agricom
ShambaPesa

FEASIBILITY STUDY
FOR

INTEGRATED AGRO-INDUSTRIAL COMPLEX DEVELOPMENT

October 2022

Data Page

Task Order Number:	IRCP-21-5-0002-01
Consultant:	Rakestar Group Limited, P.O. Box 11925, Dar es Salaam.
Promoter:	Agricom Africa Limited, P.O. Box 79291, Dar es Salaam.
Document Title:	Feasibility study for integrated agro-industrial complex development
Date of Report:	October, 2022
Study Design and Methodology:	Literature review, interviews, and field study.
Photo Credits:	Shutterstock
Scope of Work:	Performing feasibility study of market, technical, and financial aspects of developing an integrated agro-industrial complex for rice drying, storage, processing and distribution center.
Project Area:	Melela, Morogoro
Document Status:	Final
Copyright:	Agricom Africa Limited

Disclaimer

This feasibility study report is to introduce the subject matter and provide a general idea and information on the said matter. Although, the material included in this document is based on information gathered from various reliable sources; however, it is based upon certain assumptions, which may differ from case to case. The information has been provided on as is where is basis without any warranties or assertions as to the correctness or soundness thereof. Although, due care and diligence has been taken to compile this report, the contained information may vary due to any change in any of the concerned factors, and the actual results may differ substantially from the presented information. Rakestar Group Limited, its employees or agents do not assume any liability for any financial or other loss resulting from this report in consequence of undertaking this activity. The contained information does not preclude any further professional advice. Therefore, Agricom Africa Limited, who is the intended user of this report, is encouraged to carry out additional diligence and gather any information which is necessary for making an informed decision, before taking any decision to act upon the information provided. For more information on services offered by Rakestar Group Limited, please visit our website: www.rakestar.co.tz

Contents

1. Executive Summary

Agricom Africa Limited (Promoter), requested Rakestar Group Limited (Consultant) to assist in conducting pre-feasibility study of integrated rice complex project, covering description of project and analysis of market, technical, and financial aspects. This pre-feasibility study report is submitted in compliance with the above agreed scope.

The COVID-19 pandemic has highlighted long-standing shortcomings of Tanzania's agricultural value chains. The scarcity of modern storage for agricultural commodities has also led to insecurity of supply raising concerns about Tanzania's food security.

Significant investment in modern agri-storage is critical for addressing this situation. But nearly all modern drying and silo storage for Tanzania's leading grains—wheat, rice paddy, and maize—exists inside large-scale mill facilities and is not accessible for farmers, traders, and medium-to-small-sized millers. Between these three crops, Tanzania's value losses in

post-harvest are estimated at nearly USD 343 million per annum in quantity and quality due to lack of proper drying, storage and milling.

Farmers are the real losers in these crop value chains even though they bear the most risk among all stakeholders in the agricultural sector. The loss of quality is mainly due to the primitive practice of sun drying which farmers as well as traders depend on since they do not have access to mechanical drying facilities. Farmers are not able to hold their rice paddy or maize since they require drying after harvest and most often have to make a 'distress sale' of their harvest as the prices at harvest time are the lowest of the year.

Beyond these physical losses, the lack of reliable storage with grading of commodity means that the markets for these commodities are often constrained to local buyers. In Tanzania's grain sector, commodity testing labs are not found in the wholesale markets but only on the premises of the larger mills. This leads to lack of standardization which has far-reaching consequences: this is the major hurdle in the way of nation-wide trading of agri-commodities.

This pre-feasibility study has been conducted to develop commercially viable integrated rice complex project with drying, storage and milling facilities. The exploration of the target value chains conducted through a literature review, extensive interviews with traders, and a field visit to Kilombero, Ulanga, Kilosa and Mvomero shows that the rice belt districts of Morogoro are the most suitable geographies for the integrated rice complex projeect. The level of paddy production in these areas can maximize the utilization of the cleaning, drying, storage and milling facilities through the year.

A comprehensive value chain mapping for paddy for this pre-feasibility study reveals that farmers can make appreciable gains by getting their paddy cleaned and dried mechanically and stored in silos or milled. This value chain mapping uses prices for the main services of the proposed facility—cleaning, drying, storage and milling—which have been paid by real customers of these services to the local rice millers.

Using this value chain mapping as a reference, detailed financial modeling was conducted for this pre-feasibility study. The financial modelling focused on a 10,000-ton facility with four Germany-origin silos of 2,500 tons each (equivalent to rice paddy). Using reference prices for cleaning, drying, storage and milling, this capacity level was found to show an equity IRR of 16.13 percent and a simple payback of 5.6 years but with significantly constrained liquidity during the 7 years tenor of debt contracted at the beginning of the

project. With a projected NPV of USD 2.37 million at 14 percent discount rate, this results indicate that a 10,000-ton facility is a commercially viable unit at the reference prices for cleaning, drying, storage and milling paid by customers during the study conducted. The option of above 10,000-ton facility may require too much grain volume to be aggregated at one spot given the low yields and relatively small farm sizes in Tanzania.

The financial projections take into account all costs associated with imported rice mill and silos with units for receiving, pre-cleaning, drying, and outloading. The investment outlay for this facility is estimated at USD 7.36 million with Germany-origin silos. The proposed business is a low-margin, high-volume business with a lumpy capex profile. Rapid market adoption of its services and full utilization of its machinery are key to its sustainability. The financial analysis shows that sufficiency of liquidity is critical while the business is paying off its debt.

The strategic priority for building the proposed business is to develop trust and credibility among its relevant agriculture stakeholders. The regulatory review conducted for this study found that rice, the country's second largest crop, the value chain has government influence or direct control right from the farmer to the rice miller. Therefore, for the success of this venture it is believed that the government will continue to protect domestic smallholder rice producers who make approximately 90 percent through import duty of 75 percent on milled rice in Tanzania mainland.

Overall, there is a strong case for public support to the proposed integrated rice complex project investment as it has been done in other countries like Kenya and Uganda. Given the findings of this pre-feasibility study, a serious effort is required to realize the benefits for farmers through establish a unique project of multi-dimensional, multi-faceted value addition to rice production and rice value chain.

Last but not least, the Promoter should consider purchasing Kilombero Plantation Limited as an alternative investment to integrated rice complex project. The company is now under sale by NMB Bank, and so far the highest bid on table is USD 10.5 million placed by Lake Group,the Tanzanian energy trading and transportation company.

2. About Promoter

Agricom Africa Limited is a specialized agri machinery trading company offering a comprehensive range of products solutions from land preparation througout the production cycle. The company commands 33.3% market share with leading tractor and paddy harvester selling brands in Tanzania. It has a distribution network of 60% national coverage with 3 service centres, 6 branches and 9 sales agents and is poised for significant further expansion and diversification into agri commodities, and most notably rice trading.

Established in:	2009
Ownership:	Private Held
HQ Location:	Plot 2319, Nyerere Road Kamata, Dar es Salaam, Tanzania
CEO	Alex Duffar (April 2021 –)
Gross Revenue	9.79 million USD (2020)
Employees:	60, highly trained and dedicated team
Subsidiaries:	Bravo Logistics Tanzania Limited, Green City (T) Limited
Contacts:	**[M]** +255 743402195, **[E]** ceo@agricom.co.tz, **[W]** www.agricom.co.tz

3. Project Description

3.1 Concept

This project concept aims to establish a unique project of multi-dimensional, multi-faceted value addition to rice production and rice value chain. In a normal rice mill, rice is milled and processed by purchasing paddy from farmers. So, consistency of grain quality as well as food safety and traceability aspects are neglected.

At the pre-harvest side, under the integrated rice complex project concept, which is very much different from conventional and traditional rice mill, Promoter will collaborate with farmers to obtain the stable supply of consistent quality paddy under Contract Farming Scheme which includes providing:

(1) the right quality seed to farmers,
(2) the right technology and good agriculture practices,

(3) the right crop protection and agrochemical fertilizer, and
(4) the required working capital for farmers.

Besides, Promoter will provide farm mechanization services such as tractor and combine harvester rental service.

At the post-harvest side, when the paddy is brought at Promoter's integrated rice complex project site, it will be properly cleaned and dried using modernized grain drying technology. After cleaning and drying, the paddy will be systematically stored in metal silos to keep the right quality and grain moisture. The stored paddy will then be milled and processed using state-of-the-art rice milling machines. Since Promoter's rice will be produced by using the better quality paddy, as well as by using the systematic and modern cleaning, drying, storage and milling technology, the quality and freshness is assured. Promoter's rice will be packed and distributed to local and regional market.

3.2 Mission and Objectives

The purpose of the project is:

1. Preserving quality and quantity in rice supply chains through reduction of post-harvest losses.
2. Increasing holding power and access for smallholder paddy farmers to local and regional markets of milled rice products.
3. Engaging at least 10,000 smallholder paddy farmers in competitive rice supply chains leading to a sustainable improvement of their livelihoods;
4. Opening up new business avenues for insurance and banking targeting financial inclusion for smallholder farmers.
5. Formulating public-private recommendations for up-scaling this business model in Tanzania.

3.3 Strategy

The proposed integrated rice complex project will offer reliable silo storage services for paddy with rice milling.

Service businesses in this space in comparator countries are found to offer the following services:

1. Storage and Warehouse Receipt/collateral services (round the year)
2. Grain Quality testing (round the year or storage period)
3. Cleaning (peak during harvesting period)
4. Drying (peak during harvesting season)
5. Milling (round the year)
6. Inputs supply: seeds, machineries, chemicals, etc. (round the year)
7. Financial services: credit, insurance, trade finance, etc. (round the year)
8. Organized marketplace for grain (round the year)

The strategic direction of the proposed business must be to establish credibility and trust for the first five core business lines and subsequently leverage these to build the last three business lines. This is the international experience where the initial revenue growth is from provision of the core services and revenue growth in subsequent years is from the associated services particularly the arrangement of financial services for which the Promoter begins to apply charges to the financial institutions. To remain conservative, the financial modeling conducted in this effort only includes revenue from the core services. The focus in the initial years must be on maximizing silo capacity and utilization, increasing the efficiency of pre-cleaning and drying, increasing the utilization of quality testing lab, and minimizing operational costs to develop trust and a reputation for the high quality for services provided.

For scaling up such a project, the recommended strategy is to build up a portfolio of silo facilities with a couple of facilities to start with and gradual additions as the mastery of grain management and local conditions improves. This pre-feasibility study focuses on one such facility but the commercial considerations, design choices, and revenue model outlined in this report can be replicated for many grain facilities.

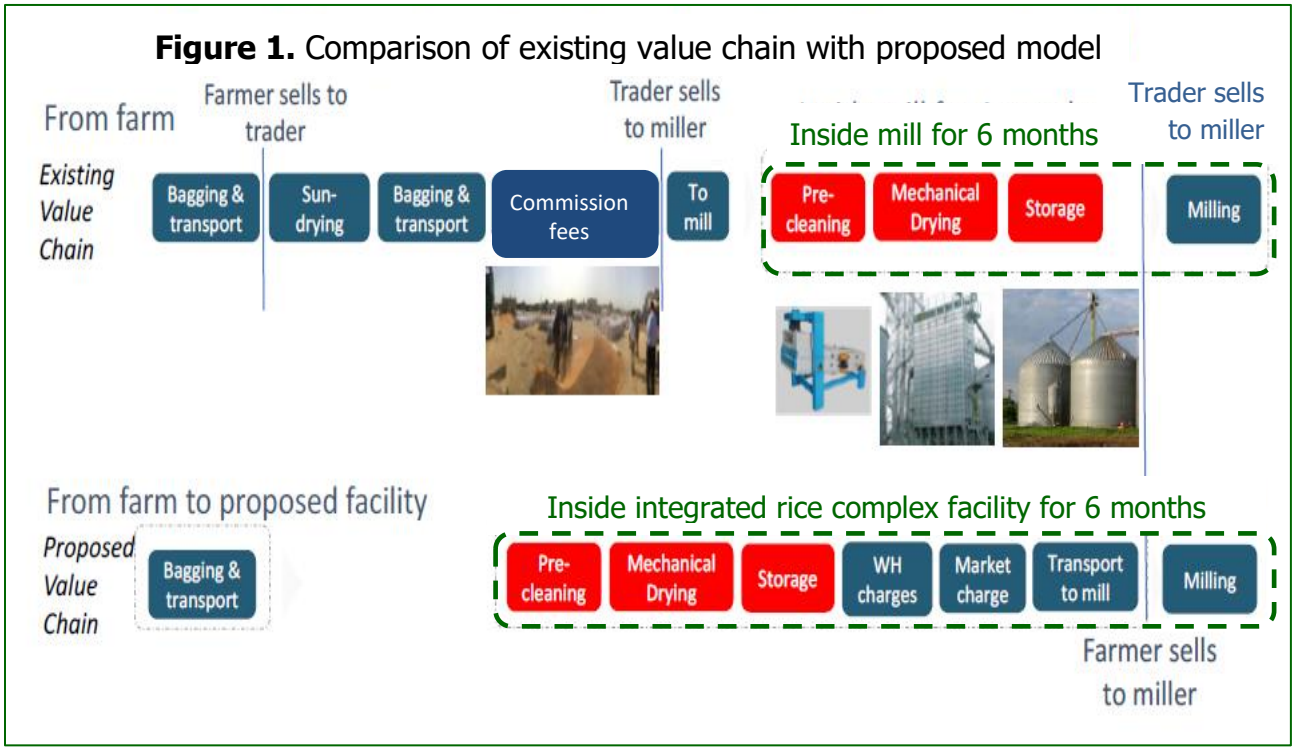
In the short- to medium-term, two strategic pull factors must be relied upon to fill the silo storage (which drives most of the other services):

- The dire need for drying of paddy after harvest makes the drying and storage business highly attractive for farmers, traders, and second-tier processors who do not have access to mechanical drying.

- The need for bank financing for agri stakeholders means that, under with accreditation under the warehouse receipts system, the drying and storage business has a strong pull for agri stakeholders.

To place the proposed business in the context of the existing value chains, a simple comparison can be made with a scenario that is commonly observed in Tanzania's agriculture sector. Millers and traders regularly purchase grain at harvest and place it in storage for a few months for profit-taking on the back of the gradual price increase. Gradual increase in price subsequent to harvest is a regular feature of grain value chains. The lowest price of the year is typically observed at harvest time since the entire supply of a grain becomes available during the few weeks of harvest and the demand for the grain is distributed over the entire year. This play is best implemented by millers who have drying and silo storage capacity which means that at the time of sale a few months later, they can offer pristine quality grain in a market where quality grain is a highly scarce commodity so far away from the harvest. This play is not the core business of millers, but it offers the closest comparison of the proposed business model with what is happening in the market today. Figure 1 tracks the movement of the grain through the entire value chain for this play to set up a comparison with the proposed business.

Figure 1. Comparison of existing value chain with proposed model



3.4 Study Location

This study was conducted in the Morogoro region as shown in the map of Tanzania above.

The Morogoro region is the second largest producer of rice in Tanzania (contributing 12% of total production), and rice is the second most important crop in the region after maize, with over 250,000 smallholders currently producing rice. The region largely serves the Dar es Salaam market (Tanzania's largest rice consuming market) which will see growing rice consumption due to rising urbanisation, incomes and population growth.The region contains the largest commercial rice players in the country, Kilombero Plantation Limited and Murzah Wilnar Rice Millers Limited. Morogoro is well connected to national grid electricity, water and cross country roads network

4. Market Study

4.1 Tanzania Rice Industry Context

About 71, 9 and 20 percent of rice cultivation in Tanzania takes place under rain fed lowland, lowland irrigated and upland conditions, respectively. Available information indicates that more than 70 percent of rice production in the country originates from six leading rice producing regions: Shinyanga, Tabora, Mwanza, Mbeya, Rukwa and Morogoro. Other regions include Songwe, Katavi, Arusha, Kilimanjaro, Kigoma, Manyara, Iringa, Mara and Tanga. Over the past two decades from 1995 to 2014, the area under rice and production at national level increased by 57 and 76 percent respectively. Increase in production has gradually reduced the need for imports and rice self-suciency has been attained in the recent years (Table 1). Average paddy yields across ecosystems have varied widely during the same period (between 1.25 and 2.5 tons per hectare) without a clear increasing or declining trend (http://ricepedia.org/tanzania). Average paddy yields also signicantly vary among the

Table 1: Trend of Rice Production and Consumption

Year	Area Harvested (Ha)	Yield (t/ha)	Production (MT)	Consumption (MT)	Self-sufficiency ratio (%)
2012	900,275	1.3	1,170,385	818,699	143
2013	1,005,622	1.3	1,307,308	840,487	156
2014	840,563	2.0	1,681,125	886,962	190
2015	1,139,358	1.7	1,936,909	926,096	209
2016	1,238,372	1.8	2,229,071	976,925	228
2017	758,861	2.1	1,593,609	924,435	172
2018	1,109,814	2.0	2,219,628	990,044	224

rice growing regions. For example, the average paddy yields in 2016/17 cropping season for Morogoro and Mbeya (the two major growing regions) were 4.0 and 2.2 t/ha respectively. Around 90% of Tanzania's rice production takes place under smallholder (small-scale) system. The sizes of rice farms range from 0.5 to 3 ha, with an average farm size of 1.3 ha. Among the cereal crops, rice alongside maize has been selected as one of the strategic commodities for commercial investment in Agricultural Sector Development.

Morogoro is Tanzania's second largest rice producing region and the government of Tanzania has indentified Morogoro rice as a priority region. Whereas, rice is the second most important crop in Morogoro and has the potential to become the most important if yields are improved. Within Morogoro, Kilombero district is the second highest rice producing district.

4.2 Competitor Overview

The largest commercial players in the country operating in the same space are Kapunga Rice Project Limited (Mbeya), Kilombero Plantations Limited and Murzah Wilmar Rice Millers Limited (Morogoro).

The following is a brief overview of above competitors:

➢ Kapunga Rice Plantation Limited (Mbeya)

The Kapunga Rice Plantation Limited (KRPL) is one of Tanzania's commercial rice farm situated in the Usangu planes of Rufiji river basin. The farm was established in 2007 as a stand alone business. KRPL acquired a government rice farm with 7,800 Ha total land. In 2019, KRPL produced 24,000-ton of paddy equivalent to 16,000-ton of milled rice.

Investment to date includes:

- 10,000 ton storage capacity with 8 silos of 1,250 ton each.
- 3,000 Ha of irrigated paddy fields (this totals to 500 plots in which 1 plot is 6 Ha in size).
- 1,700 Ha of 3,000 Ha of total land is under tenant farmers who are contracted by KRPL.
- Water is supplied by 18km feeder canal.

Commercial Sustainability includes:

- Zero Tillage conservation planting technology.
- Brand rice for premium sales to domestic market and exports to Zambia and DRC.
- Breed rice seed of superior taste quality and yield
- Use rice husk as fuel source and wind and solar power to drive the administrative power needs.

➢ Kilombero Plantations Limited (Morogoro)

Kilombero Plantations Limited (KPL) is developing the 5,469 ha Mngeta Farm. 450 km from Dar es Salaam, the largest market, by road and rail, Mngeta is situated in the fertile Kilombero Valley, best agro-eco zone for rainy season rice and dry season irrigated maize farming in East Africa.

Investment to date includes:

- 6,200 m^2 warehouse and 2 industrial rice mills.
- 3,000 ton automated cleaning and drying facility.
- Fleet of John Deere and Claas tractors, planters and combine harvesters.
- 500KW biomass gasification plant.
- Refurbishment of 320KW mini-hydro station.
- 3,000 hectares of overhead center-pivot irrigation circles fed by a river pump station, 4 km of underground pipes and two canals, 4.5 km and 6 km.

Commercial Sustainability includes:

- Zero Tillage conservation planting technology.
- Farm's own mini-hydro plant powers operations.

• Rice husk furnaces produce heat for drying.
• Rice husk waste converted into clean power through biomass plant.

Mngeta Farm produces up to 15,000 tons of milled rice in the rainy season and 30,000 tons of maize in the dry season, with rotations of beans and pulses. However, KPL is now under sale by NMB Bank, so far with highest bid on table of USD 10.5 million placed by Lake Group, the Tanzanian energy trading and transportation company.

➢ Murzah Wilmar Rice Millers Limited (Morogoro)

Murzah Wilmar Rice Millers Limited (MWRM) is a commercial rice miller situated on Plot number 66-75, Block 'E', Industrial Complex, Kihonda in Morogoro Municipality. MWRM is now the largest rice miller in the country with a capacity of processing 102,680-ton of milled rice per annum.

Investment to date includes:

• Paddy Sampler and 288-ton per day industrial rice mill.
• Automated cleaning and drying Tower
• 10,800-ton storage Silos of 100-ton (3 Nos.), 500-ton (3 Nos.) and 3,000-ton (3 Nos.).
• Canteen and Office Block.
• Pump House and Toilet.
• Mechanical Engineering Workshop.

Commercial Sustainability includes:

• Electricity and Biomas Power Generation.
• Brand rice for premium sales to domestic market and exports to Kenya and Singapore.

5. Technical Study

5.1 Designed Choices

One of the most important design choices for the proposed business is the total storage capacity of a given facility. Given the low crop yields and small farm sizes in the target areas, large volumes are not aggregated at one location. This factor and inputs from industry players indicate a choice of either a 10,000-ton storage unit or a 15,000-ton storage unit with sufficient space to expand as business builds up. Starting with storage capacities or 20,000 tons or more would be suitable in situation where business can be guaranteed for a stand-alone facility of this size.

Beyond the capacity of the entire facility, the choice of the unit size of the silos that comprise the facility is important as well. The most common choices are silos of 2,500-tons each

which are typically of 60-foot diameter and silos of 3,300 tons each which are typically of 72-foot diameter. Since the inputs from study indicate at least three grades of paddy, it would be ideal to have multiple silos which can house sizable volumes of each grade. This points in the direction of the 2,500-ton silo unit.

Storage by grades means that stocks of different depositors which fall into the same grade will be commingled. It is important to note that these tonnage numbers are specific to paddy and the overall design choice is specified in Table 2 below:

Table 2: Design Choice Specifications

Paddy Intake, Pre-cleaning, and Storage	Intake capacity	:25-ton per hour
	Pre-cleaning capacity	:300-ton per day
	Moisture	:18 to 25%
	Impurities	:Max 0.5% by volume
	Storage capacity	:10,000-ton in 4 silos of 2,500-ton each
	Connected load	:65kWh
Paddy Drying	Drying capacity	:200-ton per day
	Input moisture	:22 to 215
	Output moisture	:12 to 13%
	Type	:Continous
	Connected load	:70kWh
Rice Milling	Paddy rice variety	:Medium grain
	Paddy rice condition	:Raw
	Paddy rice bulk density	:525 to 550kg/cu.m
	Plant operation	:20 hours per day
	Processing volume	:160-ton per day
	Optimum performance	:At input moisture of 12% and bulk density of 525kg/cu.m
	Connected load	:635kWh

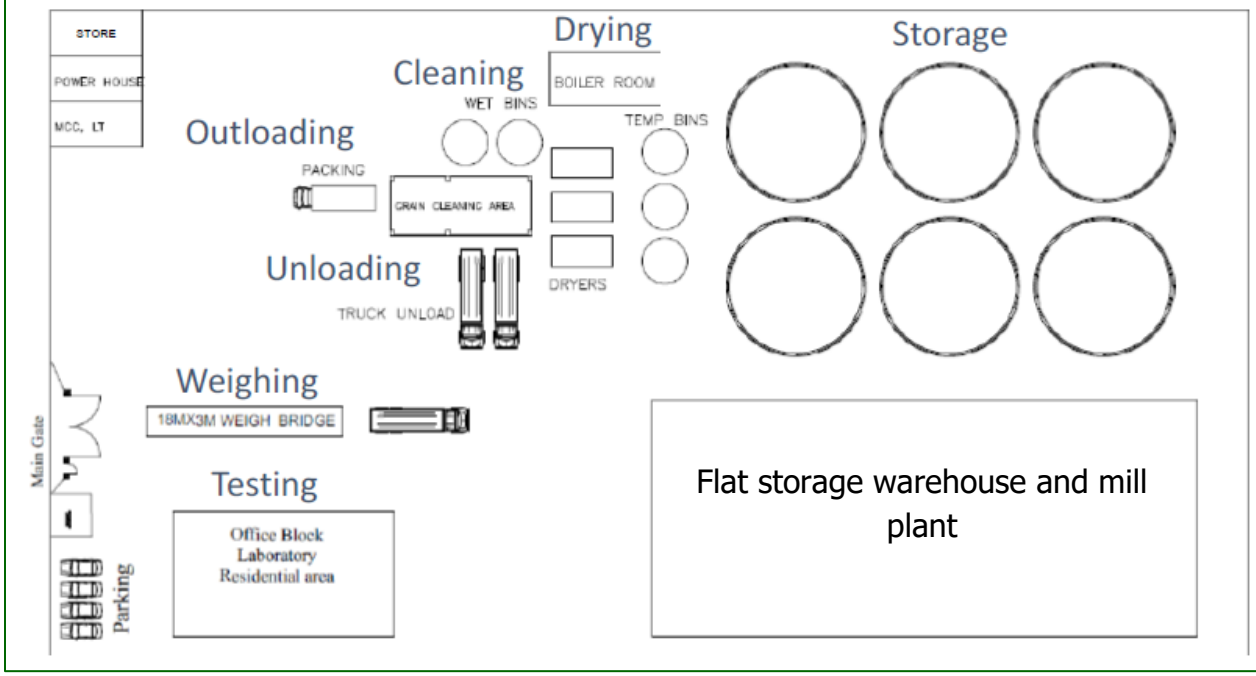
5.4 The Proposed Facility

The proposed facility requires additional space to accommodate the capacity that will be installed first, an area to accommodate providers of associated services (banks, input suppliers, etc.), space for flat warehousing if required, and possible expansion in future. The preparation of this land involves levelling. More importantly, for planning civil works and a bill of quantities for the grain station, geological/soil testing of the land is required to

check the condition of the earth that is going to bear heavy loads of grain in a vertical silo structure.

As Figure 2 shows, the construction of office space and accommodation for staff, a parking shed for 10 vehicles and roads for vehicle mobility are also proposed. A 100-ton truck weighing scale is suitable for this facility since the typical truck carries 20-40 tons of grain and modern dumper trucks may carry heavier loads. To remove human intervention in weighment, the weighbridge will have direct electronic connectivity with the enterprise resource planning system of the facility.

Figure 2. Sample site layout (not to scale)



To facilitate speed of grain delivery at the facility, the grain receiving set-up includes dumping units for two vehicles to unload simultaneously. Grain dust filters will be present to collect dust during unloading. Gravitational force utilization is the principal that governs the loading and unloading of silos.

Grain unloaded in dumping hoppers will be transported horizontally by motorized conveyer to motorized bucket elevator for vertical transportation of grain to start the pre-cleaning process.

This will be done by passing the grain through:

1. a magnetic separator (for separation of metal impurities),
2. a motorized drum cleaner (for separation of coarse impurities that are larger in size than the grain, and
3. a motorized sifter (for separation of tiny impurities that are smaller in size than the grain) and motorized aspirator (for separation of light weight impurities).

Completion of pre-cleaning results in a grain that has less impurities and is ready to store if it is in dry condition (less than 13% moisture for more than one-year storage). By passing through the pre-cleaning system through gravitational force, this precleaned grain is then moved through vertical transportation through bucket elevator either to a motorized conveyer for a silo destination or the buffer bins of the dryer that are placed to hold the pre-cleaned wet grain for drying. Two buffer bins can support the three-dryer set-up for almost 24 hours.

Three column type dryers equipped with motorized bucket elevators are proposed to circulate the grain in column and high velocity fans for intake of ambient air passing through heating coils to raise its temperature and reduce the relative humidity. The moist air that has taken some moisture from grain to dry the present grain can be let out. It is supported by a steam line from a 1000 heating surface boiler using biomass as a fuel. When the grain batch has received its targeted moisture, it will be shifted to one of three tempering bins to cool down. Each tempering bin will be designated for a dryer to facilitate the whole operation. In this state, this cool grain can be transported by motorized bucket elevator to a motorized conveyer for its silo storage destination.

The grain will rest for the rest of its storage life in steel silos which are a cylinder shape space with galvanized, corrugated walls, supported by stiffeners and wind pipes. Silos have a steel roof with vents and one exhaust fan for each silo to facilitate the grain and head space temperature differences. Two centrifugal fans for each silo with air flow rate of 0.1-0.2 cfm/bushel (depending upon grain type: wheat requires more than corn) will pull the air from the environment and push it through the grain through air ducts in the bottom of silo structure. Efficient use of this aeration system will reduce quality and quantity losses during storage.

The silos will be equipped with 3D inventory sensors and ICT or IoT based temperature and moisture sensors that will keep the silo operators/warehouse operators updated regarding the storage conditions.

For unloading stored grain, discharge gates in the bottom of silos will release the grain by gravitational force and will be transported horizontally by motorized conveyer to delivery point where grain will be elevated by motorized bucket elevator to a hopper connected to an automated mill plant. Pneumatic system with a compressor is in place to operate all gates/valves in loading, unloading. All electrical supplies will be from the main control center (MCC) and programmable logistic control (PLC) with interlocking of all receiving, precleaning, drying, loading and unloading systems to save energy and time.

5.5 Human Resources Requirement

The proposed integrated complex rice project facility will run well-understood and time-tested technologies. But their operation requires robust technical expertise in a complement of human resources that have the relevant experience with these technologies. Table 2 lists a staff count of thirty personnel broadly divided into teams for management, administration, marketing, silo storage, testing lab, drying, security, boiler room, security, and HSE. Some double-hatting is possible within this count of thirty.

Table 3: Staff Count

No.	Title	Responsibility	Count
1.	Manager Site	Responsible for all site matters (operations, administration, quality, inventory, HSE, HR and security) as a team lead.	1
2.	Mill Operator	Responsible for all maintenance of machinery, storage operations (aeration, fumigation and monitoring), grain handling operations (unloading of grain, precleaning of grain, drying of grain, loading of silos and transfer of grains to mill) and mill operations (hulling, whitening, polishing, grading, sorting, weighing and packing.	1
3.	Mill Helper	To support mill operator	2

4.	Lab Technician	Responsible for all Laboratory operations and its inventory; samplings and their record keeping/entering	1
5.	Samplers	Responsible for all grain sampling of grain receiving, unloading, drying, loading and packing	2
6.	Electrician	Responsible for all matters of maintenance and operations of Pneumatic, MCC, PLC and Genset	1
7.	Mechanic	To provide mechanical support to Foreman	1
8.	Boiler/Foreman	Responsible for all matters of maintenance and operations of mechanical machinery and Boiler	1
9.	Boiler Helpers	To provide boiler operation support to Foreman	2
10.	Marketing Manager	For promotion, marketing and sales of the facility's services and coordination with related parties (banks, etc.)	1
11.	Marketing officers	To support marketing manager	3
12.	Accounts officer	Responsible for all inventories of the facility	1
13.	Store Helper	To support the accounts officer	1
14.	Gate Clerk	To keep/enter all gate in-out	1
15.	Security Supervisor	Responsible for site security	1
16.	Security Guards	To support security supervisor	4
17.	Gardner	For housekeeping of site landscape	1
18.	Fire Fighters	To support HSE	2
19.	Sweeper	For housekeeping of site	1
20.	Office Boy	To serve officers and guests/visitors	1
21.	Driver	To assist manager site	1

The highest priority is to source professionals with the relevant expertise, experience, and integrity for this operation. Since silos have been in operation in Pakistan's poultry feed industry for nearly forty years and have been in active use in the country's wheat and rice value chains for a couple of decades, there is a good number of professionals in the various areas of expertise required for the proposed facility.

5.6 Risks Assessment

The key risks to the bottom line and reputation of the proposed business mainly emanate from the sampling and testing activity, the reasons that can result in weight shortage, risks during storage, risks from improper silo and mill operation, fraud and theft. Thus, the minimum risk cover required for hedging said risks is fire and allied perils insurance which

provides cover for physical risks to the silos, the mill and its contents as well as insurance for fraud and theft which takes place with malintent by the complex facility operator's staff and for professional indemnity to cover for the results of negligence by the staff.

This study has assessed this project associated risks and identified the following potential mitigating measures:

1. **Sampling and testing risks:** A key risk at the time of receipt of commodity at the complex facility is the incorrect assessment of its quality and grade. This risk can be addressed by ensuring that scientific random sampling is implemented by the sampling team and rigorous testing is conducted by the analysis team.

2. **Weight shortage risks:** There are a handful of risks that can cause weight shortage which can bring serious liability to the operation. If the weighing scale is not calibrated properly, the accuracy of weight measurement gets compromised. To eliminate this possibility, fit-for-purpose weighing equipment or scales must be used with suitably frequent calibration.

3. **Storage risks:** The deterioration of commodity during storage is a serious risk for the proposed business. This can be addressed through strict quality testing at entry, regulator monitoring of stocks during unloading, proper pre-cleaning, adequate drying, regular monitoring of stocks during storage with proper aeration and fumigation.

   Another key risk during storage is infestation by insects. The main measure to deal with this risk is a strict testing protocol that rejects any incoming stocks that have a live infestation. Further, fumigation of stocks during storage is another measure to deal with this risk.

4. **Silos and Mill operation risks:** Some in-storage risks are associated with improper operation of the silos and mill equipment. Periodic maintenance is the solution.

5. **Fraud:** Fraud by warehouse staff by diverting goods can lead to serious liability for the warehouse operator. This can be addressed through strong procedural controls such as,

multi-layer checks, separation of maker of each document from its checker, electronic link of weighbridge scale to ERP, inventory management, and routine surprised audits by the warehouse operator's management, etc. The fraud insurance cover can hedge this risk, but operational vigilance must be the first line of defence against fraud. The weighbridge is always a vulnerable component. A suitable ERP system with suitable MIS as well as a skilled weighbridge operator can eliminate the risk. Scale operator rotations are also a management tool that can mitigate this risk.

6. **Theft risk:** Can be addressed by ensuring that the boundary wall of the facility is secured with barbed wire, by achieving physical security through private security guards, and monitoring the facility through CCTV cameras, etc.

7. **Market risk:** The proposed facility will be new and has not been marketed widely yet. Therefore, the market risk consists in low uptake of the new services to be offered by the Promoter. However, as indicated by the need for cutting down post-harvest losses , there is a case to be made for rapid uptake of the proposed services. However, the benefits of these services will have be to be actively marketed and the cost-benefit analysis of these services will need to be explained to each customer.

6. Financial Study

Keeping in view the low yields and smallholding prevalent in Tanzania's agriculture sector, detailed financial modelling was conducted for a pre-cleacing, drying, storage facility of 10,000 tons capacity for paddy with four silos of 2,500 tons each, 200 tons per day paddy drying capacity, and rice milling plant of 160 tons per day capacity. Sub-section 6.5 shows the results based on an estimated investment cost of USD 7.36 million with a debt-equity ratio of 85:15. The results showed a commercially attractive return with a positive NPV of USD 2.37 million at a discount rate of 14 percent. The IRR to equity was found to be 16.13 percent and simple payback at 5.6 years. The business exhibited liquidity constraints in its first five years—of debt repayment—using IRR to equity as a proxy.

The proposed business is a low-margin, high-volume business with a lumpy capex profile. Rapid market adoption of its services and full utilization of its machinery are key to its

sustainability. The project financial show that sufficiency of liquidity is critical while the business is paying off its debt.

6.1 Financial Assumptions

The assumptions deployed for the analysis in this study (see Table 4, 5, and 6), intend to mirror the numbers obtaine from the field study. The choice of these assumptions is to establish a minimum base case of what we know can be accomplished in the market. The field study enabled a test of the market demand, gain insights into the feasibility of providing cleaning, drying, storage and milling services as well as identifying potential challenges as well as opportunities that could proactively be addressed through a more responsive marketing and business strategy.

In this regard, we use the following clustered assumptions in the financial modelling of this study:

Table 4: Operating Cost Assumptions

Description	Details
Machinery Maintenamce	5% of Machinery Cost
Raw Material Transportation Cost	TZS 600,000 Per Ton
Office Expenses (Janitorial Services, Stationery, Entertainment etc)	15% of Administration Expenses
Communication Expenses	5% of Administration Cost
Office Vehicle Repair and Maintenance	3% of Total Depreciation
Promotional Expenses	2% of Revenues
Utilities Expenses (Electicity and Water)	TZS 66 million Per Annum
Annual Cummulative OPEX Growth Rate	3.7%
Depreciation Method	Straight Line
Insurance Cost	1% of Total Depreciation
Depreciation Rate	10% on Plant & Machinery 5% on Building and Infrastructure
Depreciation Factor	20 Years

Table 5: Production and Revenue Assumptions

Description	Details
Annual Cumulative Cost of Goods Sold Growth Rate	1.32%
Annual Cumulative Growth in Sales Price	1.32%
Days Operational per Year	312
Storage Holding Period (Months)	6
Number of Holding Cycles per Year	2
Maximum Silo Storage Capacity	10,000 Tons
Per Day Pre-cleaning Capacity	300 Tons
Per Day Drying Capacity	200 Tons
Per Day Milling Capacity	160 Tons
Sale Price per Ton in Year 1	TZS 2,000,000
Hours Operational per Day	20
No of Shifts	2
Production Capacity Utilization in First Year	100%
Maximum Production Capacity Utilization	100%

Table 6: Financial Assumptions

Description	Details
Debt	85%
Promoter's Equity	15%
Interest on Debt	14%
Debt Tenure	7 Years
Debt Payments per Year	12
Annual Cumulative Inflation Growth Rate	3.7%
Annual Cumulative Electricity Price Growth Rate	1.32%
Price of 1 kWh of Electricity	TZS 236.73 of USD 0.102
Annual Cumulative Salaries Growth Rate	1.32%
Corporate Tax on Products and Services	30%
Exchange Rate (USD to TZS)	2,319
Import Duty of Equipment	0%

6.2 Project Cost

Following fixed and working capital requirements have been identified in Table 7 for operations of the proposed business:

Table 7: Project Cost

Description	USD	TZS
Preoperative Expenses (Incl. Architectural, Legal and EIA fees)	25,000	57,975,000
Land Acquisition and Preparation 2 Ha (20,000 Sqm.)	129,370	300,009,030
Buildings and Civil Works (Incl. Warehouses, Office, Truck Parking and Boundary Wall)	1,720,000	3,988,680,000
Machinery and Equipment (Incl. Cleaner, Dryer, Silos, Mill, Weighbridge, Transformer & Generator)	3,779,500	8,764,660,500
Vehicles	342,000	793,098,000
Furniture and Fittings (Incl. Local installation Labour, Installation & Supervisors upkeep)	63,200	146,560,800
Working Capital for 1 Month	1,296,661	3,006,956,859
TOTAL	**7,355,731**	**17,057,940,189**

6.3 Means of Finance

The project will be financed by two means including debt and equity as shown in Table 8 below:

Table 8: Project Means of Financing

Description	Percentage	Amount TZS
Sponsor Equity Contribution	15%	2,558,691,028
Long Term Debt	85%	14,499,249,160
TOTAL	**100%**	**17,057,940,189**

6.4 Revenues and Costs

Based on the capacity utilization of 100%, the details of revenues generation and cost of goods sold of the proposed business are provided in Table 9. We use the following service

charges as indicated by industry players for storage is TZS 1,500 per 100 Kg bag, handling and testing is TZS 1,000 per 100 Kg bag, milling is TZS 3,000 per 100 Kg bag, transport is TZS 500 per 100 Kg bag. Whereas, the sale price of milled rice is TZS 2,000,000 per Ton, by-product (bran and husk) is TZS 700 per 100 Kg, and Cost of Goods Sold (COGS) is TZS 1,700,000 per Ton.

Table 9: Revenues and Costs

Products and Services	**FY-2022**	**FY-2023**	**FY-2024**	**FY-2025**	**FY-2026**	**FY-2027**
Service Charge, Storage	300,000,000	303,960,000	311,984,544	324,339,132	341,464,238	364,000,878
Service Charge, Handling	200,000,000	202,640,000	207,989,696	216,226,088	227,642,825	242,667,252
Service Charge, Milling	600,000,000	607,920,000	623,969,088	648,678,264	682,928,476	728,001,756
Service Charge, Logistics	100,000,000	101,320,000	103,994,848	108,113,044	113,821,413	121,333,626
By-produts (Bran & Husk)	28,000,000	28,369,600	29,118,557	30,271,652	31,869,996	33,973,415
Milled Rice	40,000,000,000	40,528,000,000	41,597,939,200	43,245,217,592	45,528,565,081	48,533,450,377
Cost of Goods Sold	34,000,000,000	34,448,800,000	35,358,248,320	36,758,434,953	38,699,280,319	41,253,432,820

6.5 Projected Financial Statements

Unless noted otherwise, the financial projections and analysis conducted in this study rely on a 'base case' that uses the combination of key business variables assumptions listed in su-section 6.1 to derive the following projected income statement, balance sheet and cash flow as shown in Table 10, 11 ans 12 respectively:

Table 10: Projected Income Statement

Revenues	**FY- 2022**	**FY- 2023**	**FY- 2024**	**FY- 2025**	**FY-2026**
Service charge - Storage	300,000,000	303,960,000	311,984,544	324,339,132	341,464,238
Service charge - Handling	200,000,000	202,640,000	207,989,696	216,226,088	227,642,825
Service charge - Milling	600,000,000	607,920,000	623,969,088	648,678,264	682,928,476
Service charge - Transport	100,000,000	101,320,000	103,994,848	108,113,044	113,821,413
Service charge - By-products (Bran and Husk)	28,000,000	28,369,600	29,118,557	30,271,652	31,869,996
milled Rice Trading:	40,000,000,000	40,528,000,000	41,597,939,200	43,245,217,592	45,528,565,081
Total Income	**41,228,000,000**	**41,772,209,600**	**42,874,995,933**	**44,572,845,772**	**46,926,292,029**
Cost of Goods Sold:	34,000,000,000	34,448,800,000	35,358,248,320	36,758,434,953	38,699,280,319
Gross Profit	**7,228,000,000**	**7,323,409,600**	**7,516,747,613**	**7,814,410,819**	**8,227,011,710**
OPEX					
Fumigation	125,797,500	130,452,008	140,105,456	155,657,162	178,694,422
Salaries	55,972,938	58,043,937	62,339,188	69,258,838	79,509,146
Utilities - Electricity, Water	66,431,789	68,889,765	73,987,608	82,200,232	94,365,867
Administrative	16,957,500	17,584,928	18,886,212	20,982,582	24,088,004
Repair and Maintenance	291,130,179	301,901,996	324,242,743	360,233,688	413,548,274
Insurance	8,577,378	8,894,741	9,552,952	10,613,330	12,184,102
Other	100,000,000	103,700,000	111,373,800	123,736,292	142,049,263
Total OPEX	**664,867,284**	**689,467,374**	**740,487,959**	**822,682,123**	**944,439,077**
EBITDA	**6,563,132,716**	**6,633,942,226**	**6,776,259,654**	**6,991,728,696**	**7,282,572,633**
Depreciation	858,000,000	889,000,000	921,000,000	952,000,000	984,000,000
EBIT	**5,705,132,716**	**5,744,942,226**	**5,855,259,654**	**6,039,728,696**	**6,298,572,633**
Interest	1,775,000,000	1,469,000,000	1,120,000,000	722,000,000	269,000,000
Earnings before tax	**3,930,132,716**	**4,275,942,226**	**4,735,259,654**	**5,317,728,696**	**6,029,572,633**
Tax	1,179,000,000	1,283,000,000	1,424,000,000	1,606,000,000	1,833,000,000
Net Profit	**2,751,132,716**	**2,992,942,226**	**3,311,259,654**	**3,711,728,696**	**4,196,572,633**

Table 11: Projected Balance Sheet

ASSETS	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026
Current Assets						
Cash	3,006,956,859	6,616,089,575	6,888,899,085	7,239,216,513	7,670,685,555	8,187,529,492
Prepaid expenses	57,975,000	57,975,000	57,975,000	57,975,000	57,975,000	57,975,000
Total Current Assets	**3,064,931,859**	**6,674,064,575**	**6,946,874,085**	**7,297,191,513**	**7,728,660,555**	**8,245,504,492**
Fixed Assets						
Land and Buildings	4,288,689,030	4,288,689,030	4,288,689,030	4,288,689,030	4,288,689,030	4,288,689,030
Machinery and Equioment	9,704,319,300	9,704,319,300	9,704,319,300	9,704,319,300	9,704,319,300	9,704,319,300
...Less Depreciation	-	(858,000,000)	(889,000,000)	(921,000,000)	(952,000,000)	(984,000,000)
Total Fixed Assets	**13,993,008,330**	**13,135,008,330**	**13,104,008,330**	**13,072,008,330**	**13,041,008,330**	**13,009,008,330**
TOTAL ASSETS	**17,057,940,189**	**19,809,072,905**	**20,050,882,415**	**20,369,199,843**	**20,769,668,885**	**21,254,512,822**
FUNDING						
Debt	**-**	**19,809,072,905**	**20,050,882,415**	**20,369,199,843**	**20,769,668,885**	**21,254,512,822**
Outstanding Amount	14,499,249,161	14,499,249,161	14,499,249,161	14,499,249,161	14,499,249,161	14,499,249,161
	14,499,249,161	**14,499,249,161**	**14,499,249,161**	**14,499,249,161**	**14,499,249,161**	**14,499,249,161**
Equity						
Capital	2,558,691,028	2,558,691,028	2,558,691,028	2,558,691,028	2,558,691,028	2,558,691,028
Retained Earnings		2,751,132,716	2,992,942,226	3,311,259,654	3,711,728,696	4,196,572,633
Total Equity	**2,558,691,028**	**5,309,823,744**	**5,551,633,255**	**5,869,950,683**	**6,270,419,725**	**6,755,263,662**
TOTAL FUNDING	**17,057,940,189**	**19,809,072,905**	**20,050,882,415**	**20,369,199,843**	**20,769,668,885**	**21,254,512,822**

Table 12: Projected Cash Flow

	FY-2021	FY-2022	FY-2023	FY-2024	FY-2025	FY-2026	FY-2027
Revenues							
Service Charge - Storage, Handling, milling and Transport		1,200,000,000	1,215,840,000	1,247,938,176	1,297,356,528	1,365,856,952	1,456,003,511
Products- Milled Rice, By-produts (Bran, & Husk) Sales		40,028,000,000	40,556,369,600	41,627,057,757	43,275,489,245	45,560,435,077	48,567,423,792
COGS	-	34,000,000,000	34,448,800,000	35,358,248,320	36,758,434,953	38,699,280,319	41,253,432,820
	-	**7,228,000,000**	**7,323,409,600**	**7,516,747,613**	**7,814,410,819**	**8,227,011,710**	**8,769,994,483**
Expenses							
Fumigation	-	125,797,500	130,452,008	140,105,456	155,657,162	178,694,422	211,752,890
Salaries	-	55,972,938	58,043,937	62,339,188	69,258,838	79,509,146	94,218,338
Utilities - Electricity, Water	-	66,431,789	68,889,765	73,987,608	82,200,232	94,365,867	111,823,552
Administrative	-	16,957,500	17,584,928	18,886,212	20,982,582	24,088,004	28,544,284
Repair and Maintenance	-	291,130,179	301,901,996	324,242,743	360,233,688	413,548,274	490,054,704
Insurance	-	8,577,378	8,894,741	9,552,952	10,613,330	12,184,102	14,438,161
Depreciation		858,000,000	889,000,000	921,000,000	952,000,000	984,000,000	857,737,806
Other	-	100,000,000	103,700,000	111,373,800	123,736,292	142,049,263	168,328,377
		1,522,867,284	**1,578,467,374**	**1,661,487,959**	**1,774,682,123**	**1,928,439,077**	**1,976,898,112**
EBIT		**5,705,132,716**	**5,744,942,226**	**5,855,259,654**	**6,039,728,696**	**6,298,572,633**	**6,793,096,371**
CAPITAL EXPENDITURE	**(17,057,940,189)**						
NET CASH FLOW	**(17,057,940,189)**	**5,705,132,716**	**5,744,942,226**	**5,855,259,654**	**6,039,728,696**	**6,298,572,633**	**6,793,096,371**
CUMULATIVE CASH FLOW	(17,057,940,189)	(11,352,807,473)	(5,607,865,247)	247,394,408	6,287,123,104	12,585,695,737	19,378,792,108
NET PRESENT VALUE	**5,492,430,700**						
INTERNAL RATE OF RETURN	**16.13%**						
PAYBACK PERIOD (YEARS)	**5.6**						