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**FEASIBILITY STUDY**

**FOR**

**MANUFACTURE OF HEAVY CLAY PRODUCTS  
ROOFING TILES, BRICKS, SPLIT TILES, HOLLOW BLOCKS**

**FOR**

**KYELA VALLEY FOODS LTD.  
DAR-ES-SALAAM**

**SUBMITTED THROUGH**

**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION**

**MARCH 1998**

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*Backstop off. Ms. Yelanda*

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PROJECT SUMMARY

1. Product	: Heavy Clay Products such as Roofing Tiles, Bricks, Split Tiles, Hollow Blocks.			
2. Promoters	: Kyela Valley Foods Ltd. Dar-Es-Salaam.			
3. Production Capacity (Saleable output)	: Per Day Nos.	Per Day Tonnes	Per Annum Nos. (000)	Per Annum Tonnes
i) Roofing Tiles	15,100	41.0	5280	14250
ii) Ridge Tiles	850	3.4	296	1189
iii) Bricks, Split Tiles	5,700	16.9	1975	5920
iv) Hollow Blocks	650	6.8	225	2370
Total		----- 68.1 -----		----- 23729 -----
4. Share Capital	: 1.0 Million US Dollars			
5. Long Term Loans	: 3.504 Million US Dollars			
6. Total Project Cost	: 4.504 Million US Dollars			
7. Sales Turnover	: 3.024 Million US Dollars			
8. Interest Rate :				
Long Term	: 15%			
Short Term	: 25%			
9. Power Required	: 400 KW			
10. Employment Potential	: 123			
11. Return on Investment (5th year)	: 28%			
12. Payback Period	: 5.5 years			
13. Breakeven Value of Sales (4th year)	: 35%			
14. IRR	: 18%			
15. Project Implementation	: 18 months			

## INTRODUCTION

1. Kyela Valley Foods Ltd. established in 1991 is trading in Fertilisers. The company acquired Mbeya Ceramics Company Ltd. (MBECECO) a tableware manufacturing company at Mbeya which was set up with Swedish Assistance. The annual production capacity is about 120 Tonnes. Kyela Valley Ltd. intends to diversify into Electrical Insulators apart from the current products. For technical guidance, they approached United National Industrial Development Organisation (UNIDO).
2. As a UNIDO Consultant for the Insulator Project discussions were held with the promoters of Kyela Valley Foods Ltd. The Consultant also had earlier an opportunity to visit and discuss with Eastern & Southern African Mineral Resources Development Centre (ESAMRDC) Dar-Es-Salaam. From these discussions and visits to some industries, it is felt that Tanzania has excellent raw material resources which can be gainfully utilised for ceramic industries.
3. Housing needs of a society constitute among the basic needs of the developing countries. Tanzania with a population of 30 million requires considerable strengthening in the field. In Dar-Es-Salaam the largest city of the country has two Cement roofing Tile factories. The cement tiles are porous and absorb moisture during rainy season and cause high humidity. In the summer months they get heated causing discomfort to the occupants. Worldover Terra-Cotta tiles are

the most popular among the roofing materials. There are a number of buildings in Dar-Es-Salaam with roofing tiles of Terra-Cotta imported from India. In Tanzania there is no Terra-Cotta roofing Tile factory. During discussions Col.Kaisi, the promoter of Kyela Valley Foods felt that setting up a Tile Factory near Dar-Es-Salaam would open up the Tile Industry and will have excellent market potential.

4. In India in the Western Coast, there are over 100 Tile factories manufacturing Roofing Tiles. These factories produce upto 25000 Tiles per day. Tiles constitute 60% of the roofing materials world over. The Capital equipment for Tiles are being made in India.
5. For a plant of 25000 Tiles per day would require an investment of about 4 million US Dollars as against over 10 million with European equipment. The European plants are Capital intensive, automated and can produce excellent products. As against this, the Indian equipment would be of simple design. It was felt with Indian equipment of proven performance can be used in Tanzania. The consultant offered to prepare a project report using Indian equipment which Kyela Valley could consider for implementation.

## I. MARKET ANALYSIS

- 1.1 In Tanzania generally one can see two types of roofing. The high cost construction is of reinforced cement concrete Roof. For cheaper construction corrugated galvanized steel sheets are used. In some cases on the RCC roof cement tiles are also fixed.
- 1.2 No statistical information on the construction activities in and around Dar-Es-Salaam is available. However being a Capital city with about half a million population, a number of houses are being constructed every year. Because of the high cost of transportation, a tile factory can serve only an area of 150 Km around the factory. Since this would be a first venture in Dar-Es-Salaam, there would be certainly a good demand. Currently roofing tiles are being imported from India mainly from Gujarat. Because of the high cost involved in imports, the demand is limited. The countries in Asia and in Europe, the main roofing material is Terra-Cotta tiles. In India, it meets over 50% of housing construction and in the villages it would be over 70%. Hence roofing tile will certainly have an excellent prospects in Tanzania and also in other African countries.
- 1.3 In roofing, 14.1 Tiles are required to cover an area of one square meter. For a medium sized residential housing unit of 120-150 Sq.Meter of roof can be estimated. An annual requirement of 2000 tenements can be assumed for the proposed plant. The daily requirement would be for 7 tenements of 120-150 Sq.Meters roofing with 15000 Tiles.



1.4 A house of 100-150 Sq.Meters of floor area would also require about 12000 Bricks or 1500-2000 Hollow Blocks. As against this, the plant capacity is 6000 Bricks per day and 750 Hollow Blocks. The Split Tiles can be used for flooring. Alternately the factory can be designed exclusively for Roofing Tiles.

## II. MANUFACTURING PROCESS

2.1 The raw material for Bricks and Tiles are generally available in abundance. One or two types of clays containing natural fluxes are used in production without refinement. Prior to manufacturing it is important the clays are adequately aged and necessary homogeneity is achieved. An approximate composition is as follows :

SiO <sub>2</sub>	....	55-70%
Al <sub>2</sub> O <sub>3</sub>	....	20-25%
Fe <sub>2</sub> O <sub>3</sub>	....	upto 6%
K <sub>2</sub> O	....	upto 3%
MgO, Cao	....	< 1%

2.2 Clays from the localities where salts are found in traces should be avoided. Presence of salt can be detected by the formation of efflorescence on the sides of fresh excavations. The clays drawn from the tank beds, river estuaries normally meet the requirements. The raw materials are required to be plastic with firing temperature of 900-1000 C.

2.3 The required clays are available around Dar-Es-Salaam. The Kisarawe Brick Factory located about 15 KM from the city was established in the late eighties was in production for quite sometime. The raw materials used by them can be successfully utilised for roofing tile production.

The ideal time for collection of clays is after the rainy season when there is still good moisture is left. The clays are excavated by excavators and transported by trucks or Dumpers to the factory and stored in the factory premises and spread evenly so that homogeneity of material can be attained in storage and retrieval. In summer months it is advisable to keep the clay moist by spraying water on top. The clay is required to be further aged for about 7 days prior to taking for production. The final clay ageing can be done in an open shed.

2.4 The aged clay is charged to the Box-feeder which is about 5 meters long with adjustable Feed Conveyor capable of feeding 8-10 Tons per hour. The Box feeder controls the uniform feeding to the clay crusher. The material is conveyed through a Belt Conveyor. The clay crusher breaks and shreds the lumps of clay to uniform size while passing through the Cast Iron rollers (Size 600 X 500 mm). The Crushed clay is then conveyed to the 'Double Shaft Clay Mixer' with Rollers. The clays get further mixed and the lumps if any get crushed. The clay is then conveyed to the Fine Rollers where the clay gets formed into uniform thin layers. This finely ground clay is then separately processed for Tiles and Bricks.

2.5 For making Tiles, the clay is fed to a De-airing Pug Mill and blanks in suitable size are extruded. These extruded blanks are pressed in Tile Presses. These Tile Presses are made of Heavy Duty Cast Iron frame work with cam mechanism capable of producing 6-7000 Tiles per shift. Separate presses are used

for making Ridge Tiles. The pressed tiles in wet condition are supported by wooden pallets and conveyed to the Chamber Drier. Here the tiles are loaded on to the stillages for drying. The Dried tiles are then unloaded and conveyed to the Kiln Cars to be loaded to the Kilns. The Tunnel Kiln is fired by Furnace oil.

The manufacturing process can be seen at **Annexure 1**.

### III. CAPACITY BUILDUP & FACILITIES

3.1 The proposed plant is a composite factory to manufacture

- Roofing Tiles
- Bricks
- Split Tiles
- Hollow Blocks

3.2 The basic specification of the products is as follows :

Product	Dimensions	Fired weight
Clay Roofing Tiles	420 X 230 X 10 mm	2.7 Kg
Bricks	115 X 230 X 76 mm	3.0 Kg
Split Tiles	40 X 130 X 254 mm	2.8 Kg
Hollow Blocks	200 X 150 X 400 mm	10.5 Kg

The daily output proposed is 75 Tonnes of Kiln loading and the product mix is :

Product	% of Production	Saleable Output
Roofing & Ridge Tiles	65	I Class 90%
		II Class 5%
Bricks & Split Tiles	25	I Class 90%
		II Class 5%
Hollow Blocks	10	95%

3.3 The above product mix is not based on any market study and requires to be reviewed. Since the material preparation is common to these products a plant with all the allied products has been considered for the study. Another alternative that require full consideration is to make this plant exclusively

for roofing Tiles. However this would require changes in the equipment proposed. However in the total investment, there may not be a significant change.

3.4 The facilities proposed is on the basis of single shift production with 6 days per week working. A plant of this type can be easily worked in two shift basis. However plant capacity is limited to Kiln loading capacity. As the plant gains experience two shift working can be introduced which would help in bringing down the cost of production. In such a working system, the capacity of the Kiln will have to be kept in mind. The technology of manufacturing can be acquired easily. Hence high capacity utilisation can be achieved right from the beginning. It is assumed that in the first year of production, the Capacity Utilisation would be 70% followed by 90% and from the third year onwards it would be 95%. The Production Build up is given at Annexure 2.

3.5 The land requirement is about 10 acres which would be adequate for the proposed capacity. But to cater to future expansion a total area of about 15 acres is recommended. The land should have good access to a road so that material and the finished products can be transported.

3.6 The List of Equipment can be seen at Annexure 3. The price indicated are currently prevailing India. There are a few capital Equipment manufacturers for the Tile and Brick industry located in Mangalore, Calicut, Trichur, towns located in South India. Their machinery are working

satisfactorily in a number of small factories. It is suggested, the promoter of this plant visit some of the factories to ascertain the reliability prior to deciding on the source of equipment.

3.7 In India Tile factories use Hoffman Kilns. These are cheaper in construction and multi-fuel can be used. This aspect requires full consideration during the implementation of the project.

3.8 The manufacturing facilities can be divided into three sections for establishing sectional capacities and shift working.

They are :

- Material Preparation Section
- Press Shop/Extrusion Shop
- Drier and Kiln

3.9 The material preparation section consists of Box Feeder, Crusher, Double Shaft clay mixer and Fine roller. All these equipment will have capacity to process 10 Tons of material per hour. The extruder is a high capacity equipment and can extrude upto 60000 Tiles per shift and the twin screw Pug Mill can produce upto 10000 Bricks per shift. With these equipment it is possible to process 75 Tonnes in a single shift. Four Tile Presses are provided. Each can produce 6-7000 Tiles per shift.

3.10 A Chamber Drier with Hot air generator is proposed and Furnace oil Fired Tunnel Kiln is included in the capital equipment. Considering the high cost of Electric Power and

the fuel cost alternate drying system with Hoffman Kiln may required to be analysed during the project implementation. The high cost of fuel at Kisarawe Brick Factory and cost of Electricity at Mbeya ceramics are important indicators while deciding upon the fuel and type of Kiln for the project.

3.11 To support the production operations, the following facilities have been provided :

- i) A General Store
- ii) Material Handling Equipment
- iii) Electric Power System
- iv) Maintenance Workshop
- v) Fuel Oil Storage

3.12 While arriving at the requirements of the above, full rated production has been considered. The clay materials are stored in open yards. For other consummables, spares etc. a general store has been provided. The building for the general store will also accommodate the Diesel generator. For the clay movement an Excavator has been provided. The finished products can be handled on wooden pallets. A Fork lift Truck is included for moving the pallets. A van and transport truck are provided for general transportation.

3.13 The requirement of Electric Power has been estimated on the basis of power requirements for the Production Machinery and ancilliary equipment and general lightening. The total power requirement is 400 KW. (Refer Annexure 8). To keep the important production operations going during power break downs, it is recommended a Diesel generator of 200 KVA capacity may be provided.



A maintenance workshop would be required to attend to the breakdowns. This is essential considering the remote location of the plant. A financial provision of 25000 US Dollars with further miscellaneous provision of 20000 US Dollars is made for the workshop and the allied facilities. The details of the equipment can be decided during the detailed engineering stage. A fuel oil storage and pumping system is also included consistent with the supplies expected from the oil companies.

#### **Land & Buildings**

3.14 A typical plant layout is given at Annexure 19 and Production Shop Layout at Annexure 20. Space for storage (50 X 50M) is required for storing clay for long duration for ageing and homogenisation. Provision has been made for Roads and Paving the area for storage of finished products. Facing the main production buildings are the office block, stores, canteen and oil storage. The layout may require changes depending upon the site chosen for implementation.

#### IV. ORGANISATION & MANPOWER

- 4.1 The technology of Tile & Brick can be acquired by associating with an established tile manufacturer. The Collaborator's engineer will assist initially to establish the technology and operating parameters. The technicians are required to be trained in collaborator's work to get trained in shop practises, quality control etc. Once the technology and operating parameters are established, the manufacturing activities do not require high levels of skill.
- 4.2 The Head of the company will be a General Manager or the Managing Director who will be responsible for the running of the organisation. He will be assisted by two Managers. One will be incharge of production operations, maintenance of facilities and the final output and quality. He will be assisted by a Maintenance Engineer to look after the plant maintenance, including civil works, utilities, water supply etc. For the production activities a Supervisor for each will be incharge of Clay preparation, Press Shop, Kiln & Drying.
- 4.3 The Manager (Finance & Administration) will be responsible for purchases, stores and sales function. The proposed organisation can be seen at Annexure 17. The broad categories of manpower is as follows :

i) Managing Director/General Manager	1
ii) Managers	2
iii) Sectional Heads such as Engineer, Purchase officer, Personnel Officer, Sales officer	4
iv) Supervisory grade staff such as Shop Supervisors, Stores, Sales and Accounts Assistants	8
v) Skilled Workers Masons, Welders, Fitter, Turner, Generator operator, Kiln operators, Electrician, Drivers etc.	18
vi) Semi-skilled & Unskilled	90
	-----
Total	123
	-----

4.4 The details of Manpower requirements with the wage bill statement can be seen at Annexure 7.

The wage structure adopted is based on the discussions with Tanzanian engineers and generally prevailing in Tanzania. Provision for Leave salary, Provident fund, Bonus etc. has been made to the extent of 30% of the Wage bill.

## V. CAPITAL COST

5.1 The total Capital cost of the Project is 4.504 million US Dollars. For details Refer Annexure 5. This estimate comprises of the requirements of fixed assets such as Land, Site development, Buildings, Plant and Equipment and other costs involved in organising the project and the Margin money for the working capital. Briefly the outlay can be sub divided as follows :

	US Dollar in Thousands
Civil Works	1222
Plant and Equipment	2519
Projecting cost including interest on loans during construction	583
Margin money for working capital	180
Total	4504

### Civil Works

5.2 The factory is to be located near Dar-Es-Salaam. For an area of 10-15 acres a provision of US Dollars 25000 has been made. The size of the buildings and the rate of construction cost assumed is given at Annexure 4. A provision of 7.5% on the cost has been made to meet the fluctuations in cost and contingencies. The cost of construction has been assumed at 100-125000 Tanzania Shillings per Sq.Meter. (Exchange rate assumed is 600 Tsh Per US Dollar). This unit cost of construction is as prevailing in Tanzania.

## Plant & Equipment

5.3 The statement of Equipment can be seen at Annexure 3. While estimating the costs the following factors have been considered.

- The Equipment proposed is from Indian sources which have been functioning satisfactorily in Indian Tile and Brick industry.
- The Equipment are not of the same quality and Technology that are available in some of the leading Equipment manufacturers of Europe. As compared to the cost of these equipment the equipment proposed cost around 50% .
- There are not well established Tunnel Kiln and Drier manufacturers in India. In case of Hoffman Kiln is to be purchased the same can be sourced from India since it would be far cheaper.
- At the time of project implementation it is essential the performance of the equipment are checked for their reliability.
- The prices indicated are ex-factory prices and the other costs such as packing, transport, insurance, Port handling etc. have been provided for while arriving at the total capital cost.
- Some provision has been made in local currency to accommodate the total purchase where possible.
- The conversion rate for Tanzanian Shilling has been assumed at 600 Tsh per US Dollar.
- While estimating the cost, for major equipment prices have been checked with equipment manufacturers, wherever it is not possible to obtain, purchase prices have been estimated.
- Detailed specification of the equipment has not been furnished. This can be done during the implementation of the project. However the prices indicated can accommodate the specified product output.

## Projecting Cost

5.4 In establishing the project, following expenses have been grouped under 'Projecting Cost'.

- 1) Preliminary & Promotional Expenses
  - ii) Engineering Fee
  - iii) Project Establishment charges
  - iv) Interest on Capital held up during Construction period.

5.5 The details of the provision for the above can be seen at Annexure 5. A token provision of 20000 US Dollars has been made for the preliminary & promotional expenses.

5.6 Since Clay Tiles (Terra Cotta) are not made in Tanzania, it would be necessary to have a collaboration with an established manufacturer. A provision of US Dollars 40000 has been made for technology. It is felt it would be possible to identify a manufacturer who could assist in establishing the manufacturing process and offer facilities for training Tanzanian personnel. A provision of 6 man months has been made for collaborator's technicians to train the personnel in Tanzania and 4 man months for the Tanzanian technicians in India. A provision of 7 man months has also been made for assistance during erection and commissioning. A provision of 130000 US Dollars has been made for the technical assistance. For the Technical staff and the managerial personnel recruited during the construction stage, their travels and establishment a provision of 140000 US Dollars has been made. Interest on the loans during construction period is based on the project implementation schedule and phasing of capital expenditure. The interest on loan capital is based on the assumption that the share

capital would be spent initially. The ~~amount~~ on the loan capital has been worked out with an ~~interest~~ rate of 15%.

#### Project Implementation

- 5.7 In controlling the cost of the project ~~implementation~~ of the project in a time frame is an ~~important~~ criterion. Considering the Infra-structure available in Tanzania, and the need to import the complete plant ~~to be used~~ for implementation is assumed at 18 months. The ~~most~~ activities which would require long duration is ~~completion~~ of the main building and the construction of the ~~plant~~ Annexure 18 gives the Schedule of implementation ~~including~~ the important activities. For the success of the ~~project~~ the schedule is required to be closely monitored.

## VI. OPERATING RESULTS & FINANCIAL ANALYSIS

6.1 The Operating Costs are dependant on the following ~~are~~ required to be controlled in order to achieve success ~~in~~ venture. They are :

- Cost of Raw materials and other inputs
- Cost of Fuel, Power, Water and other Utilities
- Wages and other working capital requirements
- Selling price of the products
- Administrative and overhead expenses
- Cost of servicing the Long term loans.

6.2 The basic raw material is plastic clays. Since ~~the~~ proven clays available near Dar-Es-Salaam which were ~~in~~ the past by Kisarawe Brick factory, it is assumed ~~will~~ will be available at reasonable cost. The cost as ~~is~~ at the factory is assumed at 2500 Tanzanian Shilling ~~per~~ Ton. In India generally at 40% of this cost ~~is~~ available. This assumption on cost of clays is ~~required~~ to be checked. The production operations are based ~~on~~ assumed cost. The other consummables and ~~material~~ material requirements are assumed at 150000 US Dollar ~~per~~ annum. These costs are estimated at twice the ~~costs~~ costs in India for a comparable factory.

6.3 In the Roofing Tile Industry the raw material costs ~~are~~ for 10% of Production cost. As against this, the ~~cost~~ could vary between 20-30% depending upon the cost ~~of~~ the area. In this project cost of fuel comes to ~~50%~~



total cost. In India also the fuel oil cost is high. As such the Tile manufacturers are using either jungle wood or coal. Because of this fuel, most of the kilns in India are Hoffman type. This study is based on furnace oil. In Tanzania, the oil cost being very high an alternate fuel as in India may be considered with a techno-economic analysis. Normally for a Ton of finished product 0.3 to 0.4 Ton of wood is required depending upon the quality of firewood. The fuel consumption is assumed at the rate of 50 kg. per Ton of product and the cost of fuel oil is assumed at 370 Tsh per Ton.

- 6.4 The connected Electrical power of the project is 400 KW (Refer Annexure 8). It is estimated the monthly power requirement would be 100000 units. The Electrical power tariff is worked with the following assumption.

Cost of 1 KWH	: 64 Tsh
Per KVA	: 5700 Tsh/month
Reading Charges	: 4000 Tsh/month

Based on the above the cost of Power and utilities is estimated at 190000 US Dollars per year.

- 6.5 The maintenance cost is estimated at 3% of the capital cost for Equipment and 1% for the Civil structures.
- 6.6 The Working Capital requirement has been worked at Annexure 9. The total requirement comes to 723000 US Dollars. Of this, 25% (180,000 US Dollars) is to be borrowed as a part of Long Term Loan and the balance 543000 US Dollars is required to be

borrowed from commercial banks. The assumed interest rate for the working capital is 25% per annum. While calculating the working capital the holding period has been considered. The clay storage has been worked for 18 months this is to ensure ageing of clays which is a technological requirement.

6.7 The other main costs are Salaries, Wages and Administrative expenses and depreciation. The depreciation rate is assumed at 4% for buildings and 12.5% for capital equipment. These rates are generally practised in Tanzania. Depreciation is worked on the basis of written down value. The schedule of depreciation and written down value can be seen at Annexure 13

6.8 The Cost of Production is given at Annexure 11. It can be seen that the dominant cost is that of fuel oil. Hence selection of fuel and the type of Kiln to be installed require a very careful consideration. There is scope to bring down this cost which would improve the profitability of the venture.

#### Selling Price

6.9 Since the proposed products are not made in Tanzania, selling price is required to be estimated. The roofing tiles to a limited extent are being imported from India. The market price for a Roofing Tile is found to be between 350-400 Tsh per unit. The ridge tiles were sold at 700 Tsh each. Taking this selling price as a criterion and the price as prevailing in India were compared. A selling price between these two rates has been adopted in this report. The following statement gives the details.

	Unit	Unit	Unit	Price Assumed		
	Weight Kg	Price in India EqTsh	Price in Tanzania Tsh	Per Unit Tsh	Per Kg Tsh	Per Ton USDollar
Tile						
I Grade	2.7	110	350	250	92	153
II Grade	-	-	-	-	82	135
Ridge Tile						
I Grade	4	200	700	480	120	200
II Grade	-	150	-	400	100	167
Bricks	3.0	60	-	120	45	75
Split Tiles	2.8	65	-	150	45	75
Hollow Blocks	10.5	225	-	450	45	75

Based on the above pricing schedule production and sales value have been worked in Annexure 10.

#### Financing Pattern

6.10 The total cost of the project is 4.504 million US Dollars (Refer Annexure 5). Of this, excluding the interest on Long Term Loans during construction and margin money for working capital, the project cost comes to 4.062 million US Dollars (Refer Annexure 6). It is assumed that 25% of the cost can be taken as the share capital to be contributed by the promoters and the balance amount as Long Term Loan. The share capital is taken at 1.0 million US Dollars. The balance 3.504 Million will be the Long Term Loan. The interest on

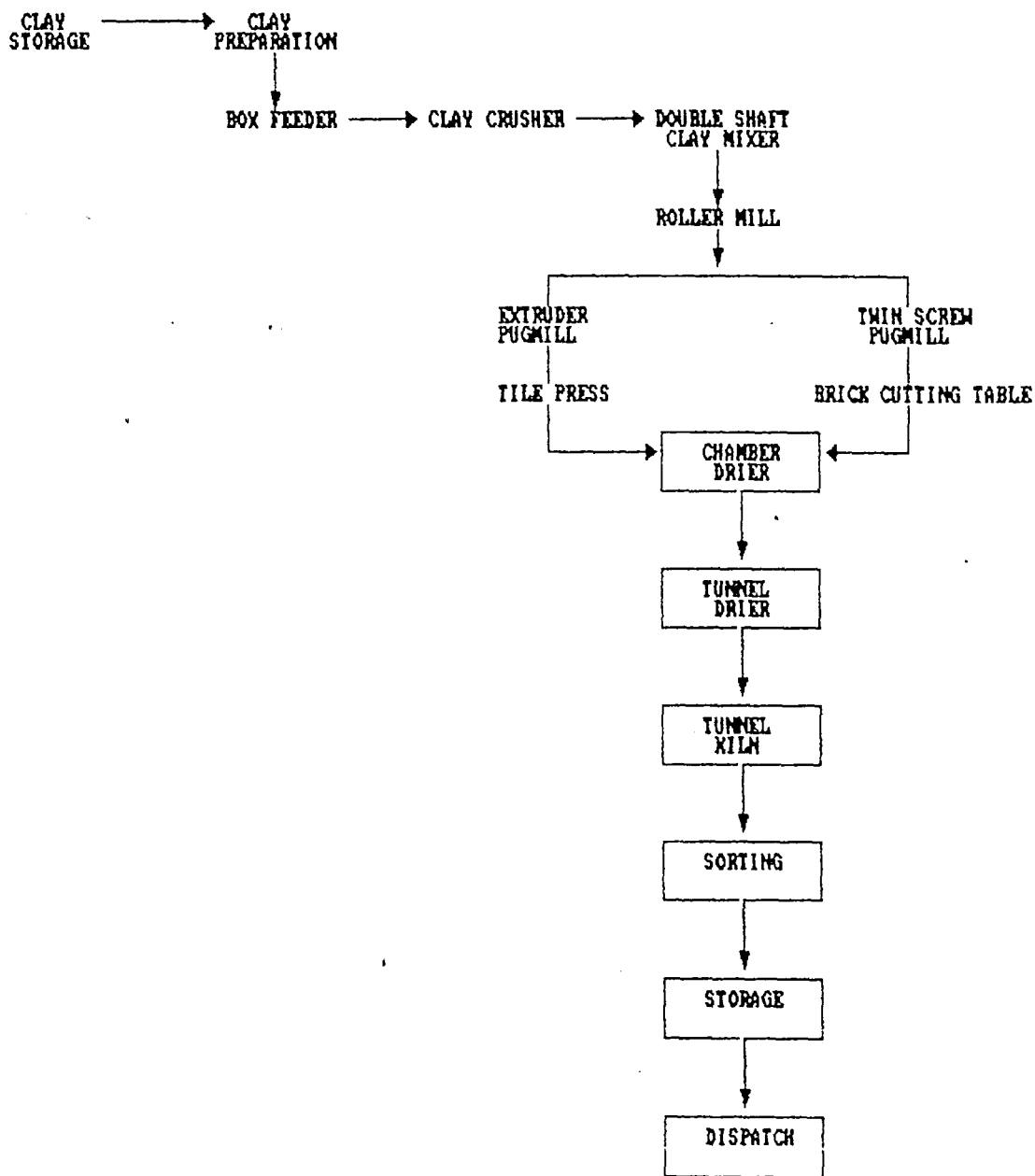
Long Term loan is worked at 15% per annum. For repayment of loans there would be moratorium of one year. The repayment schedule is worked out at Annexure 14.

#### Working Results

6.11 The Working results is given at Annexure 12. The results indicate that in the first year of working at 70% Capacity Utilisation there would be a profit to the extent of 326030 US Dollars before allowing for depreciation. The profitability is encouraging right from the start of operations. The Break even analysis at Annexure 15 indicates at 35% of the installed capacity in terms of sales turn over the company breaks even. The return on investment at Annexure 16 on the 5th year of operations is 28%. The payback period for the Term Loans is 5.5 years and the IRR a healthy 18%.

## **ANNEXURES**

ROOFING TILE & BRICK MANUFACTURING PROCESS



## PRODUCTION BUILD UP

## KYELA VALLEY TILE &amp; BRICK WORKS

Nos. in Thousand

Sl. No.	Item	I Year		II Year		III Year onward	
		Nos.(000)	Tons	Nos.(000)	Tons	Nos.(000)	Tons
	Capacity Utilisation		70%		90%		95%
1.	Roofing Tile						
	I Class	3675	9920	4725	12750	5000	13500
	II Class	210	550	260	710	280	750
	Total Tiles	3885	10470	4985	13460	5280	14250
2.	Ridge Tile						
	I Class	207	830	265	1060	280	1120
	II Class	13	49	15	60	16	60
	Total Ridge Tiles	220	879	280	1120	296	1180
3.	Bricks, Split Tiles	1450	4360	1870	5610	1975	5920
4.	Hollow Blocks	166	1745	215	2245	225	2370
	Total		17454		22435		23720

Kiln loading assumed 350 days in a year with a charge of 75 Tons per day.

## LIST OF EQUIPMENT

## KYELA VALLEY BRICK &amp; TILE WORKS

Price in US Dollars

Sl. No.	Equipment	Nos.	Local	Price in US Dollars	Total
I.	PRODUCTION				
1.	Box Feeder	1	-	20000	20000
2.	Clay Crusher	1	-	12500	12500
3.	Double Shaft Clay Mixer with Roller	1	-	15000	15000
4.	Fine Roller	2	-	30000	30000
5.	Extruder (De-Airing Pug Mill)	1	-	30000	30000
6.	Twin Screw Pug Mill	1	-	10000	10000
7.	Tile Press	4	-	40000	40000
8.	Ridge Press	1	-	5000	5000
9.	Hand operated Clay Cutting Machine	1	-	4000	4000
10.	Belt Conveyors	-	5000	25000	25000
11.	Tile Press Conveyor	-	-	1000	1000
12.	Tile Dies	8 sets	-	15000	15000
13.	Die for Ridge Tile	1	-	1000	1000
14.	Dies for Bricks	2 sets	-	2000	2000
15.	Accessories & Spare parts	-	-	10000	10000
16.	Wooden Pallets	65000	25000	25000	25000
17.	Drier Racks (Stillages)	300	25000	150000	150000
18.	Chamber Drier		25000	150000	150000
19.	Tunnel Kiln	1	50000	500000	500000



Sl. No.	Equipment	Nos.	Local	Foreign	Total
20.	Kiln Cars	50	-	200000	200000
21.	Fuel Oil Storage & Pumping system	-	-	15000	15000
Sub Total (I)		-	130000	1130500	1260500
II.	OTHER EQUIPMENT				
1.	Electrical Substation Transformer & Distribution system.	-	-	200000	200000
2.	Office Equipment	-	5000	-	5000
3.	Excavator/Loader	1	-	40000	40000
4.	Fork Lift Truck	1	-	20000	20000
5.	Pallets & Misc. Material Handling equipment	-	-	10000	10000
6.	Furniture, Store Racks, Safety, Fire fighting etc	-	10000	10000	20000
7.	Van	1	-	24000	24000
8.	Transport Truck	1	-	40000	40000
9.	Workshop Equipment	-	-	25000	25000
10.	Diesel Generator	1	-	75000	75000
11.	Miscellaneous Equipment	-	-	20000	20000
Sub Total (II)		-	15000	484000	479000

## ESTIMATE OF CIVIL WORKS

## KYELA VALLEY TILE &amp; BRICK WORKS

US Dollar = 600 Tsh

Sl. No.	Item	Quantity	Cost/Unit (000) TSH	Total Cost (000) TSH	Total Cost in US Dollars
1.	Land	10 Acres	-	15000	25000
2.	Fencing	-	-	5000	8400
3.	Roads, Paving Storage Area	-	-	15000	25000
4.	Water Supply System	-	-	9000	15000
5.	Security Shed	9 X 6 M	100 /Sq.M	5400	9000
6.	Office	12 X 9 M	120 /Sq.M	12960	21600
7.	Production Building	114 X 25 M 90 X 20 M	125 /Sq.M	581200	968750
8.	Canteen	12 X 9 M	100 /Sq.M	10800	18000
9.	Workshop	12 X 9 M	100 /Sq.M	10800	18000
10.	Store & Generator Room	20 X 9 M	100 /Sq.M	18000	30000
11.	Contingencies 7.5% on (2-10)	-	-	50112	83530
Total				733272	1222280

## CAPITAL COST ESTIMATE

KYELA VALLEY TILE &amp; BRICK WORKS

US Dollars

Sl. No.	Item	Estimated Cost			Total
		Local Currency		Imported	
		000 Tsh	US Dollars	US Dollars	
A.	Civil Works	733000	1222000	-	1222000
B.	Plant & Equipment				
B1.	Production Equipment	78000	130000	1130500	1260500
B2.	Other Equipment	9000	15000	464000	479000
B3.	Seaworthy Packing assumed at 7.5% for the imported Equipment.	-	-	119000	119000
B4.	Freight & Insurance assumed at 10% for the imported Equipment.	-	-	160000	160000
B5.	Port Handling and Transport to site assumed at 7.5% for the imported Equipment.	-	-	119000	119000
B6.	Cost of Transportation to site for the local equipment	9000	15000	-	15000
B7.	Erection & Commissioning including cost of foundation assumed at 8% of the cost.	7000	12000	127000	139000
B8.	Initial Spares (3%)	2600	4500	47500	52000
B9.	Contingencies & Unforeseen (10%)	9000	15000	160000	175000
	Total (B)	114600	191500	2327000	2518500

Sl. No.	Item	Estimated Cost			Total
		Local Currency	Imported		
		000 Tsh	US Dollars	US Dollars	
C.	Projecting Cost				
C1.	Preliminary, Promotional Expenses	12000	20000	-	20000
C2.	Engineering Fees 2.5% on Civil works	17500	29000	-	29000
	1% on Equipment	-	-	17000	17000
C3.	Technical Assistance for Erection/Commission and establishing technology.	-	-	125000	125000
C4.	Project establishment charges	78000	130000	-	130000
	Total (C)	107500	179000	142500	321000
D.	Interest during construction period.	157200	262000	-	262000
E.	Margin money for Working Capital.	108000	180000	-	180000
	Total (A+B+C+D+E)	1220300	2034500	2469500	4504000

## PHASING OF CAPITAL EXPENDITURE

## KYELA VALLEY TILE &amp; BRICK WORKS

US Dollars in Thousands

Sl. No.		First 3 months	3 - 6 months	6 - 9 months	9 - 12 months	12 - 15 months	15 - 18 months	Total
1.	Land	25.00	-	-	-	-	-	25.00
2.	Civil Works	-	200.00	520.00	450.00	27.00	-	1197.00
3.	Plant & Equipment	50.00	150.00	300.00	300.00	1200.00	519.00	2519.00
4.	Projecting Cost	30.00	40.00	45.00	30.00	80.00	96.00	321.00
	Total	105.00	390.00	865.00	780.00	1307.00	614.00	4062.00
I.	Financed from Share Capital	105.00	390.00	505.00	-	-	-	1000.00
II.	Financed from Long Term Loans	-	-	360.00	780.00	1307.00	614.00	3062.00
III.	Interest on Long Term loan during construction period.	-	-	13.50	42.50	91.50	114.50	262.00
IV.	Margin money for Working Capital	-	-	-	-	-	-	180.00
V.	Total Investment Required	-	-	-	-	-	-	4504.00
VI.	Total Loan to be raised	-	-	-	-	-	-	3504.00

MANPOWER REQUIREMENT & WAGE BILL

KYELA VALLEY TILE & BRICK WORKS

Sl. No.	Category	Nos.	Monthly Salary Tsh(000)	Annual Salary	
				Tsh (000)	In US Dollars
1.	General Manager	1	300	3600	6000
2.	Managers	2	250	6000	10000
	. Production				
	. Finance/Administration				
3.	Engineers/Section Heads	4	200	9600	16000
	. Purchase				
	. Sales				
	. Personnel				
	. Maintenance				
4.	Supervisors/Office Assistant	8	120	11520	19200
	. Accounts Assistant				
	. Stores Assistant				
	. Clay Preparation				
	. Press Shop				
	. Drying/Kiln				
	. Sales Assistant				
	. Maintenance				
	. Office Assistant				
5.	Skilled Workmen	18	50	10800	18000
	. Excavator Operator	1			
	. Mason	1			

Sl. No.	Category	Nos.	Monthly Salary Tsh(000)	Annual Salary	
				Tsh (000)	In US Dollars
6.	. Kiln Operators	3	45	48600	81000
	. Fitter, Welder, Turner etc.	6			
	. Generator Operator	3			
	. Electrician	2			
	. Drivers	2			
	Workmen	90			
	. Clay Preparation	8			
	. Manufacturing	6			
	. Press Operators	20			
	. Material Movement	4			
	. Kiln Car Loaders	12			
	. Kiln Helpers	6			
	. Kiln Unloaders	12			
. Misc. Shift relief	15				
. Security	6				
. Store	1				
Total		123	-	90120	150200
Social Benefits 30%		-	-	27036	45060
Total				117156	195260

## ELECTRICAL POWER REQUIREMENTS

## KYELA VALLEY TILE &amp; BRICK WORKS

S1. No.	Equipment	Nos.	Total Connected load KW
1.	Box feeder	1	6.0
2.	Clay Crusher	1	30.0
3.	Double Shaft clay Mixer with Roller	1	30.0
4.	Fine Roller	2	30.0
5.	Extruder / Pugmill	1	45.0
6.	Twin Screw Pugmill	1	15.0
7.	Tile Press	4	16.0
8.	Ridge Press	1	4.0
9.	Belt Conveyors	-	20.0
10.	Chamber Drier	-	90.0
11.	Tunnel Kiln	1	60.0
12.	Oil Heater	-	10.0
13.	Oil Pump	-	3.0
14.	Lights, Fans etc.	-	15.0
15.	Unforeseen and Miscellaneous	-	25.0
	Total		399.0
		(say)	400 KW



WORKING CAPITAL ESTIMATE  
(FOR STABLE YEAR OF PRODUCTION)

KYEVA VALLEY TILE & BRICK WORKS

Sl. No.	Category	Holding Period in months	Amount	
			Tsh(000)	US Dollars
1.	Clays	18	112500	187500
2.	Miscellaneous Stores, Consumable	1.5	5700	9500
3.	Maintenance Materials	3	5700	9500
4.	Power, Water, Utilities	1	9480	16000
5.	Fuel Oil	0.5	20200	34000
6.	Salaries, Wages	1	9750	16500
7.	Administrative Expenses	1	6000	10000
8.	Insurance	6	9000	15000
9.	Work in Progress & Finished Goods	1	135000	225000
10.	Accounts Receivables	1	120000	200000
	Total			723000
	Margin Money for Working Capital (25%)			180000
	Net Working Capital Requirement			543000

## PRODUCTION &amp; SALES VALUE

## KYELA VALLEY TILE &amp; BRICK WORKS

Nos. in Thousands

Sl. No.	Item	Price /Ton US Dollar	I Year		II Year		III Year onwards	
			Tons	USDollar Thousand	Tons.	USDollar Thousand	Tons.	USDollar Thousand
1.	Roofing Tile							
	I Class	153	9920	1518	12750	1951	13500	2065
	II Class	135	550	74	710	96	750	101
2.	Ridge Tile							
	I Class	200	830	166	1060	212	1125	225
	II Class	167	49	8	60	10	64	11
3.	Bricks, Split Tiles	75	4360	327	5610	421	5920	444
4.	Hollow Blocks	75	1745	131	2245	168	2370	178
	Total		17454	2224	22435	2858	23729	3024

## COST OF PRODUCTION

KYELA VALLEY TILE & <del>BRICK</del> WORKS		US Dollar in Thousand		
Sl. No.		I Year 70%	II Year 90%	III Year onward
1.	Raw Materials	87.50	112.50	119
2.	Misc. Consumables	52.50	67.50	71
3.	Power, Water & Utilities	133.00	171.00	180
4.	Fuel Oil	566.00	728.00	769
5.	Salaries, Wages	150.20	195.26	198
6.	Insurance	30.00	30.00	30
7.	Maintenance			
	i) Plant & Equipment (3%)	60.00	70.00	78
	ii) Civil Works	10.00	12.00	14
8.	Contingencies & Miscellaneous Factory Expenses	30.00	30.00	30
9.	Estimated Cost of Production	1119.20	1416.26	148

## ESTIMATE OF WORKING RESULTS

KYELA VALLEY TILE &amp; BRICK WORKS

US Dollar in Thousands

Sl. No.		I Year	II Year	III Year	IV Year	V Year	VI Year	VII Year
A.	Cost of Production	1119.20	1416.26	1486.26	1486.26	1486.26	1486.26	1486.26
B.	Administrative Expenses							
	i) Telephone / Fax / Postage	20.00	20.00	20.00	20.00	20.00	20.00	20.00
	ii) Office Supplies	15.00	15.00	15.00	15.00	15.00	15.00	15.00
	iii) Insurance, Taxes	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	iv) Travel & Conveyance	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	v) Miscellaneous	12.00	12.00	12.00	12.00	12.00	12.00	12.00
	Total ( B )	87.00	87.00	87.00	87.00	87.00	87.00	87.00
C.	Sales Expenses	30.00	30.00	30.00	30.00	30.00	30.00	30.00
D.	Total Cost of Production A+B+C	1236.62	1533.26	1603.26	1603.26	1603.26	1603.26	1603.26
E.	Value of Production	2224.00	2858.00	3024.00	3024.00	3024.00	3024.00	3024.00
F.	Gross Profit before Interest (F-D)	987.38	1324.74	1420.74	1420.74	1420.74	1420.74	1420.74
G.	Financial Expenses							
	i) Interest on Term Loans (15%)	525.60	525.60	435.60	315.60	165.60	-	-
	ii) Interest on Working Capital (25%)	135.75	135.75	135.75	135.75	135.75	135.75	135.75
	Total ( G )	661.35	661.35	571.35	451.35	301.35	135.75	135.75
H.	Depreciation	435.63	385.24	340.99	302.12	267.95	237.92	211.50
I.	Operating Profit ( F-G-H )	(109.58)	281.15	508.40	667.27	853.44	1047.07	1073.49

## SCHEDULE OF FIXED ASSETS, DEPRECIATION &amp; WRITTEN DOWN VALUE (WDV)

KYELA VALLEY TILE &amp; BRICK WORKS

US Dollar in Thousands

	Land	Buildings	Plant & M/c	Total
Cost of Acquisition	25.00	1197.00	3102.00	4324.00
I Year				
Depreciation	-	47.88	387.75	435.63
WDV	25.00	1149.12	2714.25	3888.37
II Year				
Depreciation	-	45.96	339.28	385.24
WDV	25.00	1103.16	2374.97	3503.13
III Year				
Depreciation	-	44.12	296.87	340.99
WDV	25.00	1059.04	2078.10	3162.14
IV Year				
Depreciation	-	42.36	259.76	302.12
WDV	25.00	1016.68	1818.34	2860.02
V Year				
Depreciation	-	40.66	227.29	267.95
WDV	25.00	976.02	1591.05	2592.07
VI Year				
Depreciation	-	39.04	198.88	237.92
WDV	25.00	936.98	1392.17	2354.15
VII Year				
Depreciation	-	37.48	174.02	211.50
WDV	25.00	899.50	1218.15	2142.65
VIII Year				
Depreciation	-	35.98	152.27	188.25
WDV	25.00	863.52	1065.88	1954.40
IX Year				
Depreciation	-	34.54	133.23	167.77
WDV	25.00	828.98	932.65	1786.63
X Year				
Depreciation	-	33.16	116.58	149.74
WDV	25.00	795.82	816.07	1636.89

## REPAYMENT SCHEDULE OF TERM LOAN

KYELA VALLEY TILE & BRICK WORKS		US Dollar in Thousands				
	I Year	II Year	III Year	IV Year	V Year	
A. Loan	3504.00	3504.00	2904.00	2104.00	1104.00	
Interest Payable	661.35	661.35	571.35	451.35	301.35	
<b>Total (A)</b>	<b>4185.35</b>	<b>4185.35</b>	<b>3475.35</b>	<b>2555.35</b>	<b>1405.35</b>	
B. Interest Paid	661.35	661.35	571.35	451.35	301.35	
Loan Instalment Paid	-	600.00	800.00	1000.00	1104.00	
<b>Total (B)</b>	<b>661.35</b>	<b>1261.35</b>	<b>1371.35</b>	<b>1451.35</b>	<b>1405.35</b>	
Closing Balance	3504.00	2904.00	2104.00	1104.00	-	

## BREAKEVEN ANALYSIS

Figs. in US Dollar Thousands

Sales on Stable Year of Production	-	3024
Less Variable Cost		
i) Material	-	190.00
ii) Fuel, Power, Water etc.	-	949.00
iii) Wages	-	100.00
iv) 50% of Maintenance cost	-	46.00
v) Contingencies, Miscellaneous Factory Expenses	-	30.00
vi) Sales Expenses	-	30.00
vii) Interest on Working Capital	-	135.75
Total (i to vii)	-	1480.75
Contribution (3024-1480.75)		1543.25
Profit Volume Ratio	=	$\frac{\text{Contribution}}{\text{Sales}}$
	=	$\frac{1543.25}{3024}$
	=	0.51
Fixed Cost		
i) Salaries	-	50.00
ii) Insurance	-	30.00
iii) 50% Maintenance Cost	-	46.00
iv) 60% of Miscellaneous Factory Expenses	-	18.00
v) Administrative Expenses	-	87.00
vi) Depreciation (IV year)	-	302.12
Total (i to vi)		533.12
Breakeven Sales	=	$\frac{\text{Fixed Cost}}{\text{Profit Volume Ratio}}$
	=	$\frac{533.12}{0.51}$
	=	1045
Breakeven Level	=	$\frac{1045}{3024}$
	=	35%

## RETURN ON INVESTMENT &amp; PAYBACK PERIOD

Figs. in US Dollars Thousands

## 1. Return on Investment

$$\begin{aligned}
 \text{ROI (V Year )} &= \frac{\text{Earning before Long Term Loan Interest}}{\text{Cost of the Project}} \\
 &= \frac{1255.14}{4504} \\
 &= 28\%
 \end{aligned}$$

## 2. Pay Back Period

Total Project Cost : 4504

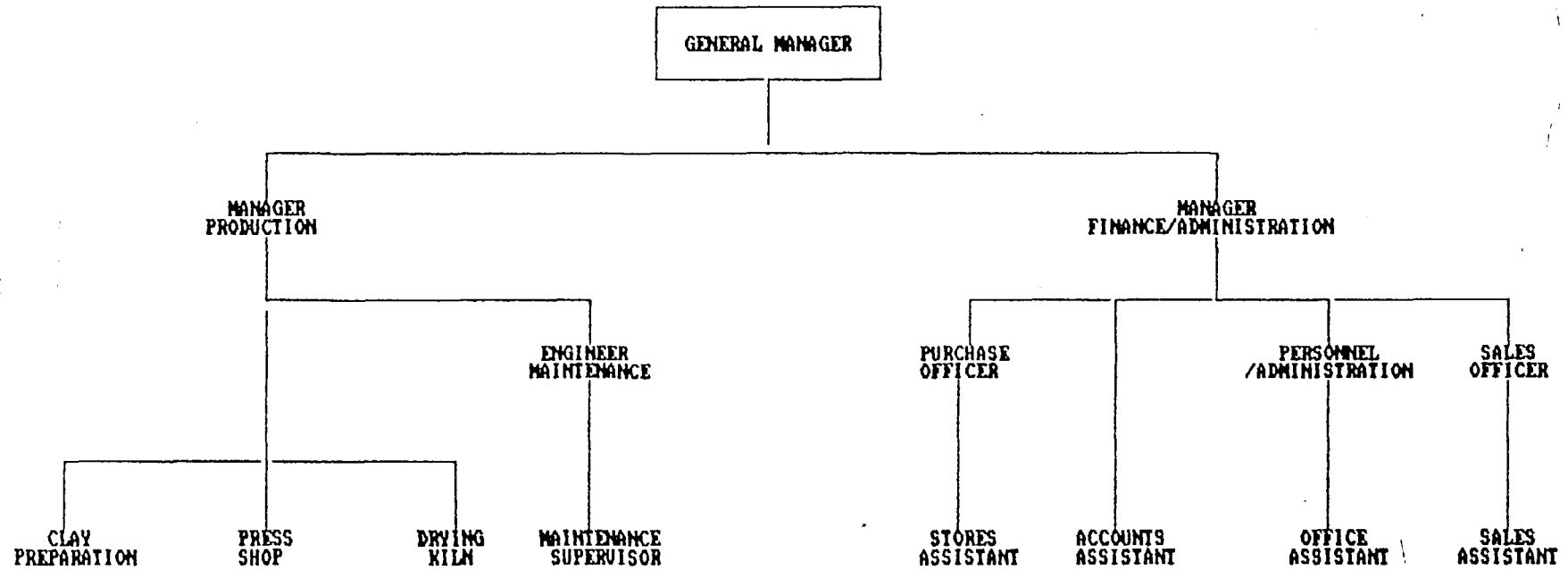
Profit Before Depreciation

		Cumulative
I Year	326.03	326.03
II Year	666.39	992.42
III Year	849.39	1841.81
IV Year	969.39	2811.20
V Year	1121.39	3932.59
VI Year	1284.99	5217.58

$$\text{Pay Back Period} = 5.5 \text{ years}$$



ORGANISATION CHART



— 41 —

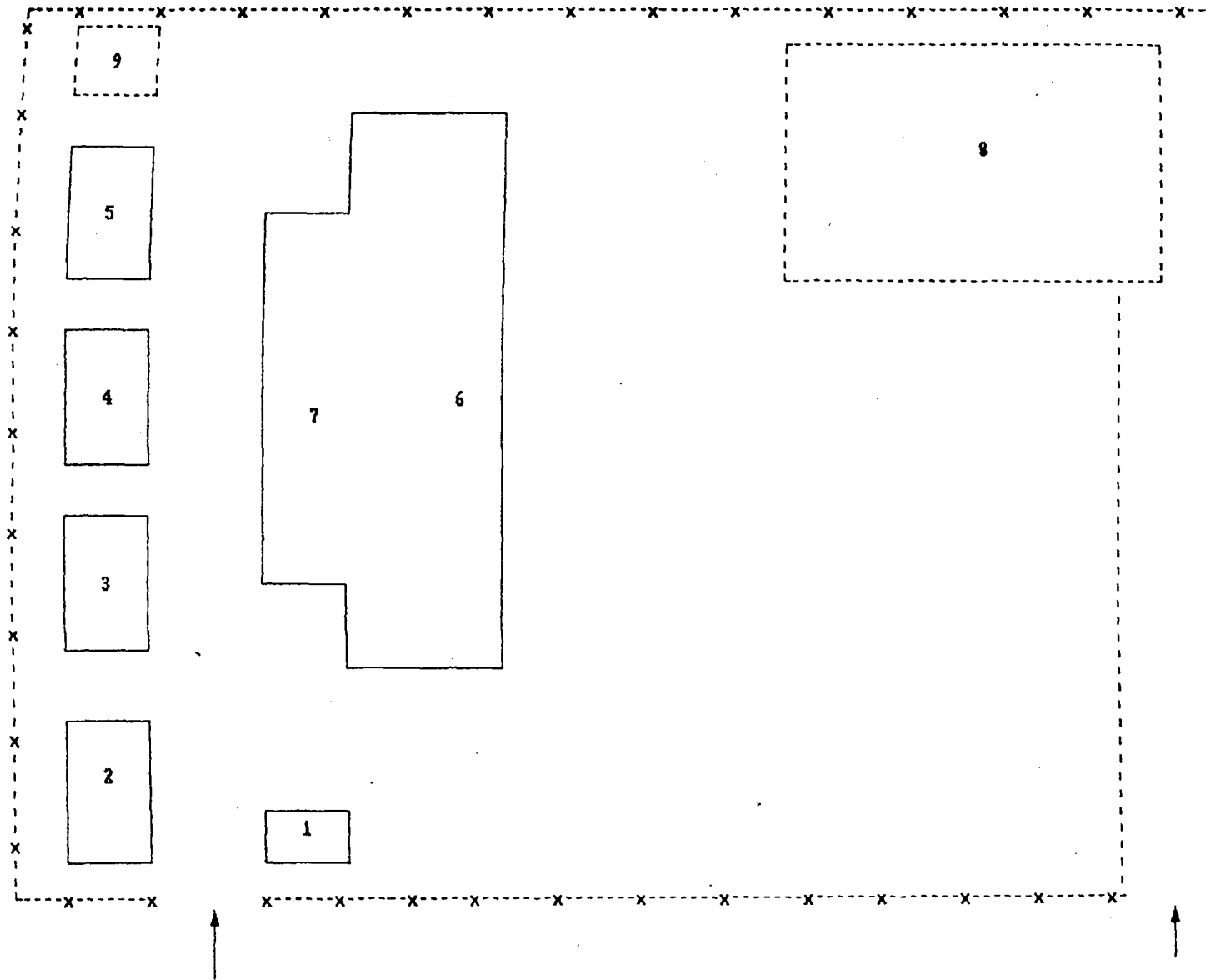
GENERAL MANAGER	1
MANAGERS	2
ENGINEERS/OFFICERS	4
ASSISTANTS/SUPERVISORS	8
SKILLED WORKMEN	18
WORKMEN	90

## SCHEDULE OF IMPLEMENTATION

## KYELA VALLEY TILE &amp; BRICK WORKS

in months

Sl. No.	Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.	Land Acquisition / Development	.....																	
2.	Design & Engineering		.....																
3.	Civil Works			.....															
4.	Electrical & Other Services									.....									
5.	Ordering Equipment			.....															
6.	Receipt of Equipment												.....						
7.	Kiln Construction										.....								
8.	Drier Construction												.....						
9.	Erection, Commissioning													.....					
10.	Raw Material Stock										.....								
11.	Recruitment, Training		.....					.....					.....				.....		
12.	Production & Commercial Operations																		.....



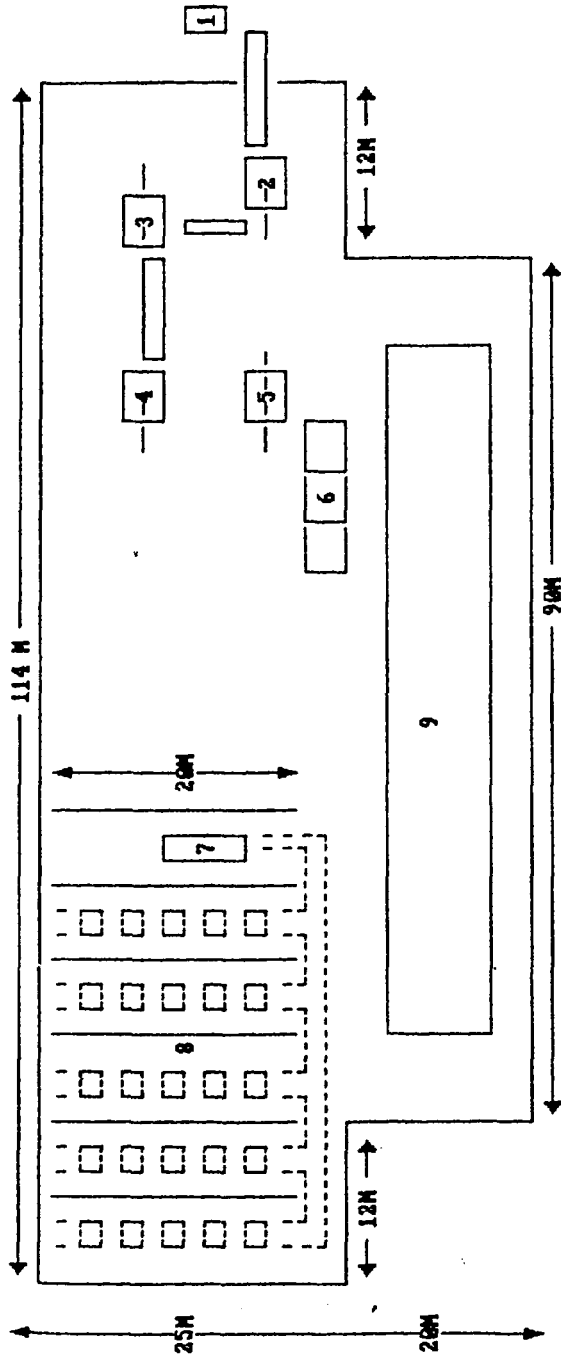
**BUILDING SIZE**

IN METERS

- 1. SECURITY : 12 X 6
- 2. OFFICE BLOCK : 12 X 9
- 3. CANTEEN : 12 X 9
- 4. WORKSHOP : 12 X 9
- 5. STORES GENERATOR : 30 X 9
- 6. PRODUCTION : 114 X 25
- 7. KILN : 90 X 25
- 8. RAW MATERIAL STORAGE
- 9. OIL STORAGE

**TYPICAL GENERAL LAYOUT  
KYEVA VALLEY BRICK & TILE WORKS  
(NOT TO SCALE)**

- 1. BOX FEEDER
- 2. CRUSHER
- 3. CLAY MIXER/ROLLER
- 4. FINE ROLLER
- 5. EXTRUDER
- 6. TILE PRESS
- 7. HOT AIR GENERATOR
- 8. DRIER
- 9. KILN



**PRODUCTION SHOP LAYOUT**

(NOT TO SCALE)

## DISCOUNTED CASH FLOW &amp; IRR

## KYELA VALLEY TILE &amp; BRICK WORKS

Year	Capital Outlay	Total Inflow			Present Value Factor 18%	
		Operating Profit	Depreciation	Total	Factor	Value
0	4324					
1		(109.58)	435.63	326.05	0.8475	276
2		281.15	385.24	666.39	0.7182	479
3		508.40	340.99	849.39	0.6086	517
4		667.27	302.12	969.39	0.5158	500
5		853.44	267.95	1121.39	0.4371	490
6		1047.07	237.92	1284.99	0.3704	476
7		1073.49	211.50	1284.99	0.3139	403
8		1096.74	188.25	1284.99	0.2660	342
9		1117.22	167.77	1284.99	0.2255	290
10		1135.25	149.74	1284.99	0.1911	246
11		1151.16	133.83	1284.99	0.1619	208
12		1165.17	119.82	1284.99	0.1372	176
	4324					4403

## COST STRUCTURE OF THE PRODUCT

KYELA VALLEY TILE &amp; BRICK WORKS

Price in T.sh.

	PER KG.				PER UNIT			
	Roof Tile	Brick	Split Tile	Hollow Blk.	Roof Tile	Brick	Split Tile	Hollow Blk.
Weight in Kg.					2.7	3.0	2.8	10.5
I. Selling Price	92	45	45	42	250	120	150	450
II. Cost of Production								
i) Raw Materials & Consumables	5.00				13.50			
ii) Power, Utilities	4.60				12.50			
iii) Fuel Oil	19.50				53.00			
iv) Wages	5.00				13.50			
v) Maintenance	2.50				7.00			
vi) Others	1.60				4.50			
Total Cost of Production	38.20				104			
III. Administration & Selling	3.00				8.10			
IV. Financial Charges								
III Year	14.50				39.15			
IV Year	11.45				30.90			
V. Depreciation								
III Year	8.65				23.35			
IV Year	7.65				20.65			