmers in their typical farm to market environment. The findings are presented in table 7 below;

Table 7(1a); Gross margin analysis of the Production segment with traditional methods and use of local manure (usually husks from threshing) with 50% self-financing.

INCOME PRICE SCENARIO	Price 1	Price 2	Yield in Kg milled rice		
			Model 1a Individual Scenario 1	Model 2a Individual Scenario 2	Model 3 Cooperative Scenario 2
			1,200	1,500	1,500
Selling price & Sales Revenue	1800	2000	2,160,000	2,700,000	3,000,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross Margin			8%	6%	25%
Net Profit			(190,715)	(327,384)	208,599
Unit cost			1,959	2,018	1,861
Unit Margin			(159)	(218)	139
% Profitability			-8%	-11%	7%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601
INCOME (MEDIAN)					
Unit price	1900	2100	2,280,000	2,850,000	3,150,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross margin			14%	12%	32%
Net Profit			(70,715)	(177,384)	358,599
Unit cost			1,959	2,018	1,861
Unit Margin			(59)	(118.26)	239.07
% Profitability			-3%	-6%	13%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601

INCOME (HIGH/MAX)					
Unit price	2000	2300	2,400,000	3,000,000	3,450,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross margin			19%	17%	44%
Net Profit			49,285	(27,384)	658,599
Unit cost			1,959	2,018	1,861
Unit Margin			41	(18)	439
% Profitability			2%	-1%	24%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601

Price scenario 1. (UGX1800-2000): This analysis looked at profitability of the three models indicated above under the low case price scenario. This price scenario describes the low level price floor. In this case the mill prices (milled rice price at the mill) range between **UGX 1800-2000** per kg depending on the level of breakage and period of sale and the quantities being sold. The traditional farming practices model is not sustainable under this price scenario. The low yields meant the unit costs of production for these farmers is high averaging **UGX 1,861-2,018** per kg of milled rice. Farmers generally make losses loses under these production models, marginal profits are realized if the farmers work in a cooperative arrangement, with a ROI of 7%. Irrespective of the production model employed traditional practices are not commercially sustainable in the rice value chain. The **loss** registered in **yield scenario 2** clearly shows the limitation of using home saved seed even under the better management practices. This analysis also demonstrate the fatality of using 50% commercial credit to finance production.

Price scenario 2. (UGX1900-2100): This scenario can be described as the middle level price floor, the profitability of the three models under the middle floor level price structure is still not profitable with 50% commercial credit financing of production activities. Farmer made marginal ROI of 13% only when operating under the Cooperative structure.

Price scenario 3. (UGX 2000-2300): This is the best case scenario and top floor price level obtainable at the moment in the market. This premium prices of between **UGX 2100-2300** per kg are payable under collective marketing where the members collectively negotiate for a price. It is also associated will large volume sales which can only be achieved by group/cooperative farmers practicing collective marketing. Individual farmers with high quality rice (Quality defined in terms of breakage rate) also have a leverage to negotiate a premium price. It is noteworthy to say that under the premium price the cooperative level farmers will realize a fair ROI estimated at **24%**. Farmers under model **1a**, traditional practices were able to break-even with a marginal return of **2%** compared to **-1%** by farmers under model **2a** with high input but following traditional methods like broadcasting and financing 50% of production cost with commercial credit.

Table 7(1b); Gross margin analysis of the Production segment with traditional methods and use of local manure (usually husks from threshing) with 100% self-financing.

INCOME @ YIELD SCENARIO 1	Price 1	Price 2	Yield in Kg milled rice		
			Model 1a Scenario 1	Model 2a Individual Scenario 2	Model 3 Cooperative Scenario 2
			1,200	1,500	1,500
Min. Unit price	1800	2000	2,376,215	2,967,884	3,193,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross Margin			6%	8%	19%
Net Profit			241,715	208,384	595,801
Unit cost			1,779	1,840	1,732
Unit Margin			21	(40)	268
% Profitability			1%	-2%	15%
INCOME (MEDIAN)					
Unit price	1900	2100	2,496,215	3,117,884	3,343,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross margin			24%	22%	40%
Net Profit			145,500	3,117,884	3,343,601
Unit cost			1,779	1,840	1,732
Unit Margin			121	60	368
% Profitability			7%	3%	21%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601
INCOME (HIGH/MAX)					
Unit price	2000	2300	2,616,215	3,267,884	3,643,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross margin			30%	28%	52%
Net Profit			481,715	508,384	1,045,801
Unit cost			1,779	1,840	1,732
Unit Margin			221	160	568
% Profitability			12%	9%	33%

Price scenario 1. (UGX1800-2000): This analysis looked at profitability of the three models indicated above under the low case price scenario. This price scenario describes the low level price floor. In this case the mill prices (milled rice price at the mill) range between **UGX 1800-2000** per kg depending on the level of breakage and period of sale and the quantities being sold. The traditional farming practices model is not sustainable under this price scenario. The low yields meant the unit costs of production for these farmers is high averaging **UGX 1,732-1,840** per kg of milled rice. Farmers generally make losses loses under these production models, marginal profits are realized if the farmers work in a cooperative arrangement, with a marginal ROI of **1%** for the traditional low input farmer Model **1a**. In model **2a,** high input farmer has a negative return of **-2%,** farmers under the cooperative structure earned up to **15% ROI.** Irrespective of the production model employed traditional practices practicing traditional practices in rice production are not commercially sustainable. The **loss** registered in **yield scenario 2** clearly shows the limitation of using low input farming or a combination of high input with traditional farm management practices. It's however noteworthy that farmers operating without commercial credit to finance production are able to break-even on one acre of rice crop. This analysis also confirms the superiority of the cooperative model in leveraging the profitability of the rice farming.

Price scenario 2. (UGX1900-2100): This scenario can be described as the middle level price floor, the profitability of the three models under the middle floor level price structure. Farmers in all the three models were able to break even with Model **1a** and Model **2a** farmers realizing Margin ROI of **7%** and **3%** respectively. The farmers under the model 3 cooperative structure realized ROI of **21%** which is closer to the market rate of return money.

Price scenario 3. (UGX 2000-2300): This is the best case scenario and top floor price level obtainable at the moment in the market. This premium prices of between **UGX 2100-2300** per kg are payable under collective marketing where the members collectively negotiate for a price. It is noteworthy to say that under the premium price the cooperative level farmers will realize a fair ROI estimated at **33%** which sustainable and in line with the market value of money estimated at 28% and 36% for commercial and rural savings lending schemes. Farmers under model **1a** and **2a**, realized better profits with a ROI of **12%** and **9%** respectively. This is however possible only where these farmers are able to produce premium quality rice that enables them to earn the premium price.

The conclusions that can be drawn from these findings are that credit financing whether through commercial credit or rural savings credit schemes which current offer 28% and 36-40% interest rates is not sustainable with low input production or a combination of high input and traditional crop management and agronomic practices. Farmer struggle to break even and in other cases make losses. The profitability and ability to break-even is entirely dependent on the price and are very vulnerable to price fluctuation. They are unable to benefit from profitability through cost reduction and increasing yield (productivity enhancement) to offset the effects of low market prices. This partly explains why rice farmers are unable to expand acreage through land hire even when land is available for hire.

Table 7 (2a) Profitability analysis of Models 1a, 2a and 3a under the modified yield[3] levels with 50% credit financing.

INCOME @ YIELD SCENARIO 2	Price 1	Price 2	Yield in Kg milled rice		
			Model 1a Scenario 1	Model 2a Individual Scenario 2	Model 3 Cooperative Scenario 2
			1,300	1,600	1,600
Unit price & Sales revenue	1800	2000	2,340,000	2,880,000	3,200,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross Margin			17%	13%	34%
Net Profit			(10,715)	(147,384)	408,599
Unit cost			1,808.24	1,892.12	1,744.63
Unit Margin			(8)	(98.26)	272.40
% Profitability			0%	-5%	16%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601
INCOME (MEDIAN)					
Unit price	1900	2100	2,470,000	3,040,000	3,360,000
			2,350,715	3,027,384	2,791,401
Gross margin			23%	19%	81%
Net Profit			119,285	12,616	568,599
Unit cost			1,808.24	1,892.12	1,744.63
Unit Margin			92	7.88	355.37
% Profitability			5%	0%	20%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601
INCOME (HIGH/MAX)					
Unit price	2000	2300	2,600,000	3,200,000	3,680,000
			2,350,715	3,027,384	2,791,401
Gross margin			29%	25%	94%
Net Profit			249,285	172,616	888,599
Unit cost			1,808.24	1,892.12	1,744.63
Unit Margin			192	107.88	555.37
% Profitability			11%	6%	32%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601

[3] Yield modified by changes in agronomic practices and input levels

Table 7 (2b) Profitability analysis of Models 1a, 2a and 3a under the modified yield[4] levels with 100% credit financing

INCOME @ YIELD SCENARIO 2	Price 1	Price 2	Yield in Kg milled rice		
			Model 1a Scenario 1	Model 2a Individual Scenario 2	Model 3 Cooperative Scenario 2
			1,300	1,600	1,600
Unit price & sales Revenue	1800	2000	2,340,000	3,147,884	3,393,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross Margin			17%	23%	42%
Net Profit			205,500	388,384	795,801
Unit cost			1,642	1,725	1,624
Unit Margin			158	75	376
% Profitability			10%	4%	23%
INCOME (MEDIAN)					
Unit price & sales Revenue	1900	2100	2,686,215	3,307,884	3,553,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross margin			34%	29%	48%
Net Profit			551,715	548,384	955,801
Unit cost			1,642	1,725	1,624
Unit Margin			258	175	476
% Profitability			16%	10%	29%
INCOME (HIGH/MAX)					
Unit price & sales Revenue	2000	2300	2,816,215	3,467,884	3,873,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross margin			40%	36%	62%
Net Profit			681,715	708,384	1,275,801
Unit cost			1,642	1,725	1,624
Unit Margin			358	275	676
% Profitability			22%	16%	42%

[4] Yield modified by changes in agronomic practices and input levels

Table 7 (3a) Profitability analysis of Models 1a, 2a and 3a under the modified yield[5] levels with 50% credit financing

INCOME @ YIELD SCENARIO 3	Price 1	Price 2	Yield in Kg milled rice		
			Model 1a Scenario 1	Model 2a Individual Scenario 2	Model 3 Cooperative Scenario 2
			1,500	1,800	1,800
Unit price & sales Revenue	1800	2000	2,700,000	3,240,000	3,600,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross Margin			34%	27%	50%
Net Profit			349,285	212,616	808,599
Unit cost			1,567.14	1,681.88	1,550.78
Unit Margin			233	141.74	539.07
% Profitability			15%	8%	34.7%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601
INCOME (MEDIAN)					
Unit price & sales Revenue	1900	2100	2,850,000	3,420,000	3,780,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross margin			42%	34%	58%
Net Profit			499,285	392,616	988,599
Unit cost			1,567.14	1,681.88	1,550.78
Unit Margin			333	218.12	549.22
% Profitability			21%	13%	35.4%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601
INCOME (HIGH/MAX)					
Unit price	2000	2300	3,000,000	3,600,000	4,140,000
Total Production Costs			2,350,715	3,027,384	2,791,401
Gross margin			49%	41%	73%
Net Profit			649,285	572,616	1,348,599
Unit cost			1,567.14	1,681.88	1,550.78
Unit Margin			433	357.88	842.87
% Profitability			28%	21%	54%
Interest @ 3% per month for 6months and 2.33% for co-op.			216,215	267,884	193,601

[5] Yield modified by changes in agronomic practices and input levels

Table 7 (3b) Profitability analysis of Models 1a, 2a and 3a under the modified yield[6] levels with 100% credit financing

INCOME @ YIELD SCENARIO 3	Price 1	Price 2	Yield in Kg milled rice		
			Model 1a Scenario 1	Model 2a Individual Scenario 2	Model 3 Cooperative Scenario 2
			1,500	1,800	1,800
Unit price & Sales Revenue	1800	2000	2,340,000	3,147,884	3,393,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross Margin			17%	23%	42%
Net Profit			205,500	388,384	795,801
Unit cost			1,423	1,533	1,443
Unit Margin			377	267	557
% Profitability			26%	17%	39%
INCOME (MEDIAN)					
Unit price	1900	2100	2,686,215	3,307,884	3,553,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross margin			34%	29%	48%
Net Profit			551,715	548,384	955,801
Unit cost			1,423	1,533	1,443
Unit Margin			477	367	657
% Profitability			34%	24%	46%
INCOME (HIGH/MAX)					
Unit price	2000	2300	2,816,215	3,467,884	3,873,601
Total Production Costs			2,134,500	2,759,500	2,597,800
Gross margin			40%	36%	62%
Net Profit			681,715	708,384	1,275,801
Unit cost			1,423	1,533	1,443
Unit Margin			577	467	857
% Profitability			41%	30%	59%

Table 7 (2a:3b) makes a strong case for the use of improved and better yielding seed, with good agronomic and farm management practices. The additional cost incurred is offset by the gains in productivity as demonstrated by increase in yields under yield scenario 2&3. The cooperative model remains superiority to other models because of the greater capacity to manage and reduce costs as well as access and utilize productivity

[6] Yield modified by changes in agronomic practices and input levels

enhancement opportunities and negotiate goods prices based on market economies of scale created.

Cost reduction strategies in production should not be ignored in advancing the need to use improved and high yielding varieties as well as productivity enhancement technologies. This could be higher if the coop leveraged on its numbers to access inputs (fertilizer, multiplied seeds from researchers, and acquire customized farm management skills to address the specific needs of each variety for) at low prices

On the other hand model 1 farmers benefit from the use of own seed and better management practices and the cost savings made up for the lower yields earned to give them a better profit margin compared to model 2 farmers.

This situation challenges the assumption that using improved seed, practices and good prices as opposed to home saved seed and other traditional practices would guarantee better incomes for farmers. It calls for a more integrated approach to ensure that all the necessary ingredients are in place combined with cost cutting measures to realize the full benefit of investments in improved seed and farm practices e.g the yield potential of the seed used, quality of fertilizers and agro-chemicals used, land preparation and timing of planting, weeding and vermin control activities.

In all the three price and yield scenarios farmers enjoyed margins above the central bank rate for money currently at 13% and comparable to the market rates for money between and 24-28% interest charged by commercial banks. Farmers under this scenario can commercially sustain their production operations.

The analysis shows that credit at current production levels and market prices is not sustainable for individual farmers even under improved farming practices. The high cost of credit erodes the profit margins, in all cases except under premium price scenario 3, obtainable in the cooperative structure. Individual farmers using improved farming methods suffer very low margins, because of the inability to take advantage of cost reduction strategies. However traditional farmers and cooperative farmers under medium floor and premium price scenarios can make some money. Cooperative borrowing has the benefit of lower borrowing costs due to collective bargaining and the potential to use group collateral as compared to individual farmer model. This is demonstrated in the higher profit margin even under credit financing. The cooperative model can represent a good entry point to advance VC financing in the production segments. While the residual margins may be low due to the credit effect under low price and yield scenarios, credit to financing production in the short-term can be useful tool from a strategic point of view to build capacity for long-term profitability and self-financing.

The findings contradict the generally held assumption that enabling smallholder farmers to access credit automatically results in better productivity and incomes to farmers. The findings put to test this assumption and credit should be considered in the broader perspective of other production, productivity and market factors. One key consideration is to ensure that credit should be accessed and directed to getting the critical inputs that create the greater impact towards increasing profitability.

A situational analysis was carried to by taking case studies of typical farmers producing rice in Butaleja and Bugiri and Tororo.

Table 8a. Case 1 Two Farmers with ¼ acre of rice crop in DOHO rice scheme

CASE DESCRIPTION	Price	Farmer 1- Low input	Farmer 2 High input
INCOME @ price 1800			
Total expected Yields of milled rice after PH loss & home retention	**1,800**	**250**	**375**
Revenues		**450,000**	**675,000**
Total cost of production		**601,575**	**791,550**
Net Profit		**(151,575)**	**(116,550)**
Unit cost		2,406	1,759
Unit Margin		(606)	41
% Profitability		**-25%**	**2%**
INCOME @ price 2000	**Price**	**Yield**	**Yield**
Total expected Yields of milled rice after PH loss & home retention	**2,000**	**250**	**450**
Revenues		**500,000**	**900,000**
Total cost of production		**601,575**	**791,550**
Net Profit		**(101,575)**	**108,450**
Unit cost		2,406	1,759
Unit Margin		(406)	241
% Profitability		**-17%**	**14%**
INCOME @ price 2300	**Price**	**Yield**	**Yield**
Total expected Yields of milled rice after PH loss & home retention	**2,300**	**250**	**450**
Revenues		575,000	1,035,000
Total cost of production		601,575	791,550
Net Profit		**(26,575)**	**243,450**
Unit cost		2,406	1,759
Unit Margin		(106)	541
% Profitability		**-4%**	**31%**

The farmers studied financed their operations from personal savings, in the first case the farmer working under Manafwa Basin Rice farmers association, practices low input on a hired irrigated ¼ acre plot of land. An analysis of the farmer's farm business under three different market price scenarios that prevailed at the time of the study demonstrated that this farmer makes losses of -25% when selling at the lower price floor, and -4% loss at the upper price floor. It is reasonable to conclude that the low acreage low input model is not commercially sustainable for rice production.

Case 2 A Farmer with 1 acre of rice crop as an out-grower of Tilda Rice scheme

In case 2, two focus group discussions were held with two separate groups of Out-growers farmers working with TILDA. In both cases it was noted that the average acreage per farmer is ½ acre and therefore the profitability analysis was based on a ½ acre farm size. Both groups of farmers used high input approach with heavy use of fertilizers and application of agro-chemicals for pest, disease and weed control.

TABLE 8b: THE FARM INCOME STATEMENT

Item	No/Qty	Unit Cost	FGD 1	FGD 2
EXPENDITURE				
Inputs				
Seed (kg) They retain dry paddy	**50**	1,000	50,000	50,000
Hoes (Pc)	5	12,000	60,000	48,000
Panga (pc)	4	7,000	28,000	21,000
Sickles (pc)	3	3,000	9,000	9,000
String (m)	50	2,000	100,000	100,000
DAP	50	3,000	150,000	150,000
Urea	50	2,500	125,000	125,000
Manure			80,000	80,000
Tarpaulin	4	45,000	90,000	90,000
Bags	20	1,200	24,000	24,000
Spray Pump hire			10,000	10,000
Pesticide (mls)	1.5	15,000	22,500	22,500
Fungicide (kg)	1	30,000	30,000	30,000
Herbicides			60,000	60,000
Subtotal Input Costs			**838,500**	**819,500**
Labour costs				
Slashing	22	10,000	220,000	220,000
Herbicides Application			40,000	40,000
1st Ploughing (tractor, ox-plough or manual)	22	5,000	110,000	60,000
2nd Ploughing (tractor, ox-plough or manual)			-	-
Nursery establishment			-	-
Bund construction			-	-
Puddling	22	9,000	198,000	198,000
DAP application	22	1,000	22,000	22,000
Transplanting	22	10,000	220,000	220,000
Weeding			-	-
Application of Urea	22	1,000	22,000	22,000
Application of insecticides	22	1,000	22,000	22,000
Application of Fungicides	22	1,000	22,000	22,000
Second weeding			-	-

Bund Clearing			20,000	20,000
Bird Scaring			130,000	130,000
Harvesting	22	5,000	110,000	110,000
Heaping	22	3,000	66,000	66,000
Threshing(50 bags)	50	2,000	100,000	100,000
Transport –roadside	50	1,000	50,000	50,000
Drying	50	500	25,000	9,000
Winnowing	50	500	25,000	9,000
Subtotal Labor Cost			**1,402,000**	**1,320,000**
Service Costs				
Warehousing/storage				-
Transportation to Tilda(in Bags)	-	500	25,000	20,000
Transportation to the market				-
Interest (financing costs)				-
Sub-Total services costs			**25,000**	**20,000**
Marketing and service costs				-
Milling	-	-	-	-
Bags			-	-
Sub-total Marketing Costs			**25,000**	**20,000**
Total production cost			**2,265,500**	**2,159,500**
PROFITABILITY MEASURES				
INCOME @ price 1500		**Price for Paddy**	**FGD 1**	**FGD 2**
Total expected Income after PH loss & home retention		**1,500**	**2,000**	**1,800**
Revenues			**3,000,000**	**2,700,000**
Total cost of production			**2,265,500**	**2,159,500**
Gross margin			**32%**	**24%**
Net Profit			**734,500**	**540,500**
Unit cost of paddy production			1,133	1,200
Unit Margin			367	300
% Profitability			**32%**	**25%**

The out-grower scheme is a better alternative to the cooperative model, the profitability levels are comparable to profitability earned from the cooperative structure. The training and appreciation of the use of cost saving methods like use of herbicides for weed control, better application of pesticides and fertilizers and proper harvest and post-harvest handling techniques give this group of farmers an edge over their counterparts farming as independent individuals. The yields realized from these farmers is between **3600-4000kgs** of paddy per acre, which is equivalent to **2300-2600kgs** compared to the yields from high input farmers of **1200-1800kgs** milled rice per acre realized by farmers under the other models discussed in this report. The major difference between the Tilda out-grower farmers and the other farmer models presented is the use of herbicides and broadcasting as opposed to nursery seeding and planting in rows. The higher yields under

broadcasting contradict the conventional wisdom of planting rice in nursery beds and then transplanting it and planting according to the recommended spacing. This is an area of possible research, but one possible explanation for increased yields is the seed rate achieved through broadcasting compared to standard spacing.

Table 8c. Case 3 Two commercial farmers with 2 & 3 acres of rice crop in Butaleja and Iganga respectively.

CASE DESCRIPTION	Price	Farmer @ 2 acres in Butaleja High input	Farmer @ 3 acres in Iganga High input
INCOME @ price 1800			
Total expected Yields of milled rice after PH loss & home retention	**1,800**	**3,000**	**4,500**
Revenues		**5,400,000**	**8,100,000**
Net Profit		**832,000**	**1,701,600**
Unit cost		1,523	1,422
Unit Margin		277	378
% Profitability		**18%**	**27%**
INCOME @ price 2000	**Price**	**Yield**	**Yield**
Total expected Yields of milled rice after PH loss & home retention	**2,000**	**3,000**	**4,500**
Revenues		**6,000,000**	**9,000,000**
Net Profit		**1,432,000**	**2,601,600**
Unit cost		1,523	1,422
Unit Margin		477	578
% Profitability		**31%**	**41%**
INCOME @ price 2300	**Price**	**Yield**	**Yield**
Total expected Yields of milled rice after PH loss & home retention	**2,300**	**3,000**	**4,500**
Revenues		**6,900,000**	**10,350,000**
Net Profit		**2,332,000**	**3,951,600**
Unit cost		1,523	1,422
Unit Margin		777	878
% Profitability		**51%**	**62%**

In case 3 two semi-commercial farmers one in Butaleja and another in Iganga were assessed to determine the profitability of their farm operations under three different price floors as illustrated above. Both farmers use high input production methodologies combined with good agronomic and farm management practices. At the lower floor price of **UGX 1,800** it can observed that a commercial farmer needs to have 2-3 acres of rice as a minimum threshold for commercial viability. The farmer on 3-acres of rice realized a ROI of **27%** which is close to the market rate of return for money, compared to **18%** ROI

realized by the farmer with 2-acres. The lower floor price has been taken to draw this conclusion because it represents the farm business resilience against market dynamics.

BUSINESS INVESTMENT PROPOSAL AND CASHFLOWS FOR A 3 ACRE COMMERCIAL RICE FARMING BUSINESS

BUSINESS: A CMOMMERCIAL RICE PRODUCTION BUSINESS

LOCATION: BUTALEJA

GOAL: CULTIVATE AND PLANT RICE IN 3 ACRES

TARGET YIELDS: 3000 KGS /ACRE MILLED RICE

PROJECTED TOTAL YIELD: 12,000 PER SEASON

NO.OF SEASONS: TWO RICE CROPING SEASONS

TARGET CUSTOMERS: RICE TRADERS IN MAJOR TOWNS AND SELLING THROUGH THE COOPERATIVE.

SALES STRATEGY: SELL THROUGH A COLLECTIVE COOPERATIVE WHAREHOUSE TO COLLECTIVELY NEGOTIATE A PREMIUM PRICE

TARGET SALES PRICE: NORMAL: 2,000 PREMIUM PRICE: 2,300

EXPECTED FARM SALES REVENUES:

YEAR 1	YEAR 2	YEAR 3
12,000,000	13,800,000	13,800,000

PROJECTED PROFITS:

YEAR 1	YEAR 2	YEAR 3
3,934,800	5,295,540	5,093,288

REQUIRED START UP CAPITAL: UGX 6,304,600

FINANCING PLAN: PERSONAL SOURCES; UGX 6,304,600

CREDIT FINANCING TO BE CONSIDERED IF NECCESSARY

PERSONNEL PLAN: USE HIRED LABOR

INPUT COST PLAN:

YEAR 1	YEAR 2	YEAR 3
6,971,600	6,820,240	8,525,300

LABOR COST PLAN:

YEAR 1	YEAR 2	YEAR 3
7,329,000	7,695,450	7,695,450

MARKETING EXPENSE AND OTHER ACTIVITY PLAN:

YEAR 1	YEAR 2	YEAR 3
736,200	809,010	907,061

PROJECTED INCOME STATEM...

Year	Yr 1	Yr 2	Yr 3
Sales Revenues	18,000,000	20,700,000	21,735,000
Total Revenues	**18,000,000**	**20,700,000**	**21,735,000**
Less			
Cost of inputs	**(6,971,600)**	**(7,668,760)**	**(8,052,198)**
Operating expenses			
Labor Costs	7,329,000	7,695,450	7,695,450
Marketing costs	496,200	521,010	547,061
Other expenses (communication, travel)	240,000	288,000	360,000
Total operating Costs	**8,065,200**	**8,504,460**	**8,602,511**
Net profit	**2,963,200**	**4,526,780**	**5,080,292**
ROI	47%	92%	43%
Net Profit margin	37%	53%	59%

FARM ACTIVITY FINANCIAL BUDGET FOR 12 MONTHS

REVENUES	Q'TITY FOR 100 ACRES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL CASH BUDGET
		QTR 1			QTR2			QTR 3			QTR4			
SEED	72	-	216,000	-	-	-	216,000	-	-	-	-	-	-	432,000
Hoes (Pc)	6	72,000	-	-	-	-	-	-	-	-	-	-	-	72,000
Panga (pc)	4	28,000	-	-	-	-	-	-	-	-	-	-	-	28,000
Sickles (pc)	4	-	-	-	22,000	-	-	-	-	-	-	-	-	22,000
String (m)	3	-	6,000	-	-	-	-	6,000	-	-	-	-	-	12,000
NPK	150	-	450,000	-	-	-	450,000	-	-	-	-	-	-	900,000
DAP	150	-	450,000	-	-	-	450,000	-	-	-	-	-	-	900,000
Urea	150	-	450,000	-	-	-	450,000	-	-	-	-	-	-	900,000
Manure	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bags	78	-	-	-	-	93,600	-	-	-	-	-	93,600	-	187,200
Tarpaulin	12	-	-	-	-	540,000	-	-	-	-	14,400	-	-	554,400
Spray Pumps	3	-	-	360,000	-	-	-	-	-	-	-	-	-	360,000
Pesticide (mls)	360	-	-	-	54,000	-	-	-	-	54,000	-	-	-	108,000
Fungicide (kg)	2100	-	-	63,000	-	-	-	-	63,000	-	-	-	-	126,000
Herbicides (L)	3	135,000	-	-	-	-	135,000	-	-	-	-	-	-	270,000
land hire	3	1,050,000						1,050,000						2,100,000
Total Cost of Inputs		**1,285,000**	**1,572,000**	**423,000**	**76,000**	**633,600**	**1,701,000**	**1,056,000**	**63,000**	**54,000**	**14,400**	**93,600**	**-**	**6,971,600**
OVERHEAD COSTS														-
Labor Costs		99,000	420,000	1,092,000	468,000	1,585,500	-	99,000	420,000	1,092,000	468,000	1,585,500	-	7,329,000
Marketing costs		-	-	-	-	-	248,100	-	-	-	-	-	248,100	496,200
Other expenses (communication, travel)		20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	240,000
Total overhead costs		**119,000**	**440,000**	**1,112,000**	**488,000**	**1,605,500**	**268,100**	**119,000**	**440,000**	**1,112,000**	**488,000**	**1,605,500**	**268,100**	**8,065,200**
Total period cash needed		1,404,000	2,012,000	1,535,000	564,000	2,239,100	1,969,100	1,175,000	503,000	1,166,000	502,400	1,699,100	268,100	15,036,800

PROJECTED CASH FLOWS

YEAR	Year 1	Year 2	Year 3
Opening cash balance	6,304,400	9,267,600	13,794,380
Cash Inflows from sales	18,000,000	20,700,000	21,735,000
Cash outflows from trading activities	(15,036,800)	(16,173,220)	(16,654,709)
Cash outflows from trading operations	-	-	-
Closing cash balance	9,267,600	13,794,380	18,874,672

INVESTMENT VIABILITY INDICATORS

Period	Yr 0	Yr 1	Yr2	Yr3
Investment Cash flows	(6,304,400)	2,963,200	4,526,780	5,080,292
Discount Rate	36%			
NPV	251,097			
IRR	40%			
ROI	66%			

Conclusion

The commercial farmer with an acreage of three acres can achieve commercial viability and will have positive cash flows and a health return on Investment (ROI) of **40%**, results in value creation to the tune of **UGX 251,097** with an internal rate of return of (IRR) of **66%** which is above the cost of capital of **36%** used as the discount rate for the cash flows and is the commercial bank lending rate. The returns and cash flows are healthy enough to enable credit financing of the production activities where the farmer is unable to raise capital to invest. This scenario is however different if we consider that most farmers borrow from local SACCOs and VSLA groups whose interest rates can be as high as 10% per month or 120% per annum. Regulated MFIS offer rates of 4-5% per month which equally will result in marginal returns for farmers.

5.4.2 Current investments in the production segment

A. Irrigated Schemes

There have been efforts to invest in irrigation infrastructure for rice production. The government founded rice schemes in DOHO in BUTALEJA, MUBUKU in KASESE, OLWENY in LIRA rice scheme, as well as a number of privately development schemes like Manafwa basin rice scheme in BUTALEJA, KIBIMBA in BUGIRI represent great attempts to invest and revamp irrigated rice production. Across the country there are a number of potential wetlands that can be sustainably transformed into rice scheme such as in BUDAKA, KAPUJAN in KATAKWI and the NILE BASIN in WADELAI/AMURU. These and other wetlands as well as several upland locations in Northern Uganda offer greater potential for current and future investments in the production segment of the rice value chain. It is however not possible to make a reasonable assessments of investments in this areas because it requires a different skills to assess the cost structure of the irrigation business, i.e infrastructure development, running costs and environmental related costs something should be considered for a detailed analysis. Individuals like Hajji Naleba of Manafa Basin has demonstrated the potential of investing and leasing out irrigation serviced rice farm land with aid from a government supported grant. This model can be scaled up through a private public partnership to attract more investors in this segment.

There is significant private sector and government investments in the production segment, government developed the irrigated rice schemes in Doho and Olwenyi and put it under the management of the farmer cooperatives. Private investments by individual entrepreneurs a case in point is Manafwa Basin Rice Farmers Association in Butaleja in the area of water management to set up a private irrigated rice scheme with support from government. The farm has been well serviced and demarcated and land is hired out to farmers for rice production.

Photo by Field team; A private irrigated rice scheme by a private entrepreneur in Butaleja. Land is hired out to members of Manafwa Basin Rice farmers association.

B. Fertilizer Production

Besides investments in irrigation infrastructure, investments in fertilizer production in Tororo. The project estimated to cost USD560m by the Chinese firm Guangzhou Dongsong Energy Group, LV Weidong located at OSukuru Industrial Complex in Tororo. The factory is expected to produce 300,000 tons of phosphate fertilizers annually. Government has put in place a supportive policy with tax incentives to promote fertilizer imports and use by the farmers. Unfortunately the benefits from this policy do not appear to trickle down to the farmers as expected, Input dealers are reluctant to stock and distribute fertilizers due to the low margins falling below 10%, this calls for more strategically targeted incentive programs and structures for cost effective delivery of fertilizers.

C. Mechanization Production

Uganda has two rice farming systems; I) Upland and ii) Low land rice. Mechanization equipment for both upland and lowland rice can vary depending on the nature of activity.

Whereas most traditional farm equipment can be used for upland rice, low land rice production requires some specialized design of equipment. The land terrain is a major factor in the choice of mechanization equipment. Special wheel designs are needed to work the muddy lowland fields. BDS providers like Bongomin Group have invested in specialized mechanical equipment for rice production and are offering these as a BDs to rice farmers in Eastern Uganda. Some of the equipment available for hire include hydro tillers, paddling machine, the seedling planter and the combined harvester. However, the current agronomic practices like nursery bed planting are not consistent with the use of these mechanical equipments such as the planter. The planters are designed for nursery beds raised on trays or mats specifically designed to fit in then system of the planter. Promoting mechanization requires adopting new agronomic practices that favor mechanization.

5.4.3 Investment Opportunities in the production segment

There are a number of investment opportunities in the segment, ranging from the need for improved seed and other input distribution, financing activities and water management for investment. Seed in particular is a key factor in rice production and poor quality seed and low yields from the existing varieties even under better management practices is a pointer to the need to invest in acquisition and distribution of improved or new higher yielding varieties. Mechanization is another important area, for investment.

The production segment is the primary driver of the rice value chain and forms the fulcrum around which all the value chain actor functions spin. The functionality and competitiveness of the value chain therefore hinged on the competitiveness of the production segment. It is the considered view in this study that VC transformation can best be achieved by streamlining the production segment as a springboard to improving the effectiveness of the down-stream and upstream segment activities. The market environment for rice is conducive for this approach with demand rising at an estimated 2.2% per year, and current deficit in supply from local production being 40%, the market availability will exist to the foreseeable future and the gap between supply and demand may even get wider at the current population growth rate of 3.0%.

Rice production is almost exclusively a manual process using rudimentary tools to work the wetlands which raise the labour costs. Critical areas for investment are;

1. Specialized Land preparation technologies capable of working in wetlands
2. Mechanical Harvesting and threshing equipment suitable for wetlands
3. Rice dryers, drying and related process have been known to influence rice milling quality and breakage rates. For instance, rice milled below 13% will break (fragment) even with modern mills. This is on record in Tilda.

4. Alternative irrigation systems where surface irrigation cannot be applied.

The production segment is has potential for investment in large scale rice production, there is plenty of land either through the out-grower model, irrigated community schemes or large scale farm models. The bimodal rainfall and the abundance of water bodies, lakes, rivers and streams provide a huge potential for expanding acreage in rice farming, both for upland and low land rice. Rice varieties capable of performing both low and upland conditions could be of great potential for Uganda.

5.5 Potential Equipment for Mechanization of rice production

The consultant had an opportunity to visit a mechanized rice production scheme in Haryana state in India. Mechanization in rice cultivation in a commercial production is a key aspect to address the escalating wages of the farm labour and the scarcity of labor particularly in the peak farming periods. Cultivation of rice requires use of a number of farm machinery and equipment to perform several tedious operations like field preparation/puddling, transplanting and plant protection measures. These operations are potential areas of investment through BDS services or in firm acquisitions.

The following farm implements and their uses are possible acquisitions for cultivation of rice.

1. The Disc harrow: It is used for field preparation under dry condition. It has a strong and sturdy main frame with high quality steel discs and heavy duty chilled cast iron spools to provide centre weight. Number of discs vary from 6-12. These are available in Uganda's local market with leading companies like car & General Ltd, Farmrite Ltd, Agro-Machinery Ltd, Jon Deere being some of the Leading suppliers. This is suitable for upland and dryland conditions.

2. Paddy harrow: It also consists of discs fitted in strong iron frame with two gangs of discs throwing the soil opposite direction. It is used mostly for puddling for preparing the field for transplanting.

3. Cultivator: It consists of spring loaded tines fitted in strong iron frame and can be lifted by hydraulic lift system in the tractor. It is used for tearing up the soil up to more depth so that it can be worked into fine condition later on by the disc harrow.

4. Planter: It is used immediately after ploughing or harrowing to crash, grind and tear the unevenly ploughed soil to produce smooth and well packed seed bed. It is a rectangular section of long wooden log provided with two pegs for hitching.

5. Laser Leveler: It is used for precise leveling of the field before transplanting of paddy. It helps to save irrigation water considerably. In Haryana state which we visited the farmers are provided with the laser leveler on custom hiring basis.

5. Rotavator: It makes the surface soil fine and smooth and is used for field preparation both under dry and wet conditions. It requires low energy in tillage operations and incorporates stubbles of previous crop thoroughly in the soil. It is used particularly for incorporating the green manure and rice straw before planting of rice.

6. Paddy puddler: This is used specially for puddling of the field before transplanting of rice and prepare homogenious puddle tilth for mechanized paddy transplanting. It consists of blades or puddler fitted in axle in a strong frame.

7. Paddy trans-planter: It is a self-propelled trans-planter having a diesel engine and is controlled by operator can be suitable for smallholder farms in Uganda. It is used for transplanting rice seedlings raised in mat type nursery. The small cakes of nursery are feeded into the frame of trans-planter from where the seedlings are picked up by its fingers which transplant the seedlings at a given spacing while the instrument is being run.

8. Combine harvester: It is a machine used to recover the grain free from plant residues through a series of operation viz. cutting, conveying, threshing, separation of grains and chaff from the straw, removing the chaff and other foreign material from the grain. It is used for harvesting of several crops mainly rice, maize and wheat in Kapchorwa.

A CASE ANALYSIS OF AN OPERATIONAL RICE PRODUCTION MECHANIZATION PROJECT IN EASTERN UGANDA.

Table 9a (i) analysis of the commercial viability of a full range rice production mechanization service business.

Capital investments	**Cost**				
Hydro power tiller	51,800,000				
Trans-planter	37,000,000				
Combine harvester	141,340,000				
TOTAL CAPITAL INVESTMENT	**230,140,000**				
Hire rates per acre	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Hydro tillage	55,000	60,000	70,000	75,000	100,000
Paddling	60,000	70,000	80,000	90,000	100,000
Transplanting	-	-	50,000	60,000	80,000
Combine harvesting	180,000	200,000	250,000	300,000	300,000

OPERATING CAPACITY BASED ON A TWO SEASON CROP CYCLE

Hydro tiller	429
Paddling	429
Combine harvester	1,714
TOTAL COMBINED ACREAGE CAPACITY	**2,571**

ACREAGE SERVICED PER YEAR

Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Hydro tiller	150	300	400	400	400
Paddling	100	150	200	250	300
Trans-planter	0	0	50	75	100
Combine harvester	20	100	300	800	1200
TOTAL COMBINED ACREAGE WORKED	**270**	**550**	**950**	**1525**	**2000**

PROJECTED INCOME AND EXPENDITURES

Projected Income from the equipment hire	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Hydro tillage	8,250,000	18,000,000	28,000,000	30,000,000	40,000,000
Paddling	6,000,000	10,500,000	16,000,000	22,500,000	30,000,000
Transplanting	-	-	2,500,000	4,500,000	8,000,000
Combine harvesting	3,600,000	20,000,000	75,000,000	240,000,000	360,000,000
Total Income	**17,850,000**	**48,500,000**	**121,500,000**	**297,000,000**	**438,000,000**
Operating expenses					
Personnel costs	5,355,000	7,275,000	12,150,000	23,760,000	35,040,000
Fuel costs	4,462,500	12,125,000	30,375,000	74,250,000	109,500,000
Maintenance charges	1,963,500	4,850,000	9,720,000	14,850,000	21,900,000
Administrative expenses	2,499,000	1,940,000	4,860,000	11,880,000	17,520,000
Total expenses	**14,280,000**	**26,190,000**	**57,105,000**	**124,740,000**	**183,960,000**
Net profit	**3,570,000**	**22,310,000**	**64,395,000**	**172,260,000**	**254,040,000**
EQUIPMENT CAPACITY UTILIZATION RATE	**11%**	**21%**	**37%**	**59%**	**78%**

INVESTMENT VIABILITY INDICATOR ANALYSIS

YEAR	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
NET INVETMENT INCOMES	(226,570,000)	22,310,000	64,395,000	172,260,000	254,040,000
Annual ROI	2%	10%	28%	75%	110%
Discount rate	28%				
NPV	5,422,281				
IRR	29%				
AVG. ROI	45%				
PAYBACK PERIOD	4 YEARS				

In the current context, the investment in a farm mechanization services is viable but highly risky, due to the high level of sensitivity of the business to any economic and market shocks. The business has a low **NPV** of **5, 422,281** with an **IRR** of **29%.** This is just about the commercial cost of capital which leaves the project with a tight cash flow position with no room to navigate or manoeuvre. Commercial debt financing of this venture is not sustainable, except where low interest loans in the range of 15-20% per annum or subsidies are available.

Rice sector mechanization is highly specialized operations where the majority of the equipment may not readily be deployed to other operation, without major modification on change of accessories.

In the perspective of the farmer investment in farm management technologies is a viable opportunity, which if well natured through a benefit based approach can be profitable and have major capability to boost farm level productivity. A comparative analysis of the benefits of mechanized farm production for a smallholder farmer and the manual production models were assessed. The analysis shows that farmers make significant savings on labour costs estimated at **UGX 217,500** representing a **32%** saving on labor as shown in table 9a below.

Table 9a. MECHANIZATION COST FOR ONE ACRE OF RICE

Activity	Manual Unit Cost	Mechanized Unit Cost
Land opening	140,000.00	110,000.00
Puddling	160,000.00	60,000.00
Transplanting	120,000.00	80,000.00
Harvesting	240,000.00	180,000.00
Drying	27,500.00	40,000.00
TOTAL COST	**687,500.00**	**470,000.00**
COST SAVINGS FROM MECHANIZATION PER ACRE		**217,500.00**
PERCENTAGE SAVING ON LABOR		32%

This saving represents a 30-40% increase in profits from one acre of rice when assessed against the TILDA out-grower farmers who earned the highest profits per acre from rice production in Eastern Uganda.

Table 9a (ii). Analysis of a partial rice production mechanization service operation without a combined harvester.

Capital investments	Cost				
Hydro power tiller	51,800,000				
Trans-planter	37,000,000				
TOTAL CAPITAL INVESTMENT	**88,800,000**				
Hire rates per acre	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Hydro tillage	80,000	85,000	95,000	100,000	110,000
Paddling	75,000	80,000	85,000	100,000	120,000
Transplanting	-	-	50,000	60,000	80,000

OPRATING CAPACITY BASED ON A TWO SEASON CROP CYCLE

Hydro tiller	429
Paddling	429
Planter	800
TOTAL COMBINED ACREAGE CAPACITY	**1,657**

ACREAGE SERVICED PER YEAR

Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Hydro tiller	250	360	400	400	400
Planter	0	0	50	75	100
Paddling	250	360	400	400	400
TOTAL COMBINED ACREAGE WORKED	**500**	**720**	**850**	**875**	**900**

Projected Income from the equipment hire	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Hydro tillage	20,000,000	30,600,000	38,000,000	40,000,000	44,000,000
Paddling	-	-	4,250,000	7,500,000	12,000,000
Trans-planting	-	-	20,000,000	24,000,000	32,000,000
Total Income	**20,000,000**	**30,600,000**	**62,250,000**	**71,500,000**	**88,000,000**
Operating expenses					
Personnel costs	6,200,000	11,628,000	21,787,500	23,595,000	26,400,000
Fuel costs	400,000	535,500	3,423,750	1,608,750	5,060,000
Maintenance charges	770,000	1,178,100	2,396,625	2,752,750	3,388,000
Administrative expenses	1,540,000	2,013,480	3,834,600	3,803,800	3,942,400
Total expenses	**8,910,000**	**15,355,080**	**31,442,475**	**31,760,300**	**38,790,400**
Net profit	**11,090,000**	**15,244,920**	**30,807,525**	**39,739,700**	**49,209,600**
EQUIPMENT CAPACITY UTILIZATION RATE	**30%**	**43%**	**51%**	**53%**	**54%**

INVESTMENT VIABILITY INDICATOR ANALYSIS

YEAR	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
NET INVETMENT INCOMES	(77,710,000)	15,244,920	30,807,525	39,739,700	49,209,600
Annual ROI	12%	17%	35%	45%	55%
Discount rate	28%				
NPV	(7,589,934)				
IRR	22%				
AVG. ROI	33%				
PAYBACK PERIOD	4 YEARS				

An investment in mechanization of rice production in Eastern Uganda is not viable, under the current market condition and price structure across the country. Based on the price structure in the market at the moment and the need to promote the adoption of the service, the investment in

mechanization is not attractive with an **NPV** of **(7,589,934)** and an **IRR** of **22%** and a payback period of 4 years. It is difficult to charge commercially sustainable prices and such an investment will need an initial for subsidy for at 3 years to facilitate adoption and increase user uptake and increase capacity utilization to **70%** to realize commercial viability. Commercial financing of this venture is only possible with interest rates in the range of 10-15% per annum.

Table 9a (iii) analysis of the commercial viability of a rice production mechanization service business to hire out a combined harvester

Capital investments	**Cost**
Combine harvester	141,340,000
TOTAL CAPITAL INVESTMENT	**141,340,000**

Hire rates per acre	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Combine harvesting	180,000	200,000	250,000	300,000	300,000

OPRATING CAPACITY BASED ON A TWO SEASON CROP CYCLE

Combine harvester	1,714
TOTAL COMBINED ACREAGE CAPACITY	**1,714**

ACREAGE SERVICED PER YEAR					
Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Combine harvester	20	100	300	800	1200
TOTAL COMBINED ACREAGE WORKED	**20**	**100**	**300**	**800**	**1200**

Projected Income from the equipment hire	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Combine harvesting	3,600,000	20,000,000	75,000,000	240,000,000	360,000,000
Total Income	**3,600,000**	**20,000,000**	**75,000,000**	**240,000,000**	**360,000,000**
Operating expenses					
Personnel costs	1,440,000	6,000,000	15,000,000	36,000,000	54,000,000
Fuel costs	828,000	4,150,000	14,625,000	48,600,000	69,300,000
Maintenance charges	257,400	1,430,000	5,362,500	17,160,000	25,740,000
Administrative expenses	226,800	1,204,000	4,410,000	12,768,000	17,136,000
Total expenses	**2,752,200**	**12,784,000**	**39,397,500**	**114,528,000**	**166,176,000**
Net profit	**847,800**	**7,216,000**	**35,602,500**	**125,472,000**	**193,824,000**
EQUIPMENT CAPACITY UTILIZATION RATE	**1%**	**6%**	**18%**	**47%**	**70%**

INVESTMENT VIABILITY INDICATOR ANALYSIS

YEAR	Year 1	Year 2	Year 3	Year 4	Year 5
NET INVETMENT INCOMES	(140,492,200)	7,216,000	35,602,500	125,472,000	193,824,000
Annual ROI	1%	5%	25%	89%	137%
Discount rate	28%				
NPV	14,773,531				
IRR	33%				
ROI	51%				
PAYBACK PERIOD	3 YEARS, 4 MONTHS				

The combine harvester is very versatile in operation and can be applied for use to a wide range of grains produced in eastern region. It has a significant labor cost reduction capability for rice and the service can be rendered at sustainable commercial rates. Services rates can further be lowered with increased capacity utilization. The investment is viable with an **NPV** of **14,773,531** and an **IRR** of **33%** which is above the commercial cost of capital. The key to increasing returns lies is high capacity utilization. This can be readily achieved by focusing beyond the rice segment and including grains like maize, soybean and others all of which are widely grown in eastern region.

Conclusion

The viability of mechanization of production service investments from this analysis can be enhanced when delivered as a complete package in the rice segment with the combined harvester as the main cash cow to provide economic resilience for the business operations and subsidize other equipment. Its versatility in use and high labor cost saving potential means it is possible to offer more affordable and attractive service prices to the farmers.

9. Mechanical driers: These are important for quick and uniform drying of seed which impacts greatly onto the milling quality of rice. Interviews by commercial millers highlighted the difference in milling yield between Ugandan rice and Kenyan rice. Ugandan rice has a yield of between 60-63% compared to Kenyan rice with a yield of between 65-67%. This difference is significant and can partly be attributed to post harvest handling procedures.

Table 9b COMPARATIVE ANALYSIS OF THE COMMERCIAL RETURNS BETWEEN MANUAL AND MECHANIZED DRYING OF PADDY RICE

RICE DRIER ANALYSIS		
CAPACITY OF DRIER (MT)		7,000
HUSK NEEDED (MT)		1.0
UNIT COST OF A KWH OF ENERGY (UGX)		11.0
UNIT COST OF HUSK (UGX/MT)		5,000.0
EXCHANGE RATE FOR UGX		3,600.0
AVG. MILLING EXTRACTION RATE UNDER PROPER DRYING		65%
AVG. MILLING EXTRACTION RATE UNDER POOR/NON UNIFORM DRYING		60%
PCOST OF PADDY RICE UGX/MT)		1,100,000.0
MILLING PERFORMANCE OF RICE MOISTURE CONDITION	MECHANICAL DRIED	MANUALLY DRIED
MILLED GRADE 1	45%	30%
MILLED GRADE II (BIG BROKEN)	25%	35%
MILLED GRADE III (SMALL BROKEN)	12%	20%
RICE BRAN	18%	15%
PRICE OF MILLED RICE/MT		
MILLED GRADE 1		3,200,000.0
MILLED GRADE II (BIG BROKEN)		2,300,000.0
MILLED GRADE III (SMALL BROKEN)		1,500,000.0
RICE BRAN		300,000.0
ADDITIONAL REVENUES ATTRIBUTED TO PROPER DRYING		
DRYING METHOD	**MECHANICAL DRIED**	**MANUALLY DRIED**
Milled rice Yield	4,550.0	4,200.0
INCOME FROM MILLED RICE	0.0	0.0
MILLED GRADE 1	6,552,000,000.0	4,032,000,000.0
MILLED GRADE II (BIG BROKEN)	2,616,250,000.0	3,381,000,000.0
MILLED GRADE III (SMALL BROKEN)	819,000,000.0	1,260,000,000.0
RICE BRAN	122,850,000.0	94,500,000.0
TOTAL INCOME	**10,110,100,000.0**	**8,767,500,000.0**
LESS		
COST OF PADDY RICE	7,700,000,000.0	7,700,000,000.0
DRYING MOISTURE LOSS	770,000,000.0	0.0
DRYING OPERATION LOSS	154,000,000.0	385,000,000.0
TOTAL COSTS	**8,624,000,000.0**	**8,085,000,000.0**
PROFITS EARNED	**1,486,100,000.0**	**682,500,000.0**
LESS ADDITIONAL DRYING OVERHEADS		
COST OF DRYING HUSKS	5,000.0	0.0
LABOR COST	40,000.0	0.0
TRANSPORTATION COSTS	150,000.0	0.0
PLANT MAINTENANCE COSTS	74,305,000.0	0.0
TOTAL OVERHEADS	**74,500,000.0**	**0.0**
NET PROFITS EARNED	**1,411,600,000.0**	**682,500,000.0**
BENEFIT ANALYSIS		
UNIT COST OF DRYING PER MT	10,642.9	0.0
INCREAMENT INCOME FROM MECHANICAL DRYING PER MT	**201,657.1**	**0.0**

A Farmer that uses a mechanical drying is able to earn an addition **UGX201,657** per MT of rice milled. Proper and uniform drying is important in reducing breakage rate, and milling loss. Profits are boosted by better rice quality which attracts premium prices and can be sold in the upscale market and compete with imported brands like BASMATI rice.

Photo by Team: Manual Paddy rice sun -drying at Manafwa Basin Farmers Association in Butaleja District

ANALYSIS OF THE INVESTIMENT VIABILITY IN DRYING TECHNOLOGIES

On farm drying technologies for grains are common in the Ugandan Market, however their efficiency compared to the turn key drying plants used by commercial millers is not yet established. A case analysis above based on a Turnkey drying plant will be applied in evaluating the potential for specific investment in this technology.

Table 9b INVESTMENT INCOMES & PROJECTION FOR A MECHANIZED DRYING PLANT FOR RICE DRYING

YEAR	YEAR 1	YEAR 2	YEAR 3
INSTALLED COST OF (10MT) DRYING PLANT IN USD	230,000.0	0.0	0.0
EXCHANGE RATE UGX AGAINST THE USD	3,600.0		
UNIT COST OF DRYING PER MT (UGX)	10,642.9	12,771.4	16,602.9
PRICE FOR DRYING	20,000.0	22,000.0	24,200.0
VOL. DRIED PER YEAR (MT)	90,000.0	120,000.0	150,000.0
REVENUES FROM DRYING	**1,800,000,000**	**2,640,000,000**	**3,630,000,000**
LESS			
COST OF DRYING OPERATION	957,857,142.9	1,532,571,428.6	2,490,428,571.4
GROSS INCOME	**842,142,857**	**1,107,428,571**	**1,139,571,428**
OPERATING OVERHEADS			
PERSONNEL	90,000,000.0	108,000,000.0	118,800,000.0
UTILITIES (Water, power)	54,000,000.0	79,200,000.0	90,750,000.0
Administrative expenses (Transport, communication and staff welfare)	162,000,000.0	211,200,000.0	254,100,000.0
Insurance expenses	16,560,000.0	18,216,000.0	19,126,800.0
Miscellaneous and service costs	84,214,285.7	99,668,571.4	102,561,428.6
TOTAL OVERHEAD EXPENSES	**406,774,285.7**	**516,284,571.4**	**585,338,228.6**
PROFITS EARNED	**435,368,571.4**	**591,144,000.0**	**554,233,200.0**

PROJECTED INCOME FROM INVESTMENT

YEAR	YEAR 1	YEAR 2	YEAR 3
INVESTMENT CASHFLOW	**(392631428.6)**	591,144,000	554,233,200
Discount Rate	28%		
NPV	107,200,269.2		
IRR	39%		
ROI	191%		
PAYBACK PERIOD	2 Crop Years or 18 Months		

The analysis shows that it is viable and profitable to set up drying plants in the major rice producing corridors like Butaleja, Bugiri and Iganga to offer exclusively drying services. Most milling plants have challenges disposing of rice husks, these could be a cheap source of energy for the drying operations and an incentive towards this kind of mechanized drying projects. The data estimates have been obtained from the drying operations of grain milling firms with installed drying plants. This can be one of the technologies farmers are most likely to adopt since it cuts done on the drying overheads per MT. On average farmers spend UGX 30,000 in drying for a MT of milled rice. This compared to the cost of 20,000 per MT for mechanical milling would result

in a cost saving of **10,000 per MT.** There is further gain by the farmer of **UGX 201,657** from quality related gains resulting in an additional profit of **UGX 210,657.**

Note: Investments in the production segments must however be closely integrated with investments in rice varietal technology investments to develop suitable, adaptable varieties that give competitive yield levels. Besides varietal development, institutional capacity of the farmer organizations is vital to achieve success in out-grower schemes and irrigated community schemes.

There is a need to invest more in infrastructure and transport around the rice fields to facilitate post-harvest handling as well as investments in adaptive research to identify agro-ecological properties of the different varieties to establish yield potential and suitable varieties for the different micro-agro-ecological areas.

5.6 The Trade Segment

The trade segments consist of is dominated by informal trading relationships, at the bottom end level of the trade chain are retailers operating in urban, peri-urban and rural trading centers. There are four major trading levels for rice; 1) The retail trade, 2) The local wholesale trade, 3) the Urban wholesalers and 4) the Import wholesalers.

Characteristics of the trade actors

Level	Trading Characteristics	Target clientele	Sources of stock supplies
Retailers	• Buy from local and urban wholesalers • Tend to buy from the wholesaler across the street • Sometimes buy stock delivered at their door step by rural assemblers • Pay cash for stocks and have limited or no access to credit supplies • Stocking rate between 2-5 bags @ 100kgs at a time	• Households • Hotel and restaurant operators • Local food/eating houses	Local
Local Wholesalers/assemblers	• Buy from local millers/farmers at the mills for local rice • Buy from import wholesalers for imported brands • Have limited access to credit supply facilities	• Local institutions like especially schools, • Retailers • Urban wholesalers	Local

	• Build strong bonds with farmers and millers • May extend advance payments to farmers on case by case basis, or pre-finance production activities of farmers. • Pay cash for stocks purchased, buy both milled and rice paddy/brown rice		
Urban Wholesalers	• Buy from local wholesalers/ assemblers and millers for local varieties • Most operate in major towns like Jinja, Kampala and, Lira and Mbale. • Buy from import wholesalers for imported brands • Have some access to credit supplies from both the importers and local wholesalers • Operate on both formal and informal trade relationship	• Similar in many aspects to rural retailers, except they carry larger stock volumes and include imported brands in their stock • Local wholesalers dealing in imported rice brands • Urban and peri-urban Retailers • Large Hotels and restaurants • Government institutions like schools, prisons, police, hospitals • Humanitarian organizations like WFP, NGOs	Local
Import Wholesalers	• Large corporate business importing rice in large volumes • Major imports come from Pakistan, India and Vietnam • Own major warehouses in Kampala and Jinja. • Operate on formal trade relationships with the supply end (exporters from the country of origin). • Local trading relationships are often adhoc and guided by transactional relationships	• Urban wholesalers based in major towns across the country.	• India • Pakistan • Vietnam • Cambodia • Indonesia • Bangladesh • Thailand

The major cost centers for traders are;

1. Freight/transport charges
2. Stock procurements
3. Selling expenses (staff salaries, casual labor and warehousing costs)
4. Security
5. Rental costs

5.6.1 Profitability of the trade segment

There are four major types of traders profiled above each have different operational cost estimates, which were determined as a percentage of monthly sales volumes. This approach was used for two major reasons;

1. Owing to confidentiality concerns most traders were unwilling to share their audited books of accounts or management accounts with the consultants; neither were they willing to divulge the details of this information.
2. Some traders lacked proper books of accounts and could only rely on memory to reconstruct their cost profile.

Through a process of active inquiry the team was able to generate cost estimates for each of the traders interviewed and these were aggregated to determine the segments cost structure. Table 5 below provides a summary of the costs profile as a percentage of the total sales revenues of the traders.

Table 10a. Profitability of the local wholesale trade Category

TRADE LEVEL	Mean Unit costs	Mean Sales price	Median Margin	% Gross Margin	*Operational Costs as % of revenues	*Operational Costs as % of gross margin	Net margin as % of sales revenues
LOCAL WHOLESALERS/ASSEMBLERS							
LOCAL BRANDS							
SUPA UG	3,111	3467	356	11.4%	3.60%	31.5%	7.4%
WITA 9	2,167	2500	333	15.4%	3.60%	23.4%	11.2%
KAISO	2,167	2500	333	15.4%	3.60%	23.4%	11.2%
UPLAND	2,133	2500	367	17.2%	3.60%	20.9%	13.0%
Mean Net- profit margin							**10.7%**
IMPORTED BRANDS							
SUPA TZ	2,467	2933	467	18.9%	3.60%	19.0%	14.6%
PAKISTAN	1,583	2100	517	32.6%	3.60%	11.0%	27.9%
VIETNAM	1,727	2200	473	27.4%	3.60%	13.1%	22.8%
INDIAN BASIMATI	5,342	6700	1,358	25.4%	3.60%	14.2%	20.9%
Mean Net-profit margins							**22%**

***Operational costs considered included cost of personnel, rentals, utilities, transportation and handling costs**

The wholesalers in this segment operate in rural and small towns and per-urban centers. The mean gross and net profits margins enjoyed by the wholesalers in this segment are in estimated at 15% and 20% for local rice and imported rice brands. Imported rice brands are more profitable to the traders than locally grown rice, the production as well as the milling costs of local rice renders it less competitive in price terms to imported rice as indicated in the farmer and comparative analysis done above. The high gross margins traders obtain from imported rice compared to local rice means they are able to absorb their operational costs and make better profits. Overall this categories operating costs are estimated at 3.6% of sales revenue. The bulk of the costs incurred under the line items such as inland transportation charges, security, rentals, salaries/wages, casual labor and agency fees for individuals hired to procure local rice from production areas.

Table 10b. Profitability of the Import trade category

IMPORTERS MARGINS							
	Mean Unit costs	**Mean Sales price**	**Median Margin**	**% Gross Margin**	**Operational Costs as % of revenues**	**Operational Costs as % of gross margin**	**Net margin as % of sales revenues**
SUPA TZ	2,349	2,817	468	22.8%	2.8%	15.1%	18.0%
PAKISTAN	1,452	1,683	232	33.2%	2.8%	11.2%	24.2%
VIETNAM	1,470	1,683	213	31.5%	2.8%	11.7%	23.3%
INDIAN BASIMATI	4,900	5,483	583	15.6%	2.8%	20.7%	13.2%
Mean Net-profit margins							**17.4%**

The Import trade category consists of commercial millers who import semi-milled rice and white milled rice. Most of the importers operate large warehouses located in major towns like Kampala and Jinja. Import level traders carry mainly imported brands from Pakistan and the main supplier, India Indonesia, Vietnam and Thailand. The mean gross and net profits margins enjoyed by the importers average 25% of sales revenues and 17% respectively. This pattern is consistent with the trends in other categories where imported brands offer better profit margins than local brands. Much of the operational costs estimated at 2.8% of sales revenues arise from warehouse management and rental charges, handling and freight costs as well as insurance and security fees.

Table 10c. Profitability of the retail trade Category

	Mean Unit costs	**Mean Sales price**	**Median Margin**	**% Gross Margin**	**Operational Costs as % of revenues**	**Operational Costs as % of gross margin**	**Net margin as % of sales revenues**
RETAILERS							
SUPA UG	3,433	4,000	567	16.5%	1.20%	7.3%	15.1%
WITA 9	2,458	2,867	408	16.6%	1.20%	7.2%	15.2%
KAISO	2,458	2,867	408	16.6%	1.20%	7.2%	15.2%
UPLAND	2,458	2,867	408	16.6%	1.20%	7.2%	15.2%
Mean Net-profit margins							**15.2%**

IMPORTED BRANDS							
SUPA TZ	2,942	3,900	958	32.6%	1.20%	3.7%	31.0%
PAKISTAN	2,025	2,700	675	33.3%	1.20%	3.6%	31.7%
VIETNAM	2,142	2,700	558	26.1%	1.20%	4.6%	24.6%
INDIAN BASIMATI	6,625	8,133	1,508	22.8%	1.20%	5.3%	21.3%
Mean Net-profit margins							**27.1%**

The retail level of the trade segment consists of traders operating urban and rural trading centers, community markets and urban markets as well as major town commercial centers/streets. The mean gross and net profits margins enjoyed by the retailers are found in the range of 16.5% for local rice types and 28.7% for imported rice brands. A similar pattern where imported rice brands offer better profit margins than the local rice types, operating costs in this category is estimated at 1.2% of sales revenues. The bulk of the costs incurred under the line items of rentals, repacking costs, trading taxes. Most procure their stocks at the door steps or local wholesaler across the street. This category by far is the most cost efficient among the traders.

The general findings show that the profit margins in the rice trade are generally low, cost efficiency and turnover are the key profitability drivers in the segment of the value chain. The production segment in comparison earned better margins than the input and the rice trade segment. However the turnover levels in the trade segment makes up for the low margins.

5.7 The processing Segment

The processing segment of the rice value chain is dominated by small millers in rural and peri-urban centers. A number of ***Turn -Key*** commercial mills have been installed in some districts including Tororo, Jinja, Kampala and Gulu. However all these are operating below capacity due to limited supply of paddy. Government has allowed the millers in this segment subject to government clearance to import paddy and semi-milled rice to shower up capacity utilization and meet local demand.

The operational costs structure of the large scale commercial mills could not be assessed due to capacity under-utilization and confidentiality concerns. Even the small millers suffer from capacity under-utilization. The major cost elements in the processing segment are;

1. Maintenance costs
2. Salaries and wages
3. Energy and Utility costs
4. Storage and security costs

Commercial scale millers have additional costs based on the different business models

5. Marketing costs

6. Transportation costs

Photo by Team: Rice mill at Doho Rice scheme

5.6.1 Profitability of the processing segment

The processing segment of the rice value chain is dominated by small millers in rural and peri-urban centers. A number of Turnkey commercial mills have be installed in some districts including Tororo, Jinja, Kampala and Gulu. However all these are operating below capacity due to limited supply of paddy. Government has allowed the millers in this segment subject to government clearance to import paddy and semi-milled rice to shower up capacity utilization and meet local demand.

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1. Maintenance costs
2. Salaries and wages
3. Energy and Utility costs
4. Storage and security costs

Commercial scale millers have additional costs based on the different business models

5. Marketing costs
6. Transportation costs

5.6.1 Profitability of the processing segment

There are three different types of millers active in rice processing/milling operations; 1) The small scale millers with plants of installed capacity at 1-2 MT per hour, 2) The semi Commercial millers with plants of capacity up to 3MT per hour and the turnkey commercial mills with capacity of up to 6MT per hour. No data is available on total installed milling capacity across the country. Small millers who are most dominant operating in villages and closer to the rice growing areas generally operate at between 30-40% capacity, most have an installed capacity of 1-2 tons per day and work for between 6-8 hours per day during peak periods at estimated machine efficiency levels of between 40-60%. The profitability analysis looked at the 1) Small miller model and 2) The commercial milling models. These two predominant models each have four sub-models that have been analyzed in this study;

1. **Sub-model 1. The milling service Model**; The Miller offers only milling service to whoever comes and charges fee
2. **Sub-model 2. The small miller trading model:** The Miller offers milling services to whoever comes and charges fee but also buys paddy, mills and trades in rice.
3. **Sub-model 3. Integrated Milling Model**; The Miller integrate backwards to establish a nuclear farm and an out-grower program, and integrates forwards to do sales and marketing of the rice. The commercial level millers such as Tilda, Kingdom rice and Eastern Millers all with Turnkey milling technologies are using this model and are at different stages of developing the model with Tilda more advanced.
4. **Sub-model 4. The Supply chain Model**; The Miller develops and works with a supply chain to provide materials for milling and charges for the milling service. Kingdom rice and Upland millers another commercial miller in Jinja is one of the millers developing this model.

We should differentiate the sizes of mills

- The mill-tops and engelbergs; normal one we see in the villages
- Medium sized one like the new Upland rice mill
- Large size one like Eastern millers

The profitability and investments in each of the two milling models was assessed in the context of the three sub-models.

5.7.2 Basis of analysis

The Gross margin, costs and profitability analysis was done based on three key scenario taking into account the yield and market price as measures of cost and profitability. Gross Profit margin and the net profit margins were determined as a function of cost, price and capacity utilization.

Profit margins {Cost, Price, and Capacity utilization}

The function above was applied to the two models and the three sub-models to analyze the profitability in the processing segment as presented in table 4.

Model 1. The Small miller Model: This is dominant milling model largely practiced by small mills across the country. These millers operate under sub-models 1 & 2 above.

Example of a small two step mill in Butaleja.

Table 11a. Key Modeling assumptions for small millers in Sub-model 1

Installed capacity	2MT @ hour	
Machine efficiency	60%	180 hour in a year
Hours worked per day	6-8	0.65kg from a kg of paddy
Effective milling days in the year	96	A bag of paddy @ 85kg
Extraction rate for paddy	65%	1.2 MT per hour
Milling rate per kg	**Lower Ugx**100	**Upper Ugx**120
Total milling days in a year	96	
No. of milling days per month (a milling day is defined as 12 hours)	8	
No. of milling hours per month	96	
No. of 6 hour milling day per month	16	
No. of hour milling days per month	12	

Table 11b. Profitability analysis of the Small miller category Sub-model 1; providing only milling services

Average milling hour per day	Average milling per day hours= 6		Average milling per day hours= 8	
	MONTHLY COST	COST PER KG MILLED		
COST ITEM (UGX)	**LOWER COST SCENARIO**	**LOWER COST/KG**	**UPPER COST SCENARIO**	**UPPER COST PER KG**
Casual labor rate/bag	1,152,000	12	1,728,000	11
Machine operator (4)	480,000	5	1,800,000	12
Manager salary	240,000	3	480,000	3
cashier salary	120,000	1	360,000	2
Rental/Storage	80,000	1	300,000	2
Power	3,500,000	37	4,000,000	26
Diesel (generator)	300,000	3	400,000	3
Water	48,000	1	144,000	1
Plant Maintenance	250,000	3	400,000	3
Parts replacement	200,000	2	400,000	3
Others (admin. costs like meals etc)	360,000	4	800,000	5
Total milling costs	**6,730,000**	**72**	**10,812,000**	**69**
Tonnage milled per month in Kg	**93,600**		**156,000**	
Revenue in one month	9,360,000	**28**	**15,600,000**	**31**
Profits earned per month	2,630,000		**4,788,000**	
Profit Margin	**39%**		**44%**	

This is the dominant model among small millers, capacity utilization under this model is fairly low because milling operations are dependent upon farmers and traders coming to use the milling service. The average capacity utilization estimated at 27%. These millers however enjoy profits margins of 39-44% depending on the level of capacity utilization and the milling cost. The Millers charge between UGX100 and 120 per kg of milled rice produced. The rates depend on location and the nature of energy source used to run the mill. Some millers who use both main grid power and back-up generator power charge UGX100 and 120 depending on whether the milling is done using main grid electricity or generator power. The Price structure gives the clients a choice between waiting for power in times of outage and having their rice milled during times of power outage.

Table 12a Key Modeling assumptions for Small miller Model - Sub-model 2

Installed capacity	2tons @ hour	1.2 MT per hour
Machine efficiency	60%	180 hour in a year
Hours worked per day	6-8	0.65kg from a kg of paddy
Effective milling days in the year	150	A bag of paddy @ 85kg
Extraction rate for paddy	65%	1.2 MT per hour
Milling rate per kg	**Lower Ugx**100	**Upper Ugx**120
Total milling days in a year	150days	
No. of milling days/ month (a milling day is defined as 12 hours)	12 1/2	
No. of milling hours per month	150	
No. of 6 hour milling day per month	25	
No. of 8 hour milling days per month	19	

Table 11b. Profitability analysis of the Small miller category Sub-model 1; providing only milling services

Average milling hour per day	Average milling hours per day = 6		Average milling hours per day = **8**	
	MONTHLY MILLING COST	**COST PER KG MILLED**	**MONTHLY MILLING COST**	**COST PER KG MILLED**
COST ITEM (UGX)	**LOWER COST SCENARIO**	**LOWER COST/KG**	**UPPER COST SCENARIO**	**UPPER COST PER KG**
Casual labor rate/bag	1,434,400	10	2,151,600	11
Machine operator (4)	480,000	3	1,800,000	9
Manager	240,000	2	480,000	2
cashier	120,000	1	360,000	2
Rental/Storage	350,000	2	500,000	2
Transportation costs to mill	1,412,000	10	1,412,000	7
Loading & offloading costs	141,200	1	141,200	1
Power	3,600,000	26	4,200,000	21
Diesel Fuel	440,000	3	650,000	3
Water	120,000	1	360,000	2
Plant Maintenance	450,000	3	720,000	4
Parts replacement	350,000	2	480,000	2
Others (administrative costs like meals etc)	1,540,000	11	1,800,000	9
Total milling costs	**10,677,600**	**76**	**15,054,800**	**74**
Tonnage milled per month	**140,400**		**202,800**	
Revenue in one month	14,040,000		20,280,000	
Profits earned per month	3,362,400		5,225,200	
Profit Margin	**31%**		**35%**	

This Model combines milling service provision and trading in rice. The millers buy rice paddy from farmers, mill it and the sell to bulk buyers or wholesalers. The act as consolidation/assembly agents. This model enables the millers achieve a higher capacity utilization estimated at 42% compared to Sub-Model 1. The trading activities enables the millers to increase their capacity utilization as they are able to mill their own rice during times when not offering services to other customers. Though have lower margins 31-35% (based the UGX100 and 120 price structure charged) compared to the Model 1 millers, largely because of added cost in handling and transportation of paddy, they enjoy overall high profits in real terms compared to the Model 1 millers.

5.7.3 Analysis of Investment in the Commercial milling segment

The rice processing segment of the value chain has seen the most investment in the recent years with large and small scale investments in milling technologies. Despite the increased investment, much has focused on production of white rice and small scale milling. According to the NRDS there were 591 operational rice mills in Uganda by 2009, no recent data on the number of mills is available, but the numbers have since increased with more investments in the small and commercial.

5.7.4 Investment in the Commercial Processing segment

This segment has by far the largest amount of recent investments in the rice value chain. However, most of the investments are in technologies that are not competitive in the market place. About 98% of the mills are in the category of the engelbergs and mill-tops which together mill about 95% of the paddy produced in the country. These technologies are associated with the low quality rice output with high broken rice levels due to poor milling capability, lack of capacity for quality management during milling and inability to perform advanced milling operations in polishing. The persistent low quality means low market value which makes Uganda's rice less competitive in the current liberalized market economy.

There is plenty of room for investment in rice processing in the following areas;

1. **Milling**; upgrading rice milling technologies to produce better quality rice grain and reduce breakage through improved management post-harvest processes like drying.

2. **Investment in production of alternative rice products;** like parboiled rice, rice flour and utilization of rice bi-products like milling husks for production of energy and organic fertilizers

3. **Investment in harvest and post-harvest processing technologies;** like threshers, mechanical driers. This processing level is crucial in determining the milling properties of the rice. There is an indication that these processing technological are demanded at farm level and investment in mobile versions can have a tremendous impact on the rice quality

Investment in the large commercial Turnkey technologies are constrained by the low production and low level of capacity utilization. Processors must consider more integrative models seeking to build direct linkage with the production segments to sustain investments at this level.

A typical case scenario of a commercial mill was assessed to determine its viability in Uganda's rice segment. The analysis showed that the plant currently operates at **26%** capacity utilization and is projected to reach a capacity utilization level of **43%** in five years, based on the current levels and growth trends in rice production in Uganda. In the absence of subsidies this is not sustainable for the Uganda rice millers in a sub-sector which is already under severe pressure from imported rice. Despite measures put in place by government to protect and boost local rice paddy production under the EAC protocols, a number of plants in this category have opted to import rice paddy or semi-milled rice to improve on their plant capacity utilization, indeed there has been pressure to which government has yielded to lower tariffs on rice paddy imports, how this impacts on the campaign for self-sufficiency through production remains to be seen in the coming years.

A TYPICAL CASE SCENARIO OF A COMMERCIAL MILL IN EASTERN UGANDA

CAPITAL INVESTMENTS		
Plant and machinery (USD)		500,000.0
Buildings and installations (USD)		1,000,000.0
TOTAL		**1,500,000.0**
Dollar rate		3,600.0
Interest rate		28%

Year	**2014**	**2015**	**2016**	**2017**	
Installed Capacity (MT/HR)	48.0	48.0	48.0	48.0	
Present Av. Operating Capacity	12.5	13.5	14.6	16.7	
Avg. Milling yield per MT	63%	63%	63%		
Revenue Assumptions					
Milling charge per MT	150,000.0	160,000.0	180,000.0	200,000.0	200,0
Milling days per year	72.0	84.0	96.0	96.0	
Days per Week	6.0	6.0	6.0	7.0	

MILLING PRODUCTS OUTPUT PROPORTIONS

MILLED RICE GRADE I		30%
MILLED RICE GRADE II (LARGE BROKEN)		40%
MILLED RICE GRADE III (SMALL BROKEN)		3%
RICE BRAN		8%
RIC HUSKS		18%
BI-PRODUCT PRICES UGX PER MT		
RICE BRAN	50% retained	80,000.0
RIC HUSKS (100% retained)	20% sold	5,000.0

REVENUES FROM MILLING OPERATIONS

YEAR		2014	2015	2016	2017	2018
MILLED RICE BI-PRODUCTS IN (MT)		3,500	3,792	4,083	4,667	5,833
MILLING SERVICE INCOME		270,000,000	364,000,000	504,000,000	640,000,000	800,000,000
RICE BRAN		11,200,000	12,133,333	13,066,666	14,933,333	18,6666
RIC HUSKS		630,000	682,500	735,000	840,000	1,050,000
TOTAL REVENUES		**281,833,500**	**376,819,625**	**517,805,750**	**655,778,000**	**819,722,500**
OPERATING COSTS						
Personnel Costs		72,000,000	72,000,000	72,000,000	72,000,000	72,000,000
Utility Costs						
Water		6,000,000.0	6,000,000.0	6,000,000.0	6,000,000.0	6,000,000.0
Power		180,000,000.0	180,000,000.0	180,000,000.0	180,000,000.0	180,000,000.0
Administrative costs		14,091,675.0	18,840,981.3	25,890,287.5	32,788,900.0	40,986,125.0
Insurance fees		27,000,000.0	28,350,000.0	29,767,500.0	31,255,875.0	32,818,668.8
TOTAL EXPENSIDTURE		**299,091,675.0**	**305,190,981.3**	**313,657,787.5**	**322,044,775.0**	**331,804,793.8**
PROFIT BEFORE TAX		**(17,258,175.0)**	**71,628,643.8**	**204,147,962.5**	**333,733,225.0**	**487,917,706.3**
DEPRECIATION COSTS		90,000,000.0	90,000,000.0	90,000,000.0	90,000,000.0	90,000,000.0
TAXABLE INCOME		**(107,258,175.0)**	**(18,371,356.3)**	**114,147,962.5**	**243,733,225.0**	**397,917,706.3**
30% Income tax		0.0	0.0	0.0	(73,013,786.2)	(119,375,311.9)
NET INCOME AFTER TAX	(5,400,000,000)	**(107,258,175.0)**	**(18,371,356.3)**	**114,147,962.5**	**170,719,438.8**	**278,542,394.4**
CAPACITY UTILIZATION		**26%**	**28%**	**30%**	**35%**	**43%**

INVESTMENT FINAL INCOMES	2016	2017	2018	2019	2020
INCOMES	(5,507,258,175)	(18,371,356)	114,147,963	170,719,439	278,542,394
ADD BACK					
DEPRECIATION	90,000,000	90,000,000	90,000,000	90,000,000	90,000,000
NET CASH INCOMES	**(5,417,258,175)**	**71,628,644**	**204,147,963**	**260,719,439**	**368,542,394**
Discount rate	28%				
NPV	(3,886,783,447)				
IRR	-42%				

Commercial milling firms cannot sustain their operations if they relied on Ugandan produced rice paddy. The sources of supply of rice paddy for commercial millers visited is traders who buy from farmers in Uganda and traders in Kenya. Peak milling periods and supplies to the factory from Uganda and Kenya is summarized in the table below;

UGANDA	KENYA
1. July 2. August 3. September 4. November	1. January 2. February 3. Match

Scenario Analysis to determine level of operation to realize commercial viability for the commercial millers

A TYPICAL CASE SCENARIO IN THE INDUSTRY

CAPITAL INVESTMENTS		
Plant and machinery (USD)		500,000.0
Buildings and installations (USD)		1,000,000.0
TOTAL		**1,500,000.0**
Dollar rate		3,600.0
Interest rate		28%
Plant capacity		6MT/HR

Year	2014	2015	2016	2017	2018
Installed Capacity PER 16 HOUR DAY (MT/HR)	100.0	100.0	100.0	100.0	100.0
Presently Av. Operating Capacity	40.0	60.0	75.0	80.0	80.0
Milling yield per MT	0.6	0.6	0.6	0.6	0.6
Milling bi-products					
BRAN	32%	32%	32%	32%	32%
HUSK	8%	8%	8%	8%	8%
Revenue Assumptions					
Milling charge per MT	150,000.0	150,000.0	200,000.0	240,000.0	240,000.0
Price for BRAN per MT	700,000.0	700,000.0	800,000.0	800,000.0	800,000.0
Price for rice husk PER MT	5,000.0	5,000.0	10,000.0	20,000.0	20,000.0

REVENUES FROM MILLING OPERATIONS		**2014**	**2015**	**2016**	**2017**	**2018**
Milling service revenues		1,680,000,000	2,520,000,000	4,200,000,000	5,376,000,000	5,376,000,000
Rice Bran		107,520,000	161,280,000	201,600,000	215,040,000	215,040,000
Rice husks		256,000	384,000	960,000	2,048,000	2,048,000
TOTAL REVENUES		**1,787,776,000**	**2,681,664,000**	**4,402,560,000**	**5,593,088,000**	**5,593,088,000**
OPERATING COSTS						
Personnel Costs		72,000,000	72,000,000	72,000,000	72,000,000	72,000,000
Utility Costs						
Water		15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
Power		180,000,000	181,800,000	189,000,000	180,000,000	181,800,000
Administrative costs		84,000,000	100,800,000	147,000,000	188,160,000	188,160,000
Insurance fees		37,800,000	39,690,000	41,674,500	43,758,225	45,946,136
TOTAL EXPENDITURE		**388,800,000**	**409,290,000**	**464,674,500**	**498,918,225**	**502,906,136**
PROFIT BEFORE TAX		**1,398,976,000**	**2,272,374,000**	**3,937,885,500**	**5,094,169,775**	**5,090,181,864**
DEPRECIATION COSTS		90,000,000	90,000,000	90,000,000	0	0
TAXABLE INCOME		**1,308,976,000**	**2,182,374,000**	**3,847,885,500**	**5,094,169,775**	**5,090,181,864**
30% Income tax		(392,692,800)	(654,712,200)	(1,154,365,650)	(1,528,250,933)	(1,527,054,559)
NET INCOME AFTER TAX	(5,400,000,000.0)	**1,006,283,200**	**1,617,661,800**	**2,783,519,850**	**3,565,918,843**	**3,563,127,305**
CAPACITY UTILIZATION		**40%**	**60%**	**75%**	**80%**	**80%**

PROJECTED INCOMES BASED ON 2016 DATA OBTAINED FROM THE MILLER

YEAR	2014	2015	2016	2017	2018
INVESTMENT NET INCOMES	(4,393,716,800.0)	1,617,661,800.0	2,783,519,850.0	3,565,918,842.5	3,563,127,304.6
Discount rate	28%				
NPV	51,720,054				
IRR	29%				
PAYBACK PERIOD	3 YEARS				
AVG. ROI OVER FIVE YEARS	71%				

The commercial millers have to operate at A typical commercial mill with a daily installed capacity of 6MT/HR should operate at a **65%** capacity utilization rate, equivalent to milling **28,000MT** per year to be able to attain commercial viability. At this level the miller is able to realize and **NPV UGX51, 720,054**, with an **IRR** of **29%** when discounted at the commercial cost of capital of **28%** applied. A number of medium and large commercial millers who rely on local production for supply of rice paddy are operating at less than **30%** capacity utilization. Some millers have resorted to imports of Rice paddy and semi-milled rice to boost capacity utilization.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The study aimed at highlighting the business potential in the different segments of rice value chain, by generating profitability and investment viability metrics that will enable interested investors and actors make preliminary decisions to invest in the rice value chain and potential strategies to make the sub-sector more competitive. Findings show that the profit margins are not fairly spread across the different segments of the value chain, this is causing disproportionate capabilities for growth of the value chain, creating significant commercial constrain to VC competitiveness. Specific analysis was carried out in the input segment, production segment and trade segment to establish the profitability levels and investment feasibility. We however had challenges in accessing accurate information from some respondents, nevertheless in the milling Table 12 below provides a summary of the prevailing profit margins in different stages of the rice value chain.

Table. 13 A summary of the prevailing profit margins at different segments of the rice value chain.

Segment	Low Margin	Mean Margins	Max. Margin
INPUTS	6.6%	18.8%	30.8%
PRODUCTION			
SEMI-COMMERCIAL FARMERS (2-3 Acres)	21%	54%	64%
OUT-GROWER FARMERS (1/4 - 1/2 acre)	25%	28%	32%
INDIVIDUAL FARMER ON ¼ ACRE	-15.5%	15.6%	31%
INDIVIDUAL FARMER 1 ACRE LOW INPUT	7%	16%	34%
INDIVIDUAL FARMER HIGH INPUT- 1 ACRE	3%	10%	24%
COOPERATIVE FARMER 1 ACRE	23%	31%	41%
WHOLESALE/RETAIL TRADE	10.7%	18.5%	27.1%
SMALL SCALE MILLERS	31%	47%	44%

The profit margins in the rice value chain are a factor of three key elements; 1) The price, 2) The production costs and the yield). These factors are affected by several systemic and business practices within the rice value chain; these include;

1. Application of cost saving mechanical technologies
2. The use of improved and better yielding fresh seed as opposed to recycled seed
3. The agronomic practices
4. The individual vs group procurement and marketing practices;
5. The quality of the rice grain i.e level of breakage and;
6. Aromatic or non-aromatic properties of the rice.
7. The national and EAC trade Policy framework

These have both a direct and remote effect on the different segments of the value chain. The analysis focused on the value creation process in the rice business, by comparing the profitability indicators with the market value of money as a measure of the business value creating capacity and resilience towards risk. The findings show that most segments of the rice value chain have a lower than market rate of return for money which was estimated at 28% for commercial markets and 36% for rural saving schemes. The small scale milling and cooperative farming models demonstrated superior levels of returns and business resilience compared to the other segments.

The low margins explain the vulnerability of rice farming, trade and input business to

the factors that affected profitability as listed above. Any changes in any of these factors mean the actors realize a below market rate return leading to loss of financial.

The study also demonstrated that to transform the rice segment in Uganda into a commercially competitive segments investments should focus creating a pull effect at the production segments. Transformation of the production segment is key to creating a transformational effect across the entire value chain; The cooperative model offers that greater capacity to create a pull effect towards the input up take and making the input segment competitive. This is because the input segments thrives on large volume sales to realize economic return, because the unit margins are low. Increasing acreage and up take of productivity enhancing inputs and technologies is key to increasing sales volumes from the input segment. On the other hand the milling segments is very much dependent on volumes coming from production to increase capacity utilization. The study showed overall capacity utilization in the small mills averaging 20% in some months of the year rising up to 50% in peak periods in the major centers of Butaleja and Mbale.

The trade segment is reliant on the supply end from the production and milling segments. Procurement costs are some of the key cost centers in the trade segments. This segment contrary to previous studies such the the one done by KILIMO trust has one of the lowest margins, local brands especially have lower margins than the imported brands which partly is a factor of the high farm gate prices and procurement costs. The variation in trade margins between now and the studies done earlier could be related to the changes in input, and labor costs at the production level which has since pushed up farm gate prices from an estimated UGX1500-1800 in 2012 to the current UGX1,800-2,300 in 2016. Imported brands continue to offer better prices than the local rice brands, however these

have also seen a fall in margins partly attributed to the depreciation of the shilling against the dollars and the EAC imposed tariffs. It is important to note that until the second half of 2016, the retail and wholesale prices for rice have not changed significantly since 2012. Much of the changes at the farm gate and import prices appear to have been absorbed by the trade at the expense of profit margins.

1. The Input segment:

In put supply is one of the major challenges facing the rice value chain? Inputs occur at two levels; 1) Hardware (agronomic inputs and Farm mechanization technologies) and 2) the software related to BDS services. The analysis focused on the hardware inputs which also influence the demand for software inputs like extension services and credit.

The input segment has one of the lowest margins in the value chain, poor infrastructure and low sales volumes. This has made the input trade at the current levels generally non-competitive and un attractive. The low demand for these inputs means the volumes sold are not sufficient for input dealers to break-even and be commercially competitive or realize a return on investment commensurate with the market cost of capital. Credit financing to the input segment at current margins and levels of sales turnover is not sustainable. The study demonstrated the returns a dealer could earn from supplying the full range of inputs for one acre of rice and estimated the break-even sales volume in terms of minimum acreage or cash turn around rate to realize a market rate of return. A typical input dealer would require to as cash turn around rate 2.4 times or supply at least a full range of inputs for 3.5 acres of rice for a cash investment of UGX541,254 in order to break-even with a 28% rate of return.

A typical business case analysis for an input dealer setting up business to supply at least 100 acres with a working capital investment of UGX 25m of rice showed that the input segment can be competitive through supplying a full range of inputs to a large acreage. It also implies strategies aimed at strengthening the input delivery system should focus on streamlining the input supply systems to create sustainable contractual relationships with organized farmer to consolidate input demand and ensure increase trade volumes for the input dealers by supply a range of inputs to a larger acreage.

2. The production Segment

The production segment alongside the milling segment by far has the most attractive margins. However margins in this segment are variable depending on the production model employed. The most viable and competitive models were the cooperative and the out-grower models at the smallholder level working with high input. The individual farmer high input model with acreage less than two is not viable and less competitive compared to the low input individual farmer with less than two acres. The semi-commercial farmers with 2-3 acres and a high input practice was more profitable and economically sustainable model with ROI of 21-64%. This has a major bearing to the design of the input supply systems discussed above. It is therefore the belief from these findings that commercially viability can be achieved under the small acreage system through promoting cooperative production and marketing models. This also aligns with the

cooperative sourcing of inputs which fits well into the proposed input supply strategy suggested above. A review of production costs in Haryana India and related data from Thailand and Pakistan showed that yields in these countries were not significantly different from other rice producing countries ranging between 4.5-6.0 tons. However their price competitiveness of rice from these countries results from significant reduction in the labor costs of production through mechanization.

3. The Small Milling segment

This alongside the production segments enjoy the largest margins, in spite of the low capacity utilization experienced across the milling segments, the small mills have lower overheads and therefore are able to operate profitability even with low materials supplies. The profitability of commercial milling segment could not be done due to difficulties in accessing the data needed to construct the profitability models for this section. There are a wide range of small mills with different levels of milling capability. However one of the challenges is the high level of rice breakage. While the mill performance has a major contribution to this problem, many other factors are known to affect the milling properties and quality of rice. Some of these factors include; the crop management, harvest and post-harvest handling and the moisture content of the rice. This calls for education and capacity building to address the knowledge and capacity gaps associated with rice handling and milling operations.

4. The Trade segment

The trade segment has a higher level of business resilience compared to the other sectors because of the level of product diversification and flexibility in cash investments. Despite the low margins from rice trading it tends to compensate by trading in other products. The major finding in this study is that trade margins have declined since 2012, alongside this farm gate and retail prices have risen from an average of 700, 000 and 2,000 respectively in 2012 to an average of 2,000 and 2,700 in 2016 for non-aromatic and imported brands. The trade segment has a greater latitude of influence on cost transfer, and may choose to transfer any price increases arising from cost factors to the consumer or absorb it within their margins. The pressure from imported brands has forced rice traders to absorb the price increases at farm gate within their profit margins for two major reasons;

1. The increasing competition coming from imported brands
2. The consumer preference for the local aromatic and non-aromatic brands largely for their bulging and aromatic qualities.

Unfortunately consumers are will to pay for these only in as far as the retail price is not significantly different from the imported cheaper brands. Price therefore is a primary factor for consumer choice. Improving trading margins to make Ugandan rice competitive is very much contingent upon cost reduction at farm level in order to realize competitive farm gate prices. The viability of the trade segment in respect of local rice is crucial for marketability and competitively to sustain the off-take function in the value chain. This is because at the current marginal profits the trade can no longer afford to absorb any further decline in margins and may shift entirely to imported brands at the expense of the local rice value chain.

Recommendations

A. The Input Segment

1. Advocate for closed input supply systems where farmers access inputs from a single sources to ensure trade viability through economies of scale. Strengthening farmer cooperative organizations to set up a one stop agronomic input supply unit, and advocating for members to buy inputs from the cooperative store has capacity to improve the input supply, ensure its competitiveness and improve the quality of inputs delivered. The alternative strategy is for input dealers to seek supply contracts with organized farmer groups or cooperatives as strategy to realize large acreage and sales turnover in order to be commercially competitive. It is important to note that this supply model can only be viable if the input dealer is willing to position as a one stop supply point for the full range of agro-inputs required.
2. There is also need to conduct a market analysis of the wholesale segment of the input supply chain to better understand the margins and device appropriate strategies to synchronize demand and supply factors in the chain and the cost and profitability drivers among the supply chain members. This analysis could not be successfully done within the methodological scope of this study because it requires a different approach to deliver credible data for analysis which the seed companies were unwilling to give due to competitive sensitivities. A general price survey approach and extracting import data from URA which could not be done in (the timeframe and context of) this study can be used, and then applying the relevant modeling assumptions to determine the gross margins.
3. The profits margins based analysis of the retail end of the input segment showed that profit margins, for productivity enhancing inputs such as fertilizers and seed ranged from 6-25%, with fertilizers particularly registered the lower end margins. On the contrary a trail of the fertilizer flow showed that the input wholesaler made a margin of 30% and benefited more from the import subsidies from government. Retail consolidation and demand aggregation (through cooperative sourcing) to create a platform for organized bulk sourcing of inputs. This will increase the through put from the retail trade, motivate retailers to improve stocking and availability of productivity enhancing inputs besides farm implements and create a trickledown effect needed for farmer to benefit from any government incentives intended to increase access and use of fertilizers and related inputs.

B. The Production segments

1. There is a case for variety inferiority for the rice types planted in Uganda, while fertilizer and other recommended farm management approaches can be applied, the return on this investment is often marginal due to genotypic limitations, compared to the high yielding hybrid varieties, which has created a disincentive among farmers. The recommendation is to step up research in the development of suitable rice hybrids as a priority, and move away from the conventional varieties in order to address genotypic productivity limitations. Counter arguments however point out that hybrids are not for smallholder farmers arguing on the need for new seed and input each season may be out of reach for the farmers in a broken input system. In Kenya,

Haryana India, Bangladesh and India hybrids have been demonstrated to yield up to 40-43% under the same good management practices than the conventional varieties.

2. Competitiveness and efficiency can be achieved through promoting cooperative farming models and semi-commercial farming models for the individual farmer and out-growers. These strategies will bring about demand aggregation for inputs and other BDS services but also create market economies of scale needed to achieve cost efficiency and increase profitability. This allows for the creation of the required pull effect needed to increase the turnover from the input and BDS segments, but also build sufficient push momentum to spur the trade segment, through reduction in transaction costs which are eroding the trading margins especially for local brands in favor of imported brands.

3. Production mechanization has a high potential to increasing the profitability at production level, however specific mechanization technologies should be assessed on their individual merit for the ability to increase farm levels profits and achieve sustainable returns for the investors. A detailed analysis from this study on the use of mechanized drying in the rice value chain clearly illustrates the strong potential to increase farm levels profits by nearly 30% through milling quality improvements and cost reduction. It also demonstrated commercial viability can be achieved in 18 months returning a high ROI in the first 3 years. This can be a great entry point towards improving rice productions and competitiveness of the sector through mechanization.

C. The Milling segment

The small scale mills by far are more suitable for the smallholder farming environment, however the concerns with the milling performance of these mills and the quality of rice produced do exist. Despite our inability to obtain representative and reliable data on the commercial mills, all of the four major mills considered operate below capacity and do struggle to find rice to mill. Some have resorted to importation of rice paddy and semi-milled rice to sustain operations. The success of commercial milling will depend on the ability of the millers to forge contractual relationships with the production segments to create dedicated supply chains. Kibimba and Kingdom Millers have already taken steps to build a network of out-growers alongside their core farm production, as an integral supply chain development process. Viable commercial milling for medium to large scale mills can only be achieved at operational capacities above 65%.

D. The trade segment

There is an urgent need to shift production from the high cost labor dependent model to a low cost semi-mechanized model to reduce production costs and maintain farm gate margins without increasing farm gate prices. There is limited room for price increase at farm gate without jeopardizing the other segments of the value chain. This should also be matched with cost effective methods of selling to reduce the transaction costs for the traders and farmers, cooperative production and marketing models have demonstrated a strong cost reduction potential that can be positive across the entire value, making the production segment ***a fulcrum for value chain efficiency and competitiveness.***

Conclusion

The Rice Value chain has a high income potential, major concerns to realizing this potential relate to the inefficient production cost structure, the poor quality of milled rice, challenges in crop management, harvest and post-harvest handling which impact on the quality of the final rice, the low yields realized which are a factor of varietal limitations, poor seed quality and inappropriate agronomic practices. Credit financing is not a viable option for the rice value chain in its current operating cost structure and would require a subsidized credit facility to realize competitiveness and avoid default. Consolidation at the production level can have a far reaching impact on the competitiveness of the entire value chain through creating a cost reduction effect that will trickle down and up the value chain.