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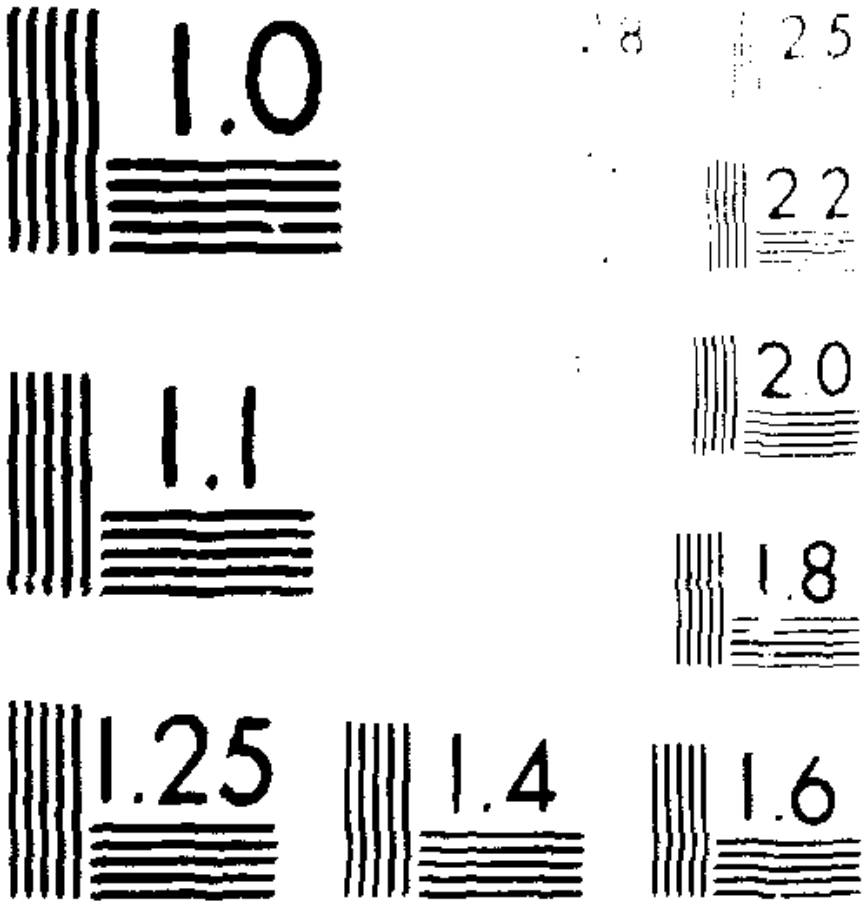
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org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15 August - 16 November 1982

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Suriname.

ESTABLISHMENT OF CERAMIC TILE PLANT.

DP/SUR/82/001

FEASIBILITY STUDY

Prepared for the Government of Suriname by the United Nations Industrial Development Organization, the executing agency of the United Nations Development Programme

Based on the work of

Josef Müller, UNIDO Technical Assistance Expert and Staff Member of the UNIDO-Czechoslovakia Joint Programme, Pilsen

Special consultant: Zdeněk A. Engelthaler, UNIDO Technical Assistance Expert and Chief Executive of the UNIDO-Czechoslovakia Joint Programme, Pilsen

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION VIENNA

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Mr. Ir R. H. Goossen, Director, Ministry of Natural Resources and Energy

Mr. E. Kasimbeg, Project Officer, Ministry of Natural Resources and Energy

Drs. L. de Rooy, Head of the Geological and Mining Services

Mr. Dr. E. Dahlberg, Advisor, Ministry of Natural Resources and Energy

Mr. Ing. R. Mahabir, UNDP Liaison Officer, Planning Bureau

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1.1.1. Promoter

Ministerie van Natuurlijke Hulpbronnen en Energie, Paramaribo - Suriname

1.1.2. Project orientation

To utilize large deposits of good quality non-metallic minerals in Suriname, the Suriname Government has decided that the priority will be paid to the establishment of a ceramic plant producing wall and floor tiles with orientation on the home market and possible exports. This project is characterized by import savings, job creation and profitability.

1.1.3. Project background

During 1980 - 1982, extensive technological tests were conducted to evaluate the possibility of the industrial development of Suriname deposits of kaolins, clays, kyanites and glass sands for their possible exploitation in the wall and floor tile manufacture, production of refractories, glass making and paper making plants.

The tests conducted by the UNIDO-Czechoslovakia Joint Programme for International Co-operation in the Field of Ceramics, Building Materials and Non-metallic Minerals Based Industries in Pilsen have proved that the raw kaolin from Onverdacht deposit can be used in the manufacture of ceramic wall and floor tiles provided that the proper technology is established. The type of body composition is lime-siliceous one. The technology

is based on wet grinding, drying in the atomizer, pressing and double firing system.

1.2. Market and Plant Capacity

1.2.1. Domestic market

The local demand for floor and wall tiles has been assessed to fluctuate between 90,000 sq.m. and 120,000 sq.m. of wall and floor tiles annually, from that 65 % are wall tiles and 35 % floor tiles.

1.2.2. Export market

Only the countries of North America have been taken into account and annual imports into this region estimated to be at least 30 mil. sq.m. wall and floor tiles annually.

1.2.3. Production programme

The ceramic wall and floor tile plant will produce after reaching the projected capacity 160,000 sq.m. of glazed wall and floor tiles, from that:

1,000 sq.m.	Home sales	Export	Total
undecor. wall tiles	50	7	57
decor. wall tiles	10	38	48
undecor. floor tiles	25	4	29
decor. floor tiles	5	21	26
TOTAL	90	70	160

1.2.4. Plant capacity

Two variants of plant capacity have been compared from the point of view of profitability (Annex 1). The variant of a plant producing 160 thousand sq.m. annually is more economical one than the variant of a plant of 90,000 sq.m. annual capacity.

1.3. Materials and Inputs

1.3.1. Raw materials

Item	kg/sq.m.	ton/year	annual cost 1,000 Sf.
Raw kaolin	4.75	760	31
Plastic clay	2.4	380	6
Silica sand	6.25	1,000	10
Limestone	2.35	375	131
TOTAL COST			178

1.3.2. Glazes and stains

Item	kg/sq.m.	ton/year	annual cost 1,000 Sf.
Frits	0.9	143	243
Stains	0.04	6	116
Zircon silicate		4	5
TOTAL COST			364

1.3.3. Auxiliary materials (annual costs)

Packaging material	160,000 Sf.
Spare parts	105,000 Sf.
Other auxiliary materials such as lubricants, saggers, silex linings, pebbles	60,000 Sf.

1.3.4. Utilities (annual costs)

Water 1,500 cu.m.	-	2,000 Sf.
Electric power 850 MWh	-	210,000 Sf.
Light oil 625 ton		344,000 Sf.

1.3.5. Availability of raw materials and inputs

Raw kaolin, plastic clay and silica sand are available locally. Glazes, stains, packaging material, limestone+/ and auxiliary materials will have to be imported. Utilities are available from the governmental grid systems in Onverdacht locality.

+/Note: Trials are being made to substitute the imported limestone (350 Sf. SIF per ton) by locally available shells (60 - 90 Sf. per ton).

1.4. Location and Site

The plant will be situated in Onverdacht. This location is optimal from the point of view of availability of raw materials, manpower and utilities.

1.5. Project Engineering

1.5.1. Lay-out

The raw materials will be taken from the stock, weighed and ground in the ball mills. The prepared slip will be

stored and pumped to the atomizer for spray drying and the dried powder will be stored in tanks. The dry clay will then be pressed and the pressed tiles will be loaded for drying in the tunnel drier. After being dried, the tiles will be pushed into the bisque firing channel of the double channel kiln. The fired bisque will be glazed and put into the glost firing channel of the same kiln.

The finished wall and floor tiles will be sorted, packed and shipped.

1.5.2. Selected technology

The production is based on the lime-siliceous body composition which is favourable as far as energy conservation is concerned. The body does not shrink during drying and firing and neither sizing nor calibration of bisque tiles is necessary. The applied technology is that of the wet grinding, spray drying and double firing. This technology is the most modern in the ceramic tile making. The acquisition of the technology costs 160,000 Sf.

1.5.3. Production equipment

According to the lay-out, there will be the following production sections in the plant:

	CIF price of the necessary equipment
- body slip preparation	500,000 Sf.
- powder preparation	580,000 Sf.
- pressing	520,000 Sf.
- drying and firing	1,063,000 Sf.
- glaze preparation	259,000 Sf.
- glazing	310,000 Sf.
- sorting	46,000 Sf.

The total costs of the manufacturing equipment will amount to 3,218,000 Sf.

1.5.4. Auxiliary plant

The auxiliary plant comprises:

- technological laboratory	123,000 Sf.
- transport centre	200,000 Sf.
- electric and water installation	700,000 Sf.
- metallic structures	210,000 Sf.
- other auxiliary equipment	200,000 Sf.

The complete auxiliary plant will cost 1,433,000 Sf.

1.5.5. Service equipment

- office furniture and equipment	200,000 Sf.
- other services	50,000 Sf.
Total	250,000 Sf.

The cost of the total equipment including the primary stock of spare parts (105,000 Sf.) will be 5,066,000 Sf.

1.5.6. Civil engineering works

Land necessary for buildings and handling raw materials is 15,000 sq.m. This surface is sufficient as the built-up area is 3,200 sq.m.

- The site preparation will cost 330,000 Sf. and will comprise all the necessary indoor works such as roads, fence, etc.
- The factory hall will cost 1,007,000 Sf.
- The necessary outdoor works will cost 500,000 Sf. and will comprise the construction of an access road, communication system and distribution of utilities.

The total costs in the civil engineering works amount to 1,837,000 Sf.

1.6. Plant Organization and Overhead Costs

1.6.1. Production

The production of wall and floor tiles runs through three principal departments, each of them under supervision of a qualified supervisor. They are as follows:

- Green tile preparation department which comprises the body slip preparation, pressing powder preparation and tile pressing.
- Kiln department which comprises the drying of the pressed tiles and both the bisque firing and glost firing of the glazed tiles.
- Glazing and selection department which comprises the glaze preparation, glazing, sorting and storing of the finished products.

1.6.2. Services

The most important section is the maintenance workshop which is under supervision. Other services are transport centre, security of the plant and cleaning.

1.6.3. Overhead costs

Item	1,000 Sf.	
	factory over.	administrative over.
wages, salaries	226	307
material	190	-
other overheads	43	60
s u b t o t a l	459	367
depreciation	-	755
TOTAL	459	1,122

1.7. Manpower

1.7.1. Labour force

supervisors	4	
skilled labour	24	
semiskilled labour	22	
unskilled labour	6	
TOTAL - workers	56	
TOTAL - wages	706	thousand Sf. including surcharges

1.7.2. Staff

general manager	1	
production manager	1	
sales manager	1	
chief accountant	1	
bookkeeper	1	
salesman	2	
technologist	1	
lab. technician	1	
designer	1	
clerk	3	
TOTAL - staff	13	
TOTAL - salaries	307	thousand Sf. including surcharges

1.8. Implementation Scheduling

1.8.1. Duration of plant construction

- setting-up the corporation management and preparation to choose the equipment suppliers; 2 months
- the supply of the production equipment; 10 months
- the detailed engineering; 2 months

- the choice of a building constructor, site preparation and building construction; 8 months
- the erection of the equipment; 3 months
- the trial run; 3 months

The implementation of the ceramic plant will take 18 months.

1.8.2. Duration of start-up

The start-up period will take two and half year from the start-up till full capacity is reached.
It is supposed that plant will produce at

- 60 % capacity during 6 months
- 80 % capacity during the following 12 months
- 90 % capacity during the last year of the start-up.

This start-up period can be shortened and full capacity can be reached within the first year of operation provided the management and the technical staff is trained.

1.9. Financial and Economic Evaluation

1.9.1. Total investment costs

- land	45,000 Sf.
- site preparation	330,000 Sf.
- buildings	1,007,000 Sf.
- outdoor works	500,000 Sf.
- technology	160,000 Sf.
- equipment	5,066,000 Sf.
- implementation	1,106,000 Sf.
- working capital	942,000 Sf.
Total costs in investment	9,156,000 Sf.

1.9.2. Project financing

The project will be partially financed by equity and long term loans:

- equity will be raised from the promoter's and collaborators' resources (60 % from the investment outlay)
- long term loan, 5 years, will be negotiated with the Nationale Ontwikkelings Bank Paramaribo. 3.5 mil. Sf. is the optimal amount from the point of view of the net present value and risks of insolvency.

1.9.3. Manufacturing costs	/thousand Sf./
- direct material	1,236
- direct labour	480
- factory overhead costs	459
- wages	226
- material	190
- other overheads	43
- administrative overhead costs	367
- salaries	307
- other administrative overheads	60
- distribution costs	71
- operating costs	2,613
- financial costs	186
- depreciation	755
Manufacturing costs	3,554
Sales revenues	5,075

1.9.4. Financial evaluation

- net present value (20 % factor) amounts to 626 th. Sf.
- internal rate of return - 23.22 %

- payback period 6 years and 2 months
- simple rate of return (on equity) 29.1 %
- break even point 86,100 sq.m. or 53.8 % capacity
- sensitivity analysis
  a) B.E.P. 111,800 sq. m. (69.9 % capacity) if prices of exported products are cut off by 30%
  b) B.E.P. 91,100 sq. m. (56.9 % capacity) if variable costs increase by 10 %
  c) B.E.P. 94,700 sq.m. (59.2 % capacity) if fixed costs increase by 10%
  d) B.E.P. 132,400 sq.m. (82.7 % capacity) if prices of exported products are cut off by 30% and costs increase by 10%
- job creation - 132,600 Sf. of investment per 1 job
- foreign currency savings - 3.9 mil. Sf. annually
- value added amounts to 3.6 mil. Sf. annually.

1.10. Conclusions and Recommendations

1.10.1. The establishment of the ceramic tile plant in Suriname is a profitable venture as showing high enterpreneurial profit as well as positive influence to the national economy of Suriname.

1.10.2. To establish the corporation which will start as soon as possible negotiating all necessary administrative steps to start the activities of the corporation.

1.10.3. After the corporation is established, the following steps are to be taken:
- to contract the supply of the technological equipment from the chosen company
- to request the detailed engineering drawings from the supplier of the technological equipment

- to select the domestic supplier of building construction and start the realization
- to select the suppliers of auxiliary equipment and order necessary amounts of raw materials and inputs for the trial run and the first period of start-up.

1.10.4. To arrange for training local staff with the supplier of the equipment and apply to UNIDO Vienna through UNDP Port of Spain for training the managerial staff.

1.10.5. To arrange for local ceramic raw materials deliveries to the supplier of the production equipment to conduct the verification tests with regard to the production equipment.

1.10.6. To continue the evaluation of other local non-metallic raw materials as a basis for a future extension of the plant.

1.10.7. To open negotiations with Messrs. P on supplies of Onverdacht kaolin and clays.

1.10.8. Since local consumption of wall and floor tiles will be saturated in the second year of operation, to open negotiations for foreign marketing in course of the first year of the operation.

1.10.9. To negotiate with suppliers of the production equipment the supply of the oil fired kiln.

1.10.10 If any trouble shootings during the assembling of the plant or during its trial run occur, to apply to UNIDO Vienna for technical assistance.

2. PROJECT BACKGROUND AND HISTORY

2.1. Project Background

The establishment of the new ceramic tile plant is based on the following findings:

- There are large deposits of raw kaolin,plastic clays and silica sands in Suriname. These raw materials are very easily accessible.
- There is a large import of tiling materials in Suriname and North America. There are only few countries in America producing ceramic tiles.
- There is available manpower for industrial development in Suriname.

Consequently, the Suriname Government gave priority to the establishment of wall and floor tile manufacturing in Suriname.
The production plant will be based on the deposits of raw kaolins, clays and siliceous sands in Onverdacht.
The local demand for wall and floor tiles is estimated to fluctuate between 90,000 sq.m. and 120,000 sq.m. There are also good possibilities for export to other American countries and consequently, the annual production 160,000 sq.m. will be sold.
The plant will be located in Onverdacht which is close to the raw materials deposits and which is close to Paramaribo. It is connected with Paramaribo by bus transport and all weather roads.
The implementation of the plant takes 18 months and the production will start in mid 1984.

Due to the Government efforts to promote the industrial development of Suriname, there are very good conditions for investments into new establishments, especially into industrial sector exploiting local raw materials. The financial resources are also available within the scope of this project in Suriname.

2.2. Project Promoter

- Ministerie van Natuurlijke Hulpbronnen en Energie
  (Ministry of Natural Resources and Energy)
  Paramaribo - Suriname, P. O.Box 856

2.3 Project History

Mr. R. A. Cambridge, former director of the Geological and Mining Service, Paramaribo, arranged for a shipment of selected clays, glass sand and kaolin samples to the UNIDO-Czechoslovakia Joint Programme for International Co-operation in the Field of Ceramics, Building Materials and Non-metallic Minerals Based Industries, Pilsen, late in 1979 asking their quality evaluation with recommendations for possible future industrial exploitation. As results obtained were encouraging, the Suriname Government sent a nominee to participate in the In-plant Technical Workshop (Industrial Exploitation of Non-metallic Minerals) in Pilsen in 1980. During this opportunity, further development of non-metallics in Suriname was deeply negotiated.

Further semi-industrial tests of local Suriname kaolin from the deposits Onverdacht and Moengo were made on the industrial scale and proved excellent results. The application of Surinamo kyanite in the refractory industry was evaluated. The following reports show more details.

(a) Raw Materials from Suriname, UNIDO-Czechoslovakia Joint Programme, Pilsen, June 1980, Ref. No. 45/80
(b) Suriname Kaolins and Industrial Applicability Tests, UNIDO-Czechoslovakia Joint Programme, Pilsen, August 1981, Ref. No. JP/99/81
(c) Report on Technological Tests of Suriname Kaolins, Geological Survey Paramaribo, Suriname, July 1981, (locality Onverdacht)
(d) Suriname Kaolins (Locality Moengo), Geological Survey, Paramaribo, Suriname, 1982
(e) Crystal Glass Technology Based on Suriname Glass Sand, UNIDO-Czechoslovakia Joint Programme, Pilsen, June 1982, Ref. No. JP/116/82
(f) Kyanites from Suriname, UNIDO-CSSR Joint Programme, Pilsen, 1982

During the UNIDO mission (Production of Kaolin and Non-metallics, TF/SUR/81/001) the Suriname Government decided that the prime priority in the development of non-metallic minerals would be related to the establishment of a ceramic plant producing wall and floor tiles. The UNIDO expert produced there two project proposals to be realized under the assignment of UNIDO.

(1) Establishment of the ceramic plant with the assistance of two UNIDO experts (an economic adviser in establishing the ceramic plant and an expert in production and technology of the ceramic plant). The presented feasibility study is a part of the final report of both the experts assigned under the project DP/SUR/82/001.
(2) Industrial exploitation of non-metallic minerals as a 4-year project will be negotiated jointly with UNDP Port of Spain and UNIDO Headquarters.

The technological tests conducted by the UNIDO-Czechoslovakia Joint Programme for International Co-operation in the Field of Ceramics, Building Materials and Non-metallic Minerals Based Industries, Pilsen, have proved that:

- The Suriname kaolin from Onverdacht deposit can be used in the manufacture of ceramic wall and floor tiles provided that proper technology is applied. As the best tile body composition for industrial exploitation of Suriname kaolins is the lime-siliceous one with the content of about 30% of raw Suriname kaolin and about 15% of plastic clay. Properties of the earthen ware body show that ceramic wall tiles, floor tiles as well as artistic ceramics and crockery can be blended from Suriname kaolin.

- Wall and floor tiles with the lime-siliceous body composition do not shrink during drying and during firing either. This is their considerable advantage since their sizing is not necessary and the accuracy of finished products is perfect.

- The bisque firing temperature being 1060^{o}C is very low and good because of the energy conservation.

- Opaque and semi-opaque glazes with the maturing temperature of 1020^{o}C and coefficient of thermal expansion between 47.10^{-7} and 50.10^{-7} are suitable for wall tile and glazed floor tile making from Suriname kaolins. Rich surface decoration of tiles can be made according to local as well as international designs.

- Aside from Suriname kaolins, plastic clays, silica sands, limestone, wollastonite or other calcareous materials can be applied for the manufacture of earthen ware tiles in Suriname. The proportion of raw kaolins and silica sand in the blend amounts to 70% from total.

- Products which resulted from semi-industrial tests correspond to the European standard. Verification of the technology on the contracted equipment will be the subject of the contract between the supplier of the equipment and the promoter of this project.
  Since there is a high potential of other non-metallic minerals and rocks in Suriname, the Suriname Government requested to carry out further tests by the UNIDO-Czechoslovakia Joint Programme as a basis for their future possible commercial exploitation. These raw materials are such as shells, ball clays, graphites, pegmatites , feldspars, etc.

2.4. Economic Justification of Project

This project is characterized by:
- foreign exchange savings
- creating new jobs
- profitability
- utilization of local raw materials

It is justified from the point of view of the dynamic development of Suriname national economy.

3. MARKET AND PLANT CAPACITY

3.1. Demand and Market

There have not been reliable import statistics regarding the imports of wall and floor tiles to Suriname and to other countries of North America since 1979.
These commodities are aggregated in larger items, mostly the whole set of tiling materials or non-metallics.
The assess of both the home and export market is based on indirect estimates and statistics respectively.

3.1.1. Home market capacity

Statistics available on imports of wall and floor tiles display only figures till 1978. If average 17 kgs per sq.m. are taken into consideration, the import of wall and floor tiles was as follows:

1974	856 ton	or	50,000 sq.m.
1975	1,047 ton		62,000 sq.m.
1976	792 ton		47,000 sq.m.
1977	2,037 ton		120,000 sq.m.
1978	1,760 ton		104,000 sq.m.

(source: A.B.S. Paramaribo)

To verify these figures, additional considerations were made. The annual construction of houses was taken into account as well. Table 3.1. exhibits the annual housing construction in greater Paramaribo (approx. 160,000 inhabitants) during 70's. Before population started decreasing (see Tables 3.2. and 3.3.), 1,400 - 1,500 houses had been built annually. Since the majority of

population within high income brackets is believed to be among emigrants, the decrease in the housing construction after 1974 was a result of the emigration.

There are no statistics on houses built after 1980 when the growth of population started again but according to the evidence and experience of constructors (VABI) 1,800 new houses have been built annually in greater Paramaribo since 1980.

The amount is kept for an average of annually built houses in greater Paramaribo during 80's because any projections of those figures are of low quality.

From the discussions with constructors and importers, the following estimate of wall and floor tile consumption in Suriname is concluded. (Houses built in greater Paramaribo were parted into two groups, smaller ones with dwelling surface below 100 sq.m. and bigger ones provided with balconies).

Estimated Consumption of Wall and Floor Tiles in 1981/1982

(1) Houses smaller than 100 sq.m. - 1,300 annually assessed

25 sq.m. wall tiles	=	32,500 sq.m.
10 sq.m. floor tiles	=	13,000 sq.m.

(2) Houses bigger than 100 sq.m. - 500 annually assessed

55 sq.m. wall tiles	=	27,500 sq.m.
35 sq.m. floor tiles	=	17,500 sq.m.
Total		90,500 sq.m.

Ration between decorated and undecorated tiles was estimated to be 15 : 85.

With regard to the facts that only 40% of population live in greater Paramaribo and that other districts are

expected to develop, the amount of 300 houses built outside Paramaribo annually is estimated. In addition, approximately 15,000 sq.m. of tiles should be consumed by other sectors and for mending and improving houses (one half of houses in Paramaribo is assessed to be obsolete and should be repaired and up-to-dated).

Consequently with 25% reserve, the home demand is expected to fluctuate between 90 and 120 thousand sq.m. annually during 80`s.

3.1.2. Export market capacity

There is a large export market for wall and floor tiles in the countries of North America. According to Table 3.6., 33 mil. sq. m. of wall and floor tiles were produced in North America in 1979 from that 88% in the USA. However, the year consumption of wall and floor tiles in the USA in the same year was 57 mil. sq. m. (Table 3.6. - 599 mil. sq.feet) and consequently, the annual import of wall and floor tiles of the USA only is 28 mil. sq.m. Other countries of North America except Mexico also import wall and floor tiles. If only the USA were taken into account as export market for wall and floor tiles produced in Suriname, the share of Suriname in the USA import would be 0.25%.

3.2. Sales Programme and Marketing

3.2.1. Sales programme

Sales programme is determined with regard to three viewpoints:

- to meet home demand with a sufficient reserve against contingent swings,
- to sell the difference between the local consumption and plant capacity abroad in order to experience a trade network for a possible enlargement of the wall and floor tile production in Suriname,
- to produce wall and floor tiles of the size 150x150 mm; other sizes 200x200 mm or 100x100 mm, etc. can be produced also as presses will be provided with different sets of dies. However, to keep inventory of auxiliary materials as low as possible and to make use of technical capacity to a maximum, a uniform size of the products is preferential.

Consequently, a minimum of 90,000 sq.m. of tiles should be sold in Suriname and 70,000 sq.m. exported into countries of North America.

The amount of the domestic sales is divided:

- glazed undecorated wall tiles, 150x150 mm	50,000 sq.m.
- glazed decorated wall tiles, 150x150 mm	10,000
- glazed undecorated floor tiles, 150x150 mm	25,000
- glazed decoracted floor tiles, 150x150 mm	5,000

in order to meet the expected demand for cheaper sets (ratio between decorated and undecorated sets is 15:85)

The amount of the exported products is divided:

- glazed undecorated wall tiles, 150x150 mm	7,000 sq.m.
- glazed decorated wall tiles, 150x150 mm	38,000
- glazed undecorated floor tiles, 150x150 mm	4,000
- glazed decorated floor tiles, 150x150 mm	21,000

in order to satisfy the expected more demanding consumers (ratio between decorated and undecorated sets is 85:15)

(See Schedule 3.1.)

This sales programme is a basis for determining the plant capacity. The end of this programme is to make the economy of numerals work and suppress risks of the foreign trade to a prudent point. (This problem is analyzed in Annex 2 - Plant Capacity Variants)

3.2.2. Pricing

Price policy is based on an estimate that the role of prices is a very important criterion of expected consumers, especially in Suriname. Consequently, tiles the price of which equals to the cheapest sold tiles in Suriname are expected to be demanded.
At the average increment to the CIF prices being 47% (from that 25% customs duty and 15% rabate from retail price) to reach the low limit of sold tiles, prices must be as follows:

21 Sf. - undecorated wall tiles
36 Sf. - decorated wall tiles
32 Sf. - undecorated floor tiles
47 Sf. - decorated floor tiles

Provided that an indirect tax levied in case of the home production is not higher than 25% (customs duty - A.B.S. Suriname), the retail prices will fluctuate between:

25.5 and 31 Sf. - undecorated wall tiles
44 53 Sf. - decorated wall tiles
39 47 Sf. - undecorated floor tiles
57 69 Sf. - decorated floor tiles

(Retail prices of wall and floor tiles in Paramaribo are shown in Table 3.4.)

There must be said that price limits between the quality categories are not a dogma. More expensive undecorated tiles can be priced higher than cheaper decorated tiles. (Prices of stains usually fluctuate in very large scale). The prices of the exported products are considered to be identical to the home prices. There are shown annual imports into Trinidad and Tobago including prices in Table 3.6. According to these statistics, the price had been fluctuating considerably. This fact could be caused by aggregation of all wall and floor tiles into one commodity. In 1980, the CIF price was 15.42 US $ per sq.m. and after discounting the average costs in shipment 2.5 US $ the FOB price is estimated to be 13 US $.

However, there are differences in prices per kg in 1978 according to importers which relate probably to the composition of sets; larger quantities are cheaper, etc.)

Exporteur	kg of prod.	US $	US $ kg
U.K.	1489067	1566.490	1.05
Italy	12017	15.595	1.30
CSSR	15724	23.997	1.50
West Germany	6375	16.970	2.65

Note: Weights are given incl. packaging.

Then, the implication for wall tiles weighing 12 kg and floor tiles weighing 17 kg:

- the cheaper sets of wall tiles 23 Sf. CIF
- the cheaper sets of floor tiles 32 Sf. CIF
- the most expensive sets of wall tiles 57 Sf. CIF
- the most expensive sets of floor tiles 81 Sf. CIF

3.3. Sales and Distribution Costs

3.3.1. Advertising

Booklets, price lists, descriptions, photos and other current advertisement is supposed.

15,000 Sf. per annum

3.3.2. Travel costs

4-month stay abroad and travel within the countries of North America and Suriname are supposed.

30,000 Sf. per annum

3.3.3. Transport

The whole annual bulk of products weighing 2,100 tons (12 kgs a sq.m. and 200 tons palets) is supposed to be transported into either Paramaribo's shops or Port of Paramaribo. Price per 1 ton between Onverdacht and Paramaribo - 12.5 Sf. (D.M. MOLL - Transport onderneming)

26,000 Sf. per annum

T o t a l per annum (Schedule 3-2) 71,000 Sf.

3.4. Plant Capacity

Two variants of the plant capacity have been taken into consideration:

Variant A - Annual production 90,000 sq.m. wall and floor tiles to be sold only in Suriname. This production amount can satisfy the domestic demand with a subdued risk of contingent failures of the local market.

Variant B - With regard to the large deposits of cheap raw materials and possible future availability of cheap hydroelectric energy, the enlargement of the wall and floor tile production will be reasonable. From this point of view, it is necessary to experience the foreign trade and labour before taking a venture like this. Other reason for foreign trade is the utilization of the economy of numerals. Taking into account these reasons, variant B of 160,000 sq.m. production is suggested from that 90,000 sq.m. shall be sold in Suriname and 70,000 sq.m. abroad. In such case, the risks of the foreign trade are comparatively low because a 45% failure of the foreign trade can be substituted by the enhanced home sales. Both the variants are put into test in Annex 1 - Plant Capacity Variants from the point of view of profit. Variant B is recommended because of being more economical.

3.5. Sensitivity Analyses

The impact of changes of the foreign demand and the average prices towards sales revenues is put into test.

3.5.1. Drops of Foreign Trade

The sales revenues correspond to the model:

$$Pf \times (700\,000-Z) + Pd \times (90\,000+Z) = 160\,000 \times C$$

(valid if $0 \leq Z \leq 30\,000$)

Where - Pf - average price of exported products - 37 Sf.
Pd - average price of home sold prod. - 27.27 Sf.

C - average price of the whole production
Z - change of foreign trade

From that it is derived that a 1% drop of the exported quantity results in a 0.21% drop of sales revenues.

3.5.2. Changes of average prices

Each 1% price change of the domestic sold products results into a 0.482% change of the sales revenues and each 1% change of the prices of foreign trade results into the complement - 0.518% change of sales revenues.

4. MATERIALS AND INPUTS

4.1. Characteristics of Materials and Inputs

This chapter is largely based on the technological tests of Suriname kaolins conducted in Czechoslovakia in 1981 - Report Technological Tests of Suriname Kaolins, Geological Survey, Paramaribo, Suriname, July 1981

4.1.1. Raw materials compositions

The body of wall and floor tiles was compounded in such a way that principles of composition of lime - - siliceous body were essentially observed so that its main constituents - annorthite and free silica - emerged in a sufficient degree to achieve a desired level of the thermal expansion of the body. The batch configuration and its chemical composition and the properties are given in Tables 4.1. and 4.2. In order to achieve the non-shrinking body, the content of silica sand was increased to 40% from total.

The pressing of the body was good, no cracks occurred during drying. The bisque firing of green tiles was conducted in an industrial gas fired tunnel kiln at the temperature of 1 060°C, the firing cycle was 48 hours, no cracks occurred.

The results of the semi-industrial tests confirmed that physical and chemical properties of the bisque body are suitable for wall and glazed floor tile making. The body is remarkably white, the overall appearance of the wall and floor tiles produced is attractive.

Consequently, the above-mentioned tests proved:

- Suriname kaolin from the deposits Onverdacht can be used in the manufacture of ceramic wall and glazed floor tiles provided that proper technology is applied. As the best tile body composition for industrial exploitation of Suriname kaolins the lime-siliceous one with the content of about 30% of raw kaolin and about 15% of plastic clay was selected.

- Wall and floor tiles with the lime-siliceous body composition did not shrink during drying and firing. This is their considerable advantage since their sizing is not necessary and accuracy of the finished products is perfect.

- The bisque firing temperature being 1060^{o}C is very low and good because of the energy conservation.

- Opaque and semi-opaque glazes with the maturing temperature of 1020^{o}C and the coefficient of the thermal expansion between 47 x 10^{-7} and 50 x 10^{-7} are suitable for wall and glazed floor tile making from Onverdacht kaolins. Rich surface decoration can be made according to local as well as international designs.

4.1.1.1. Composition of body

Raw kaolin Onverdacht	30%
Plastic clay	15%
Quartz sand	40%
Limestone	15%

4.1.1.2. Composition of glazes for Wall Tile Making

Frits	86 - 90%
Kaolin Onverdacht	9%
Stains	1 - 5%

4.1.1.3. Composition of glazes for Floor Tile Making

Frits	78%
Kaolin Onverdacht	9%
Zircon-silicate or corundum	8 - 12%
Stains	5 - 1%

4.1.2. Auxiliary materials

The kind and quantity of the consumed auxiliary materials fluctuate according to the used technology and equipment. Costs of these materials depend mainly on the used kilns and the way of packing. In case of the wall and floor tile production in Suriname, there will be spent the following auxiliary materials:

- The manufactured products shall be packed in paper boxes, one sq. m. of products a box.
- There will be torn kiln refractory saggers during the production.
- During the body slip preparation, silica pebbles and silica lining in ball mills will be consumed.

4.1.3. Factory supplies

For the maintaining production equipment, lubricants and similar material must be delivered. However, spare parts are the main item consumed. Consumption of spare parts usually amounts to 3.5% of the price of equipment according to statistics.

4.1.4. Utilities

There will be spent for drying and firing wall and floor tiles light fuel oil because of its lower price in comparison with electric energy. This question is treated in Annex 2.

Oil consumed in the production will be of calorific value 40 GJ/ton, viscosity under 10^{o}E at 50^{o}C. Installed capacity of electric power for driving equipments and other ends will be 550 kW.

In body preparation section, industrial water will be spent, installation 25 m^3/hour. Installation of drinking water - 8 m^3/hour.

4.1.5. Unit costs

Since the plant will be located in the distance smaller than 15 km from deposits of raw materials, costs in transport will be 7 Sf. per ton. With regard to more complicated winning conditions in case of raw kaolin, the mining costs including transport into the factory are different in case of kaolin, clay and sand. (The estimate is based on mining costs of Billiton).

Other raw materials will have to be imported, consequently, costs in shipment and transport Paramaribo - Onverdacht are included in prices. Prices of glazing materials are based on quotation of Messrs. Ferro B. V. and prices of utilities correspond to the prices in Paramaribo in 1982.

Raw materials

Raw kaolin	40 Sf/ton	
Plastic clay	15 Sf/ton	
Silica sand	10 Sf/ton	
Limestone	350 Sf/ton	(290 Sf. shipment, 10 Sf. transport)
Frits	1 700 Sf/ton	(average price CIF quoted by Ferro)
Stains	18 100 Sf/ton	dtto
Zircon-silicate	1 350 Sf/ton	

Auxiliary materials		
Packaging material	1.00	Sf/pc.
Other auxiliary mat.	60 000	Sf/year
Factory supplies		
Spare parts	105 000	SF/year
Utilities		
Electric power (rate for industry)	250	Sf/Mwh
Light oil	550	Sf/ton
Water	1.5	Sf/m^3

4.2. Supply Programme

4.2.1. Production programme

The plant will produce 105,000 sq.m. wall tiles weighing 1.050 ton and 55,000 sq.m. floor tiles weighing 825 ton of finished fired products. Adding producing losses, technological losses, rejects and water, the inputs of material and utilities into the production are derived from current material flow in the wall and floor tile manufacture. The Table 4.3. shows material flow in case of the wall tile production and Table 4.4. shows the flow in the floor tile production.

4.2.1.1. Raw materials

Consequently, the annual input of raw materials will be

- raw kaolin	760	ton annually
- silica sand	1 000	
- plastic clay	380	
- limestone	373	
- frits	143	

- stains	6.4	ton
- zircon-silicate	3.6	

4.2.1.2. Auxiliary materials

Paper boxes - 160,000 pc. annually, saggers, pebbles, linings and other factory supplies - lubricants etc. (based on statistics approx. 2% of costs)

60.000 Sf.

4.2.1.3. Factory supplies

Spare parts - 3.5 % of machinery

4.2.1.4. Utilities

water	1,350	ton
light oil	625	ton
electric power	750	MWh

Calculations of inputs during start-up and full capacity are shown in Tables 4.5. and 4.6.

4.2.2. Availability of supplies

4.2.2.1. Raw materials unprocessed

Raw kaolin will be mined in Billiton bauxite deposit in Onverdacht. The structure of deposit is comp unded of three layers,

- upper layer is grey plastic clay, approximately 10 m thick
- middle layer is bauxite - approximately 5 m

- bottom layer approximately 5 m thick is raw kaolin the properties of which are given in Table 4.1. and 4.2.

Both the upper layers are removed and raw kaolin is accessible.
Plastic clay will be loaded and transported from the same deposit as well.
Silica sand is available in this region in abundant quantities. During implementation phase, the access to these raw materials must be negotiated.
Finely ground limestone will have to be imported.

4.2.2.2. Raw materials processed

Glazing material except for the small quantity of kaolin will have to be imported. Among the most renown European producers Messrs. FERRO Holland can be named (Messrs. P. Ferro /Holland/ B.V. Van Helmonstraat 20, 3029 AB Rotterdam, P. O. Box 6088)

4.2.2.3. Auxiliary material and factory supplies

The saggers, pebbles and silica linings and spare parts should be delivered by machinery deliverers. Paper boxes for packing can be imported from Europe. Lubricants and other factory supplies are available in Suriname.

4.2.2.4. Utilities

All the utilities are available in Suriname. Water and electric power will be purchased in Onverdacht from governmental resources.

4.2.3. Delivery programme

Raw kaolin and clay must be won during small rainy periods and with regard to mining conditions, the cheapest way will be mining for 1-year inventory since there will have to be done some preparatory works to reach the accessibility of raw kaolin.
Silica sand can be delivered for 6-month stock and other imported raw materials (glazes and limestone) should be delivered four times per year to lower the working capital.
Spare parts are considered for 1-year stock.
Paper boxes for 3-month stock.
Other factory supplies for 2-month stock.
Light fuel for 14-day stock.

4.2.4. Cost estimate

Table 4.7. and Schedule 4-1. exhibit the production costs in raw materials and inputs during start-up and full capacity.

Raw kaolin	30 400 Sf. annually	
Plastic clay	5 700	
Silica sand	10 000	
Limestone	130 550	
unprocessed m.	176 650 Sf.	
Frits	242 800 Sf.	
Stains	113 840	
Zircon-silicate	4 900	
glazes	365 540 Sf.	
Spare parts	105 000 Sf.	
Packaging material	160 000	
Other auxiliary and factory supplies	60 000	
auxiliary and factory supplies	325 000 Sf.	

Water	2 000 Sf.
Electric power	212 500
Light oil	343 750
utilities	558 250 Sf.
PRODUCTION COSTS	1 423 440 Sf.

4.2.5. Implication

The raw materials for the body composition were chosen from the point of view of their prompt availability. It would be opportune to put other local materials into test to substitute or at least limit the share of imported materials (limestone and glazes) which are for the shipment cost's sake expensive. There are raw materials such as shells which could probably substitute the imported limestone with a considerable impact towards the operating costs.

5. LOCATION AND SITE

5.1. Choice of Location

An important viewpoint of the location of a smaller ceramic plant so that cost in implementation and production should be as low as possible is the accessibility to raw materials, utilities and labour. Two localities in Suriname have been considered from this point of view - Onverdacht and Moengo. Both the localities are centres of bauxite mining and processing and have the necessary industrial infrastructure. If compared:

- Lesser distance from Paramaribo (principal market) in case of Onverdacht which necessitates lower distribution costs; approximately 45 000 Sf.
- The Government owned grid system and water supplies in case of Onverdacht vice versa dependance on utilities generated by a private corporation in Moengo.
- Tested raw materials, the technology of this project is based on, are those of Onverdacht origin. In Onverdacht, there are not only kaolins but silica sand and plastic clay. No deposit of plastic clay is known to be in Moengo and raw materials from this location would have to be put into test.
- With regard to the small distance between Paramaribo and Onverdacht and existence of passenger transport, no problems related to the recruitment of labour and staff can be expected.
- Consequently, the plant location in Onverdacht region is more favourable than the location in Moengo.

5.2. Local Conditions in Onverdacht

5.2.1. Geographical situation

Onverdacht is situated in district Para, approximately

30 km south of Paramaribo near the road Paramaribo - Zanderij - Afobaka.
The landscape is almost plain with average level 15 - 20 m above sea level. The land is covered by trees and bush. The trees are up to 15 m in height, the diameter being under 30 cm.

5.2.2. Traffic

The region is accessible from the sea by the river Suriname. There are port facilities for handling bauxite only on special ocean-going ships.
Onverdacht can be easily reached by the asphalt road Paramaribo-Afobaka.
The deposits of raw materials are accessible by the special all-weather road (distance 5 km).

5.2.3. Mining conditions

The deposit of raw materials is situated north of Onverdacht in the Billiton bauxite quarry. Raw materials occur in three layers, the upper one is clay + sand (max. thickness 30 m), bauxite is the middle layer and the bottom is created by raw kaolin (average 5 - 10 m deep). The upper layers are removed and kaolin is accessible during small rainy seasons.

5.2.4. Climate

This region is under the influence of the tropical climate which is typical for Suriname and is characterized by two rainy periods during the year. The main rainy season begins in April and ends in early August with two precipitation maximums, late May and late July.
The shorter rainy season begins late in November and lasts till mid-January. The annual average rainfall reaches 1700 mm with 30 mm as month's minimum and 380 mm as month's maximum.

5.2.5. Utilities

The complete infrastructure exists in this region. Drinking water, electric power and communications are available from the governmental systems.

5.2.6. Labour and living conditions

The three settlements in this region - Onverwacht, Onverdacht and Smalkalden - are provided with food and other shops, churches, hospitals and bus transport. There are available workmen and technicians in this region and in Paramaribo.

5.3. Choice of Site

The plant should be erected close to the asphalt road between Onverwacht and Smalkalden, the best place being Onverdacht. The accurate site must be negotiated during the implementation period before the construction starts since the land is in private hands there. Map 5.1. shows the recommended site.

5.4. Cost Estimate

No operating costs are related to the choice of site. With regard to private owned land there, there will be the investment cost in purchasing the land. The area of the plant is 15 000 sq. m. and the estimated price of the virgin land is 3 Sf./sq.m.
Consequently, the cost in land will be 45 000 Sf.

6. PROJECT ENGINEERING

6.1. Layout

6.1.1. Production programme

The annual production of wall and floor tiles will be as follows:

57 000 sq.m. - glazed undecorated wall tiles, sized 150x150x6, weight of 1 sq.m. - 10 kgs

48 000 sq.m. - glazed decorated wall tiles, sized 150x150x6, 10 kgs/sq.m.

29 000 sq.m. - glazed undecorated floor tiles, sized 150x150x6, 15 kgs/sq.m.

26 000 sq.m. - glazed decorated floor tiles, sized 150x150x6, 15 kgs/sq.m.

With regard to the current material flow and the used technology, the material must be processed in the following production departments:

6.1.1.1. Body slip preparation section

Raw material must be crushed, watered and ground and delivered into the powder preparation section.

Annual material input:	746 ton	raw kaolin
	995 ton	silica sand
	375 ton	plastic clay
	373 ton	limestone
	2 490 ton	t o t a l
	990 ton	water for wet grinding

3 500 ton of material must be prepared in this section during 240 days of operation; i.e. the daily production

of this section is 15 tons of body slip.

6.1.1.2. Powder preparation section

The body slip is delivered into the atomizer where the dried powder containing 6% of water is being prepared for pressing wall and floor tiles. The atomizer evaporates 1 100 000 litre of water annually. Considering three shift working days (240 annually) the atomizer evaporates 200 litre of water per hour and prepares 9.8 tons of the dried pressing powder daily.

6.1.1.3. Pressing section

The pressing powder is pressed and wall and floor tiles made - the annual production is 5 140 000 pcs of wall tiles and 2 689 000 pcs of floor tiles - then 490 sq.m. of wall tiles and 255 sq.m. of floor tiles must be pressed daily during two shifts.

6.1.1.4. Drying and firing section

The pressed wall and floor tiles are put into the tunnel kiln to evaporate 6% of water content. Annual output is 179 000 sq.m. of dried wall and floor tiles, i.e. 460 sq.m. daily during 7 days' working week. After drying, the tiles are loaded on the slinding plates and put into the tunnel kiln.
After having fired the tiles, they are glazed and decorated and loaded for the glost firing. During this firing cycle, the 10% amount of wall tile is lost as rejects. Consequently, the annual output is 160 000 sq.m. of the tiles to be sold and daily output is 458 sq.m.

6.1.1.5. Glaze preparation and glazing sections

After the bisque is fired, the tiles are glazed in glazing section, the glazes being prepared during one shift working day.

Material input:

143 tons - frits
6.4 tons - stains
3.6 tons - zircon-silicate for floor tile glazes to enhance the resistance to abrasion
14.5 tons - kaolin

Consequently, the glaze slip weighing 168 tons per annum (or 700 kgs per day) must be prepared.

6.1.1.6. Selection section

Completed wall and floor tiles are sorted and packed - 160 000 sq.m. annually, i.e. 670 sq.m. daily (7.8 tons).

6.1.2. Supply programme

In order to minimize the production cost and cost in working capital, the inventory and delivery policy is as follows:

Mining raw materials will be contracted due to the very low amount of the material input as mining capacity of its own would not be economical.

6.1.2.1. Raw kaolin

The whole annual input will be delivered for 12 months' stock, i.e. 760 tons or 420 cub.m. will be stored.

6.1.2.2. Plastic clay

With regard to the similar winning condition as kaolin has, the plastic clay will be delivered for 12 months' store - 250 tons or 140 cub. m.

6.1.2.3. Silica sand

This material owing to its good accessibility will be won for 3 months` stock - 250 tons or 140 cub.m.

6.1.2.4. Limestone

The quantity necessary for the 3-month operation will be delivered - 68 tons or 50 cub. m.
Consequently, the maximum inventory will be 820 cub.m., at average 3 m height, the surface of storage will be 270 sq.m.

6.1.2.5. Glazes will be delivered 4 times a year, i.e. 38 tons inventory.

6.1.2.6. Packaging material will be stored for the 3-month production.

6.1.2.7. Spare parts will be delivered for one-year run.

6.1.2.8. Fuel oil will be delivered for 14-day run.

Inventory of raw materials, spare parts and utilities

- raw kaolin	760 tons/40 Sf/ton	30 000 Sf.
- plastic clay	380 tons/15 Sf.	6 000
- silica sand	250 tons/10 Sf.	3 000
- limestone	68 tons/350 Sf.	24 000
- glazes	38 tons	84 000
- cartons	35 000 pcs/1 Sf.	35 000
- spare parts		105 000
- fuel oil	27 tons/550 Sf.	15 000
	Inventory	302 000 Sf.

6.2. Technology

6.2.1. Used technology

The suggested technology of the wall and floor tile production in Suriname is based on the lime-siliceous body composition. The lime-siliceous composition is recommended because the body compounded of 30% of Onverdacht kaolin, 15% of plastic clay, 40% of silica sand and 15% of limestone does not shrink during drying and firing and the sizing of wall and floor tiles is not necessary. This composition is also very good from the point of view of the energy conservation since the bisque firing and the glost firing temperatures are 1060 and 1020°C respectively. This body composition shows very good appearance.

The double firing system, good from the point of view of quality, is suggested and oil fired kilns will be economical from the point of view of cost in firing (Annex 2).

The technological process is described in Scheme 6.3. and runs as follows:

6.2.1.1. Ceramic body preparation

- The raw material delivered to the factory is stored into the storage boxes.
- The raw material is then charged into containers and conveyed to the balance to be weighed.
- The raw material after being weighed is driven into the ball mills for the wet grinding.
- The ball mills are unloaded and the slip is stored and continually stirred in the tanks.
- The slip is dried in the atomizer to obtain the spray dried powder.
- The powder is transported and stored in the metallic silos.

6.2.1.2. Pressing

- The powder is drawn from the silos and transported into the sieves.
- After being sieved, the powder is transported and loaded into hoppers.
- The powder is pressed and wall and floor tiles are shaped.

6.2.1.3. Drying and bisque firing

- The pressed wall and floor tiles are collected and loaded into the trucks for the following drying in the tunnel drier.
- After drying, the tiles are manually loaded on the slinding kiln plates and put into the bisque firing channel of the kiln.
- The fired tiles are manually loaded into metallic containers and stored.
- The empty trucks are returned after feeding the glazing line for the further drying and firing cycle.

6.2.1.4. Glazing

- The containers are unloaded and the glazing line is manually fed.
- The glaze is transported to the glaze machine.
- After being glazed, the products are loaded into the refractory saggers.
- The loaded saggers are stored and prepared to input into the kiln for the glost firing.

6.2.1.5. Glaze preparation

- Glaze material is taken from the storage and weighed.
- The material is loaded into the ball mills.
- The material is ground and unloaded, the glaze slip is sieved.
- The glaze slip is stored into silos and then drawn to the glazing line.

6.2.1.6. Glost firing

- The saggers with the glazed tiles are transported to the glost firing channel of the kiln.
- After firing, the unloaded saggers are placed into containers and transported to the selection line.

6.2.1.7. Selection

- The fired products are unloaded from the saggers and the selection line is fed.
- The fired products are selected into three choices.
- The paper cartons are transported and the finished products are packed.
- The accomplished wall and floor tiles are loaded on pallets and transported into the warehouse.

6.2.2. Acquisition of technology

All the technological data necessary for the best running of the plant shall be bought from the machinery deliverer. For the sake of the good run of the plant, the following parts will have to be purchased:

- Development of the body based on local raw materials with regard to the used equipment in the deliverer's labs, laboratory and semi-industrial tests of these raw materials,
- development of glazes in the deliverer's labs,
- complete and detailed technological flow sheets,
- pressing, drying, firing tests and glaze analyses,
- detailed data for the production organization,
- detailed data for the production control.

6.2.3. Cost Estimate

According to the current European conditions, the costs in technology are estimated - 160 000 Sf.

6.3. Equipment

6.3.1. Production equipment

6.3.1.1. Body preparation section

- Metallic charging hopper
- Vibrating feeder
- Jaw crusher
- Rubber belt conveyor
- Skips
- Platform fixed balance
- Electric hoist
- Ball mills including lining and pebbles
- Vibrating sieves
- Stirrers
- Pneumatic membrane pumps
- Metallic carpentry
- Electric board

Electricity installation 175 kW
Price 500 000 Sf. CIF
Annual capacity 3 000 ton body
Daily capacity 11 ton body

6.3.1.2. Powder preparation section

- Spray drier
- Rubber belt conveyors
- Vibrating sieves
- Bucket elevators
- Metallic silos
- Level indicators
- Hoppers
- Metallic carpentry
- Dischargers
- Electric board
- Dust suction plant

Electricity installation 100 kW

Price 580 000 Sf. CIF

Annual capacity of atomizer - 2 900 ton of evaporated water

Hour capacity - 485 kgs of evaporated water

6.3.1.3. Pressing section

- Hydraulic presses including steel dies 150x150 mm, 200x100 mm and 200x200 mm
- Automatic collecting and piling machines

Electricity installation 100 kW

Price 520 000 Sf. CIF

Daily capacity 900 sq.m.

6.3.1.4. Drying and firing section

- Tunnel drier
- Trucks
- Double channel muffled kiln including automatic control
- Refractory saggers

Electricity installation 40 kW

Price 1 063 000 Sf. CIF

Annual capacity 200 000 sq.m.

6.3.1.5. Glaze preparation section

- Weighing machine
- Skips
- Electric hoist
- Ball mills including pebbles and lining
- Sieves
- Pneumatic membrane pumps
- Stirrers
- Piping
- Metallic containers
- Metallic carpentry
- Double jar turner
- Electric board

6.3.1.6. Glazing section

- Special glazing line
- Dust suction installation
- Containers
- Metallic pallets

Electricity installation 45 kW

Price 310 000 Sf. CIF

Annual capacity 210 000 sq.m.

6.3.1.7. Selection section

- Selection line
- Thermoretracting device
- Metallic containers

Price 46 000 Sf. CIF

Annual capacity 200 000 sq.m.

6.3.2. Auxiliary plant

6.3.2.1. Technological laboratory

- Technical weighing machine
- Bunsen burners
- Glass ware
- Pizzarelli calcimeter
- Laboratory sieve
- Laboratory stirrer
- Laboratory hammer mill
- Technical viscosimeter
- Chronometer
- Laboratory hydraulic press
- Drying room
- Baume densimeter
- Laboratory autoclave
- Muffled lab. kiln
- Wall bench
- Store of glass ware

Price 123 000 Sf. CIF

6.3.2.2. Transport centre

- 1 car
- 1 lorry (3.0 ton)
- 1 fork lift car (2.5 ton)
- 1 loader (0.5 cub.m.)
- 1 terrain pick-up

Price 200 000 Sf.

6.3.2.3. Utility supply plant

- Electric and lighting installation complete with transformer, low tension distribution, lighting bodies, electric cables, etc.
- Industrial, drinking and fight-firing water installation plant, distribution installation, pipes, valves and connections
- Fuel oil installation composed of storing tanks (50 cub. m.), pumping and fuel oil installation inside factory
- Waste water treating plant

Estimated price 700 000 Sf.

6.3.2.4. Metallic structures

Supporting structures in general for inspection and support of machines, chimneys, gangways, support of a atomizer, rails, tanks, warehouse furniture, etc.

Estimated weight 70 tons
Price (3 000 Sf./ton) 210 000 Sf.

6.3.2.5. Other auxiliary equipment

- Communications inside factory
- Mechanical workshop
- Ventilation

Price 200 000 Sf.

6.3.3. Service equipment

6.3.3.1. Office equipment
calculators, repro, furniture, etc.

Price 200 000 Sf.

6.3.3.2. Canteen, cleaning security
furniture, cleaners and other equipment

Price 50 000 Sf.

6.3.4. Spare parts

The spare parts necessary for 1-year operation (3.5% of costs of machinery)

- Motors
- Belts
- Bearings
- Valves
- Others

Price 105 000 Sf.

6.3.5. Cost estimate

6.3.5.1. Production equipment

- Body preparation section	500 000 Sf.
- Powder preparation section	580 000 Sf.
- Pressing section	520 000 Sf.
- Drying and firing section	1 063 000 Sf.
- - Glaze preparation section	259 000 Sf.
- Glazing section	310 000 Sf.
- Selection section	46 000 Sf.
Total	3 278 000 Sf.

6.3.5.2. Auxiliary plant	
- Technological lab.	123 000 Sf.
- Transport centre	200 000 Sf.
- Utility supply	700 000 Sf.
- Metallic structures	210 000 Sf.
- Other auxiliary equipment	200 000 Sf.
Total	1 433 000 Sf.
6.3.5.3. Service equipment	
- Offices	200 000 Sf.
- Other services	50 000 Sf.
Total	250 000 Sf.
6.3.5.4. Spare parts	105 000 Sf.
Equipment total	5 066 000 Sf.

The prices of equipment are based on prices 1982 incremented by 10% inflation and in case of import by 12% for shipment and insurance.
(Currency ratio between Suriname guilder (Sf.) and US dollar in September 1982 is 1.77 : 1).

6.4. Civil Engineering Works

Both the technological flow-sheet and used equipment implicite the necessary engineering works. Land necessary for buildings and good accessability and handling raw materials and products amounts to 15 000 sq.m. The production plant covers 3 200 sq.m. prevailing height of which is 6 or 7 m, only 80 sq.m. of surface is a 15-m high tower for the atomizer. The plant lay-out is drawn in Schemes 6.1. and 6.2.

6.4.1. Site preparation

It is supposed that the plant will be erected on a virgin unprepared land close to the road connecting Smalkalden and Onverdacht. The land must be prepared for the construction, the roads inside factory and the fence must be built.

6.4.2. Buildings

The factory hall will be that of the very light construction, steel, metallic sheets and concrete to prevent the machinery, staff and material against weather. No cranes, etc. need to be built. The covered area is 3 200 sq.m. from which 80 sq.m. is the atomizer tower. Offices and a canteen covering 400 sq.m. are supposed to be built in the 1st floor.

- 3 050 sq. m. factory hall, h = 6 or 7 m
- 80 sq. m. tower, h = 15 m
- 400 sq.m. offices and canteen

6.4.3. Cost estimate

6.4.3.1. Site preparation

The costs are estimated to be 330 000 Sf. including reserve and inflation.

6.4.3.2. Buildings

The factory buildings are estimated to be 250 Sf./sq.m. The atomizer tower - 300 Sf./sq.m., the offices - 550 Sf./sq.m.
These prices include 10% reserve + inflation.
Total cost in building construction - 1 006 500 Sf.
These costs are estimated according to VABI quotation.

6.4.3.3. Outdoor works

Outdoor works were estimated with a presupposition that a bad location from the point of view of the distances is chosen 500 000 Sf.

6.4.3.4. Estimate of production cost

According to statistics, average maintenance cost in buildings and similar asset is approximately 2% from investment cost 43 000 Sf.

Schedules 6.-1., 6.-2., 6.-4., 6.-6.

7. PLANT ORGANIZATION AND OVERHEAD COSTS

This proposal of the plant organization is one of the possible ones and takes into account:

- the scale of production,
- the used technology and physical transformations of materials and inputs during processing,
- the minimum labour to operate the used equipment,

and strives that cost in manpower should be as low as possible and quality of management (and owing to it quality of products, too) as high as possible.

With regard to the technology flow-sheet (Scheme 6.3.), the production can be parted from the point of view of the physical transformations into three departments which will be managed by a specialized supervisor. (Requirements of manpower are dealt with in Chapter 8).

7.1. Production Departments

7.1.1. Green tile preparation department

This department comprises operations from weighing materials down to pressing tiles. Its factory overheads:

- wages of a supervisor
- auxiliary materials - pebbles, lubricants, linings, cleaning materials, etc.
- supplies as drinking water and electric power for lighting.

7.1.2. Kiln department

In this department, the pressed tiles are fired, then the bisque is transported to the glazing line and glazed tiles are put into the kiln to be glost fired and then transported to the selection line.

Its overhead costs:

- wages of a supervisor
- lubricants, saggers and other auxiliary materials
- water and electricity.

7.1.3. Glazing and selection department

In this department, glazes are prepared, the fired bisque is glazed and the finished products are selected and stored.
Its overhead costs:
- wages of a supervisor
- lubricants and other auxiliary materials
- water and electricity.

7.2. Service Department

7.2.1. Maintenance shop

This department is also supervised by a specialist and it is in charge for the production equipment maintenance. The wages, contractual repairements, spare parts consumed in maintaining machines and utilities are factory overhead costs.

7.2.2. Other services

Cost in transport centre, security of the factory and cleaning are parts of the factory overheads.

7.3. Administration

The cost in wages of managerial staff (dealt with in Chapter 8) as well as other expenses related to the management of staff are comprehended as administrative overheads.

7.4. Overhead Costs

7.4.1. Factory overheads

- Wages of four supervisors, four maintenance workmen, four guards, two drivers and two workers for cleaning including surcharges are 225 600 Sf. per annum.
- Auxiliary materials and factory supplies (pebbles, silex linings, saggers, kiln plates, lubricants, etc.) are estimated to be 60 000 Sf. per annum.
- Spare parts 105 000 Sf. per annum.
- Utilities, drinking water and indirect electric power 25 000 Sf. per annum.

Total overhead materials 190 000 Sf.

- Contractual repairs of buildings are estimated to be 43 000 Sf.

Then, the factory overheads will be 458.600 Sf. per annum.

7.4.2. Administrative overheads

- Salaries of the managerial staff will be 307 200 Sf. per annum.
- Travel, insurance and communication about 2% from operating cost will be 60 000 Sf.

Then, the administrative overheads 367 200 Sf.

7.4.3. Depreciation

- Buildings and civil engineering works at rate 5% 92 000 Sf.
- Machinery at rate 10%, transport - 20%.

8. MANPOWER

8.1. Manpower Requirements

The operation of the wall and floor tile plant equipped with the machinery described in Chapter 6 is not demanding for highly skilled workers and it is appropriate to women. Considerable share of workers handles raw material, semi-products and finished products. There are three separated departments in the production of wall and floor tiles which respond to the technological changes of the material during the production process.

- The green tile preparation department includes body slip preparation section, powder preparation section and pressing section. A supervisor is considered for this department and skilled and semi-skilled workers.
- The kiln department includes the drying of the pressed tiles, the bisque firing and the glost firing. A supervisor, operators and workers for handling trucks, plates and saggers are considered.
- The glazing and selection department includes the glaze preparation, the glazing, the selection and warehouse. A supervisor and skilled and semi-skilled labour are considered.

Besides these production departments, there are service centres - maintenance, transport, guard and cleaning employing workers.

8.1.1. Workers

8.1.1.1. Preproduction phase

This phase comprehends all the activities related to the production of wall and floor tiles from the point of view of manning the factory, consequently

the preparation of workers and staff for the operation. There are three periods before the start-up: training selected people, mounting-up machinery and trial run. The factory will be manned step by step during these periods.

- Training is considered to be run by the deliverer of machinery for supervisors of the production departments and maintenance workers.
- These workers will be present at mounting-up the equipment as well. Guard, cleaning and drivers will be employed during this phase.
- During the trial run, the factory will be fully manned.

Consequently, 4 supervisors and 4 maintenance workers will be trained - 8 workers.
During mounting-up - 4 guards, 2 drivers, 5 workers to mounting-up the equipment and 1 person for cleaning will be employed.
(Schedule 8.-1. describes the manning during the trial run and full capacity).

8.1.1.2. Operational phase

To avoid all the losses caused by sickness and others, the minimum operational staff is enhanced by 20% (7 workers).

- Green tiles preparation department
  1 supervisor
  2 skilled and 2 semi-skilled workers for batching in 2 shifts
  3 skilled workers for operating the atomizer during 3 shifts
  2 skilled and 2 semi-skilled workers for operating 2 presses during 1 shift
  2 skilled workers to cover losses in this department.
  The amount total is 14 workers.

- Kiln department
  1 supervisor
  4 skilled workers operating kilns and drier during 3 shifts + 1 shift for changing in weekends
  4 semi-skilled workers for handling trucks during drying and bisque firing cycles; 3 shifts + 1 shift for changing
  4 semi-skilled workers for handling containers and saggers during glost firing cycle; 3 shifts + 1 shift for changing
  1 skilled and 2 semi-skilled workers to cover losses.
  The total amount is 16 workers.

- Glazing and selection department
  1 supervisor
  1 skilled worker for the glaze preparation - 1 shift
  2 skilled and 2 semi-skilled workers for operating the glazing line
  2 skilled and 2 semi-skilled workers for operating the selection line and handling the selected products
  1 skilled and 1 semi-skilled worker to cover losses
  The amount total is 12 workers.

- Maintenance shop
  1 supervisor
  4 skilled workers during 2 shifts for the maintenance and mending

- Guard
  4 unskilled workers during 3 shifts + 1 shift for changing

- Drivers
  3 drivers for the transport section

- Cleaning
  2 unskilled workers for cleaning offices and the factory shops

The amount of workers is 56 persons.

8.1.2. Managerial staff

The minimum requirement for the management must be related to the kind and scope of the production. In case of the ceramic wall and floor tile production, some managerial activities are not necessary such as technological development for the sake of the product permanency and some functions can be delegated to other managers because of the small scope of the production.

In case of this project, 3 functional lines are evident.

8.1.2.1. Sale management

With regard to the scope of the necessary trade network, two salesmen, one designer and one clerk are considered to manage all the activities related to the sale and material purchase. A sale manager is in charge for these activities.

8.1.2.2. Production management

This group is in charge for the constant and proper production of wall and floor tiles. Managed by a production manager, there are 4 supervisors in the production and maintenance, 1 technologist responsible for the quality of input and 1 laboratory technician.

8.1.2.3. Administration

With regard to the small amount of persons employed and the simple production and supply programmes, there is not an administrative manager. A chief accountant is supposed to manage financing, 1 bookkeeper and 1 clerk are supposed as well.

The general manager and his secretary complement the managerial staff.

The amount total of the management is 13 persons and no foreign employees are considered to assist the operation of the plant after starting-up.

8.1.2.4. Managerial staff during preproduction phase

The managerial staff is dealt with from the point of view of the plant operation. The staff controlling pre-investment and construction phases is dealt with separately (Chapter 9 - Implementation scheduling).

Training

The production manager, technologist and laboratory technician will be trained in the deliverer's facilities. The rest of the staff is supposed to be employed in the moment of mounting-up machinery.

8.2. Administrative Overhead Cost

Administrative overheads include the travel, insurance and communication expenses. These items are estimated on the basis of average share from the operating expenditures in current ceramic factories. This share being 2% from the total production expenditures, the cost is 60 000 Sf. approx.

8.3. Wages and Salaries

The development of wages and salaries in the industrial sector in Suriname during the period from 1973 to 1980 is according to the Afd. Nat. Rek. (Algemeen Bureau voor de Statistiek) as follows:

1973 - 2 610 Sf. annually including all the surcharges
1974 - 2 550 Sf. - " -
1975 - 3 370 Sf. - " -
1976 - 6 020 Sf. - " -
1977 - 7 110 Sf. - " -
1978 - 7 700 Sf. - " -
1979 - 8 370 Sf. - " -
1980 - 9 640 Sf. - " -

If this series is projected into 1984, the average wages and salaries in the industrial sector will be 14 170 Sf. per annum (correlation coefficient 0.9768) (Schedules 8.-2. and 8.-4. exhibit estimate wages and salaries respectively at average annual wages and salaries being 14.680 Sf.) According to the current diversity of wages and salaries with regard to the categories of employees, the wages and salaries per month are estimated to be in 1984 as follows:

- wages without surcharges per month
  - skilled labour 800 Sf.
  - semi-skilled labour 530 Sf.
  - unskilled labour 400 Sf.
  - supervisor 1 470 Sf.
- salaries without surcharges per month
  - general manager 3 400 Sf.
  - sale manager 2 000 Sf.
  - production manager 2 000 Sf.
  - salesmen 1 200 Sf.

chief accountant	1 500 Sf.
book-keeper	1 000 Sf.
designer	1 000 Sf.
technologist	1 200 Sf.
lab-technician	1 000 Sf.
clerks	550 Sf.

8.4. Surcharges

According to the current conditions in the Suriname industrial sector, the working week is 5 days and 40 hours. Consequently, there are 261 paid days. Average surcharge paid for the official holidays and leaves is 16% and for the sickness 10%. In addition, there are paid 10% of the pension contribution and 14% as other surcharges.

- Pension contribution	- 10%
- Holidays and leave	- 16%
- Health insurance	- 10%
- Others like bonuses	- 14%
	50%

From which necessitates the following amount of effective days per annum:

- year	365.25 days
- sundays and saturdays	104.36
- number of paid days	261
- holidays	12
- leave	15
- sickness	17
Effective days	217

Schedules 8.-2. and 8.-4. show annual wages and salaries respectively.

- Variable wages are	480 000 Sf.
- Fixed wages are	225 000 Sf.
- Salaries are	307 200 Sf.
Total	1 012 800 Sf.

9. IMPLEMENTATION SCHEDULING

The implementation period of the project is anticipated to take 18 months since the moment of decission till the start-up of the production.
The critical path of the implementation includes activities as follows:

- Setting-up the implementation team and the choice of the equipment supplier;
- Detailed engineering of the project as a fundamental condition of starting the construction of buildings;
- Purchase of land as a condition of starting the construction;
- Construction of buildings;
- Mounting-up the production and auxiliary equipment;
- Trial run.

The timing of the implementation is shown in Scheme 9.1.

9.1. Activities during Implementation

9.1.1. Implementation management

After deciding to produce wall and floor tiles in Suriname, a team of experts authorized to manage the construction of the plant will be set up. It will be in charge to choose constructors, purchase land, control construction and recruit staff and labour during the first 12 months of the implementation.
A chief expert and two specialists are supposed to be members of the team. After finishing the construction, the whole staff of the factory will take part in the following activities:

- mounting-up of the technological equipment
- trial run
- preparation of the trial run and the production
  - purchase of inputs and marketing
- recruitment and training of workers.

9.1.2. Engineering

After the technology deliverer is chosen and the order placed, the detailed engineering comprising the listed data, specification and plans must be purchased.

- All the elements necessary for the realization of the industrial buildings, general and detailed plans of the foundations, basements, sewages, passages, tanks, etc.,
- drawings and detailed specifications of the parts of the auxiliary equipment,
- executive and layout drawings of the production plant, auxiliary and service plants,
- specifications and documentation of all the equipment, instructions for the operation and maintenance,
- specifications and details of mounting-up the equipment.

Detailed implementation scheduling must be carried out and based on these data.

9.1.3. Choice of a building contractor

The bidding and choice of the contractor must be finished 7 months before the start of the mounting-up period because the civil engineering works, planning and construction will take 7 months.
Consequently, as the term of the equipment delivery is 10 months after obtaining the order, the equipment will be prepared to be mounted-up in the 12th month

after starting the implementation and the buildings must be finished at the same moment.

9.1.4. Choice of other constructors

Deliverers of the auxiliary and service equipment must be chosen and ordered to deliver this equipment during construction and mounting-up periods (according to the detailed engineering).

9.1.5. Purchase of land

The plant will be erected in Onverdacht. The land there is owned by private persons and the purchase must be negotiated before the construction of buildings starts.

9.1.6. Construction of buildings

The implementation team will manage the construction and check the quality of works.

9.1.7. Training of staff and workmen

Production manager, technologist, laboratory technician, supervisors and maintenance workers will be recruited in advance and trained in production equipment deliverer's facilities (two months).

9.1.8. Erection

The whole factory staff will be recruited and authorized to manage the further steps of the implementation. Trained supervisors and maintenance workers will take part in this activity. The guard (4 persons), 2 drivers, 1 person for cleaning and 5 workers will be recruited, too. The erection will be backed by supplier's technical assistance.

9.1.9. Trial run

The trial run of the factory will be supervised by technology supplier's assistance. The complete labour must be recruited and trained during this period and raw materials and utilities also purchased.

9.2. Timing of Implementation

There are shown times of each activity during implementation in Scheme 9.1.

9.2.1. Critical activities

- Setting-up implementation team and choice of a technology supplier - 2 months
- Detailed engineering - 2 months

Activities related to the start of construction of buildings, i.e. choice of constructors, purchase of land must be finished during the fifth month of implementation.

- Construction of buildings - 7 months
- Erection - 3 months
- Trial run - 3 months

9.2.2. Other activities

Activities the finish of which is conditional for the time of implementation are as follows:

- Delivery of production equipment takes 10 months after ordering - the finish is the 12th month
- Other equipment must be delivered before the erection starts (details according to engineering)

- Training of staff till the 12th month
- Recruitment of other staff till the 12th month
- Recruitment of other labour till the 15th month
- Purchase of raw materials till the 15th month

9.3. Cost of Implementation

9.3.1. Implementation management and arrangements for material purchase and marketing

Salaries - 2 000 Sf./manmonth	
36 manmonths	72 000 Sf.
Travel	10 000 Sf.
Other expenses	8 000 Sf.
Expenses after recruiting the staff	
Salaries	150 000 Sf.
Overheads	30 000 Sf.
Total cost in implementation management	270 000 Sf.

9.3.2. Detailed engineering

Purchase of all the data, plans, drawings, etc.	100 000 Sf.

9.3.3. Training

4 supervisors, 4 workmen, production manager, technologist and laboratory technician are supposed to be trained in Europe - two months

Wages and salaries	40 000 Sf.
D.S.A. (3 500 Sf. manmonth)	77 000 Sf.
Travel	25 000 Sf.
Total cost in training	142 000 Sf.

9.3.4. Mounting-up

Deliverer's technical assistance

- 1 chief engineer	- 2 manmonths
- 1 yard chief	- 2 manmonths
- 4 specialists	- 9 manmonths

Salaries (3 000 Sf.manmonth)	39 000 Sf.
Allowances and lodging (3 500 Sf.)	45 000 Sf.
Travel within Suriname	5 500 Sf.
Oversea travel	18 000 Sf.

Investor's workers

- 4 supervisors
- 4 maintenance workers
- 5 other workers
- 2 drivers
- 5 guard and cleaning

Wages	67 000 Sf.
Transport of equipment and other costs	15 000 Sf.
Total cost in mounting-up	190 000 Sf.

9.3.5. Trial run

Deliverer's technical assistance

- 1 chief technologist	3 manmonths
- 1 engineer	3 manmonths
- 2 specialists	5 manmonths

Salaries (3 000 Sf./manmonth)	33 000 Sf.
Allowances and lodging	38 500 Sf.
Travel within Suriname	4 500 Sf.
Oversea travel	12 000 Sf.
Investor's workers	
The plant will be fully manned, i.e.	
56 workers/3 months	
Wages	176 000 Sf.
Raw material and utilities	140 000 Sf.
Total cost in trial run	404 000 Sf.
Total cost in implementation	1 106 000 Sf.

10. FINANCIAL AND ECONOMIC EVALUATION

10.1. Total Investment Costs

The structure of total investment costs is given in Schedules 10-1/1, 10-1/2, 10-2/1, 10-2/2, 10-6/1, 10-6/2.

Break-down of these costs is as follows:

Thousand Sf.	Foreign currency	Local currency	Total
1. Land		45	45
2. Site preparation		330	330
3. Buildings + c.w.		1 507	1 507
4. Technology + know-how	160		160
5. Equipment	3 606	1 460	5 066
6. Working cap.		942	942
7. Implementation	398	108	1 106
T o t a l	4 164	4 992	9 156

From that, the production equipment is 3 600 /including spare parts/ or 40% from the investment costs. Including costs in know-how, training, mounting-up and trial run, 45% from the investment costs will have to be paid for in foreign currencies.

10.1.1. Working capital

Working capital has been calculated in Schedules 10-3/1 and 10-3/2.
The calculation has been based on estimated optimal inventories from the point of view of costs in purchasing and storing. The coefficient of turnover

was multiplied by two in 1984 since the production is expected to run 6 months.

- Accounts receivable - term 30 days for payments is derived from the current conditions in Suriname.
- Raw material B - raw kaolin and clay should be mined for 1-year inventory due to the costs in the preparation of mining and homogenization. These raw materials can be won during the small rainy periods only and the excavator must be transported and an access road into the ditch prepared.
- Raw material C - silica is anticipated to be stored for 3 months due to better winning conditions.
- Imported raw materials - glazes, stains and limestone will be stored during 3 months to minimize contingent losses in case of delayed deliveries.
- Spare parts - 1-year inventory to minimize contingent losses.
- Fuel oil - 14-day inventory is based on a presupposition that 1 current lorry can transport 25 tons of oil and this is the consumption during two weeks.
- Work in progress - 10 days correspond to the processing time.
- Finished products - 8-week inventory is anticipated with regard to the comparatively large share of exports.
- Cash in hand - 14 days of each to meet terms of cash disbursements related principally to the wages and salaries.

10.2. Project Financing

The anticipated financial sources are shown in Schedules 10-8/1 and 10-8/2. The cash flow is shown in Schedule 10-8/3. Reserves and financial balance are shown in Schedules 10-9. and 10-10. respectively.

10.2.1. Debt equity ratio

To meet the cash disbursements in the crucial year 1985 (80% utilization of the plant capacity and the first year of debt repayment) with sufficient edge for contingent production failure, the maximum loan is 3 500 th. Sf.

- Sales revenues	4 050
- Operating cost	2 350
- Repayment	700
- Interest	310
- Cash balance	690

In case of 10% decrease of the expected revenues, i.e. 400 th. Sf., there will be 300 th. Sf. in cash and a minimized risk of the insolvency.

10.2.2. Loan and interest

The outside capital is expected to be raised from the Nationale Ontwikkelings Bank Paramaribo at average 8.5% interest and 5 - 15 years term.
Since the interest is without influence on the income tax in case of 10-year plan horizon (10 year's tax exemption according to Land's Ordinance 1970), 5 year's loan is suggested to minimize the financial costs.

10.2.3. Equity

Two sources of equity are available within this project - approximately 30 - 40% of the promoter's capital and the rest of collaborators' capital.

- Required rate of return

  This question was discussed with investors and the required rate of return fluctuated between 12 - 20%. 20% are taken into account for N.P.V. calculations. (The N.P.V. without and with outside financing are calculated in Schedules 10-13. and 10-14. respectively.).

10.3. Total Production Costs

The production costs are calculated in Schedules 10-11. and 10-12.

Costs per sq.m. wall and floor tiles

- Direct materials and inputs	7.73 Sf.
- Direct manpower	3.00
- Factory overheads	2.87
- Administrative overheads	2.29
- Distribution costs	0.44
Operating costs	16.33 Sf.
- Financial costs	1.16 Sf.
- Depreciation	4.72
Production costs	22.21 Sf.

Break-down of costs (% from production costs)

- Raw materials	4.9%
- Glazes	10.3
- Packaging	4.5
- Electric power	5.4
- Oil	9.7
- Wages and salaries	28.5

- Other overheads	8.2%
- Distribution	2.0%
- Financial costs	5.2%
- Depreciation	21.3%
	100.0%

Source of calculation:

Schedules 3-2 - distribution costs
4-1 - material and inputs
6-6 - other factory overheads and depreciation
8-2 and 8-3 wages and salaries.

10.4. Financial Evaluation

10.4.1. Net present value

calculated at 20% factor

- witnout outside financing the N.P.V. is 68 000 Sf. (Schedule 10-13)
- with outside financing the N.P.V. is 626 000 Sf. (Schedule 10-14)

This criterion indicates that the project is sound investment and that financing by means of 40/60 debt equity ratio yields higher N.P.V.
Consequently, the calculation of the following criteria is based on outside financing only.

10.4.2. Internal rate of return

	cash flow	cash flow at 23% factor	cash flow at 24% factor
1983	- 2 555	- 2 077	- 2 060
1984	- 2 690	- 1 778	- 1 749
1985	690	371	362
1986	1 145	500	484
1987	1 575	559	537
1988	1 435	414	395
1989	1 700	399	377
1990	2 460	470	440
1991	2 460	382	355
1992	2 460	310	286
1993	4 745	487	445
Total	13 425	37	128

$$IRR = 23\% + \frac{37}{37-(-128)} \cdot 100 = 23.22\%$$

10.4.3. Benefit - cost ratio

	investment+repayment discounted by 20%	income after interest discounted by 20%
1983	2 129	
1984	2 153	285
1985	405	804
1986	338	890
1987	281	914
1988	301	782
1989	195	670
1990	-	572
1991	-	477
1992	-	397
1993	308	331
Total	5 494	6 122

$$B.C.R. = \frac{6\ 122\ /income/}{5\ 494\ /investment} = 1.11$$

10.4.4. Pay-back period

	Investment outlay	Income	Balance
1983	- 2 555	-	- 2 555
1984	- 6 305	410	- 8 450
1985	- 300	1 700	- 7 050
1986	- 50	2 095	- 5 005
1987	- 55	2 460	- 2 600
1988	- 200	2 460	- 340
1989	-	2 460	2 120

Then, the pay-back period is 6 years + $\frac{340 \times 12}{2\ 460}$ months,

6 years and 2 months.

10.4.5. Simple rate of return on investment outlay (1989)

$$R = \frac{NP + I}{K} \cdot 100$$

NP = net profit (revenues - production costs) = 1 645

I = interest = 60

K = investment = 9 260

$$R = \frac{1705}{9260} \cdot 100 = 18.4\%$$

10.4.6. Simple rate of return on equity (1989)

$$Re = \frac{NP}{Q} \cdot 100$$

NP = net profit = 1 645

Q = equity = 5 655

$$Re = \frac{1645}{5655} \cdot 100 = 29.1\%$$

10.4.7. Break-even analysis (year 1987)

$$px = f + vx$$

$$x = \frac{f}{p - v}$$

x = break even point (BEP)

f = fixed costs (Schedule 10-11, items 3., 4., 6,. 7,. - 1 770)

v = variable costs (Schedule 10-11, items 1., 2., 5., = 1 787) divided by production,
then v = 11.17

p = price per sq.m. $\frac{5075}{160} = 31.72$

$$BEP = \frac{1770}{31.72 - 11.17} = 86.130 \text{ sq.m.}$$

or 53.8% full capacity.

10.4.8. Sensitivity analysis

Contingency A - prices of exported products cut off by 30% (the same composition of export and home sales)
f = 1 770
v = 11.17
p = 27.00
BEP = 111.800 sq.m. (69.9% cap.)

Contingency B - Average price cut off by 10% and the same composition of exported products and home sales
f = 1 770
v = 11.17
p = 24.30
BEP = 134.800 sq.m. (84.3% cap.)

Contingency C - variable costs increased by 10%

f = 1 770

v = 12.29

p = 31.72

BEP = 91.100 sq.m. (56.9% cap.)

Contingency D - fixed costs increased by 10%

f = 1 947

v = 11.17

p = 31.72

BEP = 94.700 sq.m. (59-2% cap.)

Contingency E - cont. under A,C,D met simultaneously

f = 1 947

v = 12.29

p = 27.00

BEP = 132.400 sq.m. (82.7% cap.)

Contingency F - cont. under B,C,D met simultaneously

f = 1 947

v = 12.29

p = 24.30

BEP = 162.100 sq.m. (101.3% cap.)

10.5. National Economic Evaluation

10.5.1. Job creation

Total investment	9.155 th. Sf.
Manpower	69
Investm./job	132 600 Sf/job

Investment in foreign currency 4 164 th. Sf.

foreign cur./job 60 300 Sf/job

10.5.2. Foreign currency savings (mil. Sf.)

- Import substitution	+ 2.45
- Export	+ 2.65
- Current inputs	- 0.80
- Depreciation (investm. in foreign currency)	- 0.40
Savings	3.9 mil. Sf.

10.5.3. Value added (th. Sf.)

- Revenues	5 075
- Direct materials and inputs	- 1 236
- Other materials and inputs	- 190
Value added	3 549 th. Sf.

10.6. Implications

10.6.1. Investment costs

These costs are related to the implemented technology - wet way with drying ceramic slip by the atomizer and with two firing cycles, body is based on the lime-siliceous composition. Though more expensive in machinery, it saves manpower and energy in comparison with the other ways, e. g. body preparation by means of filter-presses, etc.
A considerable impact on these costs could have the shifting of the implementation by 1 year due to the inflation rate (up to 10 mil. Sf.)

10.6.2. Production costs

With regard to the share of costs in wages and salaries being 39% from operating costs, there is an implication

that changes of wages and salaries have a 3-times higher impact on operating costs than changes of costs in fuels, etc. Consequently, ability of competition depends considerably on costs in wages and salaries.

10.6.3. Financial sources

Debt equity ratio 40/60 is advantageous from the point of view of the present value and safe from the point of view of solvency.

10.6.4. Economic criteria

Internal rate of return 23.22% and simple rate of return 18.4% are very good from the point of view of risks in investment.
The break-even point (86,000 sq.m. or 53.8% cap.) makes possible to meet even the total failure of the export with a profit edge.
Even if costs were increased by 10% at simultaneous cutting off prices by 10%, the plant would yield 650 th. Sf. of net profit per annum.
Consequently, the establishment of the 160,000 sq.m. wall and floor tile production in Suriname is an returnable investment.

In addition, there are possibilities for future improving the incomes:

- to put into tests other local materials as shells, etc. to substitute the imported limestone,
- the necessary direct labour was added by 20% due to the expected unexperience; it can be expected that the utilization of plant capacity will be higher after mastering the operation.

- Energy consumption was calculated with considerable reserve and especially new kilns can be expected to be more economical.

11. APPENDIX

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SCHEDULE 3-1 Estimate of Sales Revenues Unit - 1000 sq.m.
1000 Sf.

Products	year 1984								year 1985					
Description	Unit Price		Quantity			Revenues			Quantity			Revenues		
	exp.	loc.	exp.	loc.	total	exp.	loc.	total	exp.	loc.	total	exp.	loc.	total
undecorated wall tiles	21	21	-	21	21	-	441	441	5	41	46	105	861	966
decorated wall tiles	36	36	-	10	10	-	360	360	30	8	38	1080	288	1368
undecorated floor tiles	32	32	-	12	12	-	384	384	33	20	23	96	640	736
decorated floor tiles	47	47	-	5	5	-	235	235	16	5	21	152	235	987
GRAND TOTAL							1420	1420				2033	2024	4057

Products	year 1986								year 1987					
Description	Unit Price		Quantity			Revenues			Quantity			Revenues		
	exp.	loc.	exp.	loc.	total	exp.	loc.	total	exp.	loc.	total	exp.	loc.	total
undecorated wall tiles	21	21	5	46	51	105	966	1071	7	50	57	147	1050	1197
decorated wall tiles	36	36	33	10	43	1188	360	1548	38	10	48	1368	360	1728
undecorated floor tiles	32	32	3	23	26	96	736	832	4	25	29	128	800	928
decorated floor tiles	47	47	19	5	24	893	235	1128	21	5	26	987	235	1222
GRAND TOTAL						2282	2297	4579				2630	2445	5075

SCHEDULE 3-2 Sales and Distribution Costs

Estimate of Production Costs									
Sales and Distribution Costs									
No.	Quality	Unit	Item Description	Local	Foreign	Unit Cost	Costs (1000 Sf.)		
							Foreign	Local	Total
1.			Sales Costs						
1.1.			Advertising				10	5	15
1.2.			Travel				25	5	30
2.			Distribution						
2.3.	2100	ton	Transport	2100		12.5	-	26	26
			TOTAL				35	36	71

SCHEDULE 3-3 Production Programme

Unit - 1000 Sf.

Products	Units at 100% Cap.	Year 1984		year 1985		year 1986		year 1987	
		Cap.%	Units	Cap.%	Units	Cap.%	Units	Cap.%	Units
Undecorated wall tiles	57	30	21	80	46	90	51	100	57
Decorated wall tiles	48	30	10	80	38	90	43	100	48
Undecorated floor tiles	29	30	11	80	23	90	26	100	29
Decorated floor tiles	26	30	6	80	21	90	24	100	26
TOTAL	160	30	48	80	128	90	144	100	160

SCHEDULE 4-1 Estimate of Production Cost: Material and Inputs

Estimate of Production Cost

Material and Inputs

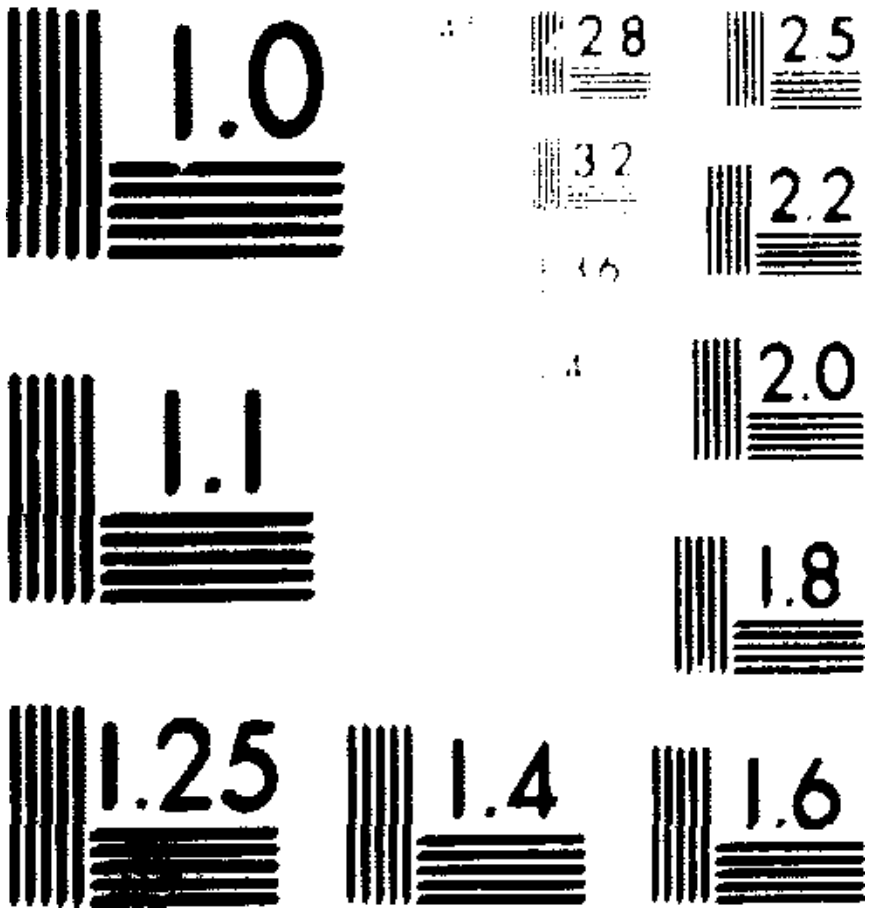
No.	Quantity	Unit	Item Description	Unit Cost	Local	Foreign	Cost		
							Local	Foreign	Total
1.	760	ton	Raw kaolin	40	760		31000		31000
2.	380	ton	Plastic clay	15	380		6000		6000
3.	1000	ton	Silica sand	10	1000		10000		10000
4.	373	ton	Limestone	350		373		131000	131000
5.	142825	kg	Frits	1.7		142725		243000	243000
6.	6400	kg	Stains	18.1		6400		116000	116000
7.	3600	kg	Zircon-silicate	1.35		3600		5000	5000
8.	160000	p.c.	Cartons	1.0		160000		160000	160000
9.	750	MWh	Electric power	250	750		188000		188000
10.	1000	cu.m.	Water	1.5	1000		2000		2000
11.	625	ton	Fuel oil	550	625		344000		344000
			DIRECT MAT. AND INPUTS				581000	655000	1236000
12.			Auxiliary mat.				20000	40000	60000
13.			Factory supplies (sp. parts)					105000	105000
14.	100	MWh	Utilities (el. power + water)				25000		25000
			Overhead mat.				45000	145000	190000
			TOTAL MAT. + INPUTS				626000	800000	1426000

SCHEDULE 6-1 Estimate of Technology Costs

Lump Sum Payment			
Technology	Foreign	Local	Total
Wall and Floor Tile Making	160 000		160 000

SCHEDULE 6-2 Estimate of Investment Costs

Estimate of Investment Cost				
Equipment				
No.	Item Description	Cost		
		Foreign	Local	Total
1.	Production Equipment			
1.1.	Body Preparation Section	500 000		500 000
1.2.	Powder Preparation Section	580 000		580 000
1.3.	Pressing Section	520 000		520 000
1.4.	Drying and Firing Section	1 063 000		1 063 000
1.5.	Glaze Preparation Section	259 000		259 000
1.6.	Glazing Section	310 000		310 000
1.7.	Selection Section	46 000		46 000
2.	Auxiliary Equipment			
2.1.	Technology Laboratory	123 000		123 000
2.2.	Transport Centre		200 000	200 000
2.3.	Utility Supply		700 000	700 000
2.4.	Metallic Structures		210 000	210 000
2.5.	Other Auxiliary Equipment	100 000	100 000	200 000
3.1.	Offices Furniture and Machines		200 000	200 000
3.2.	Other Services		50 000	50 000
4.	Primary Stock of Spare Parts	105 000		105 000
T o t a l		3606 000	1 460 000	5 066 000



SCHEDULE 6-4 Estimate of Investment Cost

Estimate of Investment Cost									
Civil Engineering Works									
No.	Quantity	Unit	Item Description	Local	Foreign	Unit Cost	Cost		
							Foreign	Local	Total
1.			Site Preparation					330000	330000
2.			Buildings						
2.1.	3050	sq.m.	Factory Hall	3050		250		762500	762500
2.2.	80	sq.m.	Atomizer	80		300		24000	24000
2.3.	400	sq.m.	Offices	400		550		220000	220000
3.			Outdoor works					500000	500000
TOTAL								1836500	1836500

SCHEDULE 6-6 Estimate of Production Cost

Estimate of Production Cost							
Civil Engineering Works: Maintenance and Repairs							
No.	Quantity	Unit	Item Description	Unit Cost	Cost		
					Foreign	Local	Total
1.	2	%	Site Preparation	3 500		7 000	7 000
2.	2	%	Buildings	13 000		26 000	26 000
3.	2	%	Outdoor Works	5 000		10 000	10 000
TOTAL						43 000	43 000

Note: % from investment cost

SCHEDULE 7 Other Overhead Costs

Item	Factory Overheads	Adm. Overheads
	Service	Administration
Maintenance	43 000	-
Insurance, Travel, Communication		60 000
Subtotal	43 000	60 000
Depreciation		75 000
Buildings		
Machinery		640 000
Cars		40 000
Subtotal		755 000
TOTAL	43 000	815 000

SCHEDULE 8-1 Manning Table - Labour

Wage Category: Supervisory - A; Skilled - B; Semi-skilled - C; Unskilled - D

Manning Table - Labour: Variable and Fixed

Department	Function	Shift	Wage Category				Total
			A	B	C	D	
Green Tile Preparation	supervisor	1	1				1
	batching	1		1	1		2
	weighing	2		1	1		2
	atomizer	1		1			1
		2		1			1
		3		1			1
	press oper.	1		2	2		4
	supplements	1		1			1
		2		1			1
	TOTAL Dept.		1	9	4		14
Kiln Department	supervisor	1	1				1
	kiln operator	1		1			1
		2		1			1
		3		1			1
		4		1			1
	bisque firing and drying	1			1		1
		2			1		1
		3			1		1
		4			1		1
	glost firing	1			1		1
		2			1		1
		3			1		1
		4			1		1
	Supplements	1		1			1
		2			1		1
		3			1		1
	TOTAL Dept.		1	5	10		16

Continuation

SCHEDULE 8-1 Manning Table - Labour

Wage Category: Supervisory - A; Skilled - B; Semi-skilled - C; Unskilled - D

Manning Table - Labour: Variable and Fixed

Department	Function	Shift	Wage Category				
			A	B	C	D	Total
Glazing and Selection	supervisor	1	1				1
	glaze prep.	1		1			1
	glazing	1		2	2		4
	selection	1		2	2		4
	supplements	1		1	1		2
	TOTAL Dept.		1	6	5		12
Guard	guard	1				1	1
		2				1	1
		3				1	1
		4				1	1
	TOTAL Guard					4	4
Drive	driver	1			3		3
Cleaning	worker	2				2	2
Maintenance Shop	supervisor	1	1				1
	worker	1		2			2
		2		2			2
	TOTAL Maint.		1	4			5
T O T A L			4	24	22	6	56

SCHEDULE 8-2 Estimate of Production Costs : Wages

Wage Category: Supervisory - A; Skilled - B; Semi-skilled - C; Unskilled - D

Estimate of Production Costs - Wages										
Department	Variable Costs				TOTAL	Fixed Costs				TOTAL
	Wage Category					Wage Category				
	A	B	C	D		A	B	C	D	
Body prep. department		9	4		13	1				1
Kiln dept.		5	10		15	1				1
Glaz--select.		6	5		11	1				1
Guard									4	4
Drivers			1		1			2		2
Cleaning Maintenance						1	4		2	2 5
TOTAL Workers		20	20		40	4	4	2	6	16
Working hours/day	8	8	8	8		8	8	8	8	
Working days/week	5	5	5	5		5	5	5	5	
Wages/month	1470	800	530	400		1470	800	530	400	
Surcharges 50%	730	400	270	200		730	400	270	200	
Wages/year /thousand Sf/	-	288	192			105.6	57.6	19.2	43.2	
TOTAL					480 000					225 600

SCHEDULE 8-3 Manning Table - Staff

Manning Table - Staff							
Function	Salary Category / No. of St.						TOTAL
	1	2	3	4	5	6	
General Manager	1						1
Production Manager		1					1
Sale Manager		1					1
Chief Accountant			1				1
Salesman				2			2
Technologist				1			1
Book-keeper					1		1
Designer					1		1
Lab. technician					1		1
Clerk						3	3
TOTAL	1	2	1	3	3	3	13

SCHEDULE 8-4 Estimate of Production Cost - Salaries

Estimate of Production Cost - Salaries							
Description	Salary Category (No. of Staff)						TOTAL
	1	2	3	4	5	6	
General Manager	1						1
Sale Manager		1					1
Production Manager		1					1
Chief Accountant			1				1
Salesman				2			2
Technologist				1			1
Book-keeper					1		1
Designer					1		1
Lab. technician					1		1
Clerk						3	3
TOTAL	1	2	1	3	3	3	13
Manmonths/year	12	24	12	36	36	36	156
Salary/month	3400	2000	1500	1200	1000	550	
Surcharge 50%	1700	1000	700	600	500	250	
Salaries/year	61200	72000	26400	64800	54000	28800	
TOTAL							307 200

SCHEDULE 9-1 Estimate of Investment Cost
Project Implementation

Estimate of Investment Cost Project Implementation				
No.	Item Description	Cost		
		Foreign	Local	Total
1.	Management of project implementation			
1.1.	Implementation team in 1983		90 000	90 000
1.2.	Implementation incl. arrangements for sup. and marketing		180 000	180 000
2.	Detailed engineering	100 000		100 000
3.	Training	102 000	40 000	142 000
4.	Mounting-up	108 000	82 000	190 000
5.	Trial run	88 000	316 000	404 000
TOTAL		398 000	708 000	1 106 000

SCHEDULE 10-1/1 Initial Fixed Investment Costs Unit 1000Sf.

Item	Investment Category	Foreign Currency	Local Currency	Total Cost
1.	Land		45	45
2.	Site Preparation Civil Works		330	330
3.	Structures and Civil Works			
	a) Buildings and Civil Works		1 507	1 507
	b) Auxiliary and Service Facilities	100	560	660
4.	Incorporated Fixed Assets	160		160
5.	Plant Machinery	3 506	900	4 406
6.	Total Initial Fixed Investment Costs	3 766	3 342	7 108

SCHEDULE 10-1/2 Fixed Investment Costs

Period	Construction						Full Capacity (Replacement Invest.)						TOTAL		
Year	1983			1984			1988			1993					
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
Fixed investment cost	160	1882	2042	3606	1460	5066		200	200		200	200	3766	3742	7508
1. Land		45	45											45	45
2. Site Preparation		330	330											330	330
3. Structures and Civil W.		1507	1507	100	560	660							100	2067	2167
4. Incorporated Fixed Assets	160		160										160		160
5. Machinery				3506	900	4406		200	200		200	200	3506	1300	4806

Note: FC = Foreign Currency
LC = Local Currency
Tt = Total

SCHEDULE 10-2/1 Preparation Capital Expenditures

Unit 1000 Sf.

Item	Category	Foreign Currency	Local Currency	Total
1	Implementation Management		90	90
2	Implementation Management and Arrangements for Supplies		180	180
3	Engineering	100		100
4	Training	102	40	142
5	Mounting-up	108	82	190
6	Trial run	88	316	404
TOTAL		398	708	1 106

SCHEDULE 10-2/2 Preproduction Capital Expenditures

Period									
Year	1983			1984			TOTAL		
1000 Sf.	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
Implementation Management		90	90					90	90
Implementation Management + Arrangements for Supplies		180	180					180	180
Engineering	100		100				100		100
Training	102	40	142				102	40	142
Mounting-up				108	82	190	108	82	190
Trial run				88	316	404	88	316	404
TOTAL	202	310	512	196	398	594	398	708	1106

Note: FC = Foreign Currency
LC = Local Currency
Tt = Total

SCHEDULE 10-3/1 Calculation of Working Capital

1. Minimum Requirements of Current Assets and Liabilities

A	Accounts receivable	30 days	(operating costs)
B	Raw materials	360 days	(raw kaolin + plastic clay)
C	Raw material	90 days	(silica sand)
D	Imported materials	90 days	(glazes+s' ins+limestone)
	Spare parts	360 days	
	Fuel oil	14 days	(1984=103; 1985=275; 1986=370; 1987=344)
	Work in progress	10 days	(factory costs)
	Finished products	55 days	(factory costs + adm. overheads)
E	Cash in hand	14 days	
F	Accounts payable	30 days	(raw material + utilities)

1. Annual Production Cost Estimate

Period	Construct.		Start-up		Full Capacity			
Year	1983	1984	1985	1986	1987	1988	1989	1990
Prod. Programme		x60%	80%	90%	100%	100%	100%	100%
Costs 1000 Sf.								
Raw Materials A		11	30	33	37	37	37	37
Raw Materials B		3	8	9	10	10	10	10
Imported Raw Mat.		196	524	590	655	655	655	655
Utilities		160	427	480	534	534	534	534
Labour		240	480	480	480	480	480	480
Spare parts		50	105	105	105	105	105	105
Factory overheads		130	354	354	354	354	354	354
Factory costs		790	1928	2051	2175	2175	2175	2175
Adm. overheads		184	367	367	367	367	367	367
Distribution costs		36	56	65	71	71	71	71
Operating costs		1010	2351	2483	2613	2613	2613	2613
Interest			310	248	186	124	62	0
Depreciation		377	755	755	755	755	755	755
TOTAL Prod. Costs		1387	3416	3486	3554	3492	3430	3368

Note 1984 - 60% capacity but only 6-month production

SCHEDULE 10-3/2 Calculation of Working Capital, Working Capital Requirements

Item	x	y	Requirements 1000Sf.						
	Min.days of coverage	Coef.of turnover 1/	Start-up			Full Capacity			
			1984	1985	1986	1987	1988	1989	1990
1. Current Asset									
Receivables	30	12	168	196	207	218	218	218	218
Inventory									
Raw mat. B	360	1	22	30	33	37	37	37	37
Raw mat. C	90	4	2	2	2	3	3	3	3
Imported raw mat.	90	4	98	131	148	164	164	164	164
Spare parts	360	1	50	105	105	105	105	105	105
Oil	14	25	8	11	12	14	14	14	14
Work in progress	10	36	35	46	48	51	51	51	51
Finished products	55	6.5	210	353	372	390	390	390	390
Cash in hand	14	25	51	67	65	63	60	58	55
Current Assets			644	941	992	1045	1042	1040	1037
1.1 Current Liabilities									
Payables	30	12	82	82	93	103	103	103	103
1.11 Working Capital									
A.Net.Work.Cap.			582	859	898	942	939	937	934
B. Increase				277	40	43	-3	-2	-3

Calculation of Cash Balance

Item	x	y	1984	1985	1986	1987	1988	1989	1990
Total Prod. Costs			1387	3416	3486	3554	3492	3430	3368
Utilities			160	427	480	534	534	534	534
Depreciation			377	755	755	755	755	755	755
Raw Materials			210	562	632	702	702	702	702
Cash Bal			640	1672	1619	1563	1501	1439	1377
Requirement	14	25	51	67	65	63	60	58	55

1/ Note: in 1984, the coefficient multiplied by 2

SCHEDULE 10-6/1 Total Initial Investment Costs

Unit 1000 Sf.

Item	Category	Foreign Currency	Local Currency	TOTAL
1.	Initial Fixed Investment Costs	3 766	3 342	7 108
2.	Pre-production Capital Expenditures	398	708	1 106
3.	Working Capital (Full capacity)		942	942
	TOTAL	4 164	4 992	9 156

SCHEDULE 10-6/2 Total Investment Costs

Period	Construction						Start-up			Full Capacity												TOTAL		
Year	1983			1984			1985			1986			1987			1988			1993					
'000 $.	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
Initial Fixed Invest.	160	1882	2042	3606	1460	5066																3766	3342	7108
Replacement																200	200		200	200			400	400
Pre-production Cap. Exp.	202	310	512	196	398	594																398	708	1106
Working Capital (Incr.)					582	582		277	277		40	40		43	43								942	942
Total	362	2192	2554	3802	2440	6242		277	277		40	40		43	43		200	200		200	200	4164	5392	9556

Note: FC = Foreign Currency
LC = Local Currency
Tt = Total

SCHEDULE 10-7/1 **Total Initial Assets**

Unit 1000 Sf.

Item	Category	Foreign Currency	Local Currency	TOTAL
1.	Initial Fixed Investment	3 766	3 342	7 108
2.	Pre-production Capital Expenditures	398	708	1 106
3.	Current Assets (Full capacity)		1 045	1 045
	TOTAL	4 164	5 095	9 259

SCHEDULE 10 - 7/2 Total Assets

Period	Construction						Start-up						Full Capacity											
Year	1983			1984			1985			1986			1987			1988			1993			TOTAL		
1000 Sf.	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
Initial Inv. Fixed Costs	160	1882	2042	3606	1460	5066																3766	3342	7108
Replacement																200	200		200	200			400	400
Pre-prod. exp.	202	310	512	196	398	594																398	708	1106
Current Assets /Increase/					644	644		297	297		51	51		53	53								1045	1045
Total Assets	362	2192	2554	3802	2502	6304		297	297		51	51		53	53		200	200		200	200	4164	5495	9659

Note: FC = Foreign Currency
LC = Local Currency
Tt = Total

SCHEDULE 10-8/1 Sources of Finance

Unit 1000 Sf.

Item	Source of Finance	TOTAL (Local Currency)
1.	Government - equity	3 556
2.	Collaborators - equity	2 100
3.	N.O.B. National Development Bank LOAN	3 500
4.	Current Liabilities	103
	TOTAL	9 259

SCHEDULE 10-8/2 Sources of Initial Funds

Period	Construction		Start-up		Full Capacity	TOTAL
Year	1983	1984	1985	1986	1987	
Currency	1000 Sf.	1000 Sf.	1000 Sf.	1000 Sf.	1000 Sf.	1000 Sf.
Equity	2 554	3 102				5 656
Loans		3 500				3 500
Current Liabilities		62	20	11	10	103
TOTAL	2 554	6 664	20	11	10	9 259

SCHEDULE 10-8/3 Cash Flow - Financial Plan

Unit: 1000 Sf.

Period	Construct.		Start-up		Full Capacity							Sal-vage value	TOTAL
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993		
Prod. Programme		30%	80%	90%	100%	100%	100%	100%	100%	100%	100%		
A Cash Inflow	2555	8080	4070	4590	5090	5075	5075	5075	5075	5075	5075		54835
1. Financial resources	2555	6660	20	10	15								9260
2. Sales revenues		1420	4050	4580	5075	5075	5075	5075	5075	5075	5075		45575
B Cash Outflow	-2555	-7315	-3970	-3795	-3865	-3950	-3685	-2925	-2925	-2925	-3125	2485	-38550
1. Total assets	-2555	-6305	- 300	- 50	- 55	- 200					- 200	2485	- 7180
2. Operating costs		-1010	-2350	-2485	-2615	-2615	-2615	-2615	-2615	-2615	-2615		-24150
3. Debt service			-1010	- 950	- 885	- 825	- 760						- 4430
3.1. Interest			- 310	- 250	- 185	- 125	- 60						- 930
3.2. Repayments			- 700	- 700	- 700	- 700	- 700						- 3500
4. Dividents (6%)			- 310	- 310	- 310	- 310	- 310	- 310	- 310	- 310	- 310		- 2790
C Surplus		765	100	795	1225	+1125	+1390	2150	2150	2150	1950	2485	
D Cumulative Cash Balance		765	865	1660	2885	4010	5400	7550	9700	11850	13800		16285

Salvage Value: Working capital 945
salvage 1335

SCHEDULE 10-9 Calculation of Reserves

Unit 1000 Sf.

Period	Construction		Start-up		Full Capacity						
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Prod.Programme		30%	80%	90%	100%	100%	100%	100%	100%	100%	100%
1. Revenues		1420	4050	4580	5075	5075	5075	5075	5075	5075	5075
2. Production Costs		1390	3415	3490	3555	3495	3430	3370	3370	3370	3370
3. Gross Profit		30	635	1090	1520	1580	1645	1705	1705	1705	1705
4. Income Tax											
5. Net Profit		30	635	1090	1520	1580	1645	1705	1705	1705	1705
6. Dividence			310	310	310	310	310	310	310	310	310
7. Undistr. Profit		30	325	780	1210	270	1335	1395	1395	1395	1395
8. Und.Prof.Cum.		30	355	1135	2345	3615	4950	6345	7740	9135	10530

SCHEDULE 10-10 Projected Balance Sheet

Period	Construction		Start-up		Full Capacity						
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
A. Assets	2555	9245	8890	8980	9500	10070	10705	12100	13495	14890	16285
1. Current Assets Cum.		1410	1810	2655	3930	5055	6445	8595	10745	12895	14845
1.1. Cash Bal.		765	865	1660	2885	4010	5400	7550	9700	11850	13800
1.2. Current Assets		645	945	995	1045	1045	1045	1045	1045	1045	1045
B. Liabilities	2555	9245	8890	8980	9500	10070	10705	12100	13495	14890	16285
1. Current Liability		60	80	90	100	100	100	100	100	100	100
2. Loans		3500	2800	2100	1400	700					
3. Equity	2555	5655	5655	5655	5655	5655	5655	5655	5655	5655	5655
4. Reserves		30	355	1135	2345	3615	4950	6345	7740	9135	10530

SCHEDULE 10-11 Total Production Costs

(at Full Capacity 1987)

Unit 1000 Sf.

Item	Foreign Currency	Local Currency	TOTAL
1. Direct Material and Inputs	655	581	1 036
2. Direct Manpower		480	480
3. Factory Overhead Costs	105	354	459
3.1. Manpower		226	226
3.2. Material	105	85	190
3.3. Other Factory Overheads		43	43
4. Administrative Overhead Costs		367	367
4.1. Salaries		307	307
4.2. Other Administrative Overheads		60	60
5. Distribution Costs	35	36	71
Operating Costs	795	1 818	2 613
6. Interest		186	186
7. Depreciation		755	755
Manufacturing Costs	795	2 759	3 554

SCHEDULE 10-12 Production Cost

Period	Start-up						Full Capacity														
Year	1984 /30%/			1985 /80%/			1986 /90%/			1987 /100%/			1988 /100%/			1989 /100%/			1990 /100%/		
1000 Sf.	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
1. Dir. mater.	196	174	370	524	465	989	590	522	1112	655	581	1236	655	581	1236	655	581	1236	655	581	1236
2. Dir. lab. labour		240	240		480	480		480	480		480	480		480	480		480	480		480	480
3. Fact.overhead	50	130	180	105	354	459	105	354	459	105	354	459	105	354	459	105	354	459	105	354	459
Fact.cost	246	544	790	629	1299	1928	695	1356	2071	760	1415	2175	760	1415	2175	760	1415	2175	760	1415	2175
4. Adm. costs		184	184		367	367		367	367		367	367		367	367		367	367		367	367
5. Distr.costs		36	36	20	36	56	29	36	65	35	36	71	35	36	71	35	36	71	35	36	71
Oper. costs	246	764	1010	649	1702	2351	724	1759	2483	759	1818	2613	795	1818	2613	795	1818	2613	795	1818	2613
6. Fin. costs					310	310		248	248		186	186		124	124		62	62			
7. Depreciation		377	377		755	755		755	755		755	755		755	755		755	755		755	755
Manuf. costs	246	1141	1387	649	2767	3416	724	2762	3486	795	2759	3554	795	2697	3492	795	2635	2430	795	2573	3368

Note: FC = Foreign Currency
LC = Local Currency
Tt = Total

SCHEDULE 10-13 Cash Flow and NVP without Outside Financing

Unit 1000 Sf.

Period	Construct.		Start-up		Full Capacity								
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	Sal-vage value	Total
Prod. programme		30%	80%	90%	100%	100%	100%	100%	100%	100%	100%		
1. Sales revenue		1420	4050	4580	5075	5075	5075	5075	5075	5075	5075		45575
2. Cash outflow	-2555	-7315	-2650	-2535	-2670	-2815	-2615	-2615	-2615	-2615	-2815	2485	31330
3. Invest.outlay	-2555	-6305	- 300	- 50	- 55	- 200					200	2485	7180
Operating costs		-1010	-2350	-2485	-2615	-2615	-2615	-2615	-2615	-2615	-2615		24150
3. Net Cash Flor	-2555	-5895	1400	2045	2405	2260	2460	2460	2460	2460	2260	2485	14245
4. NVP (20%)	-2129	-4094	810	986	967	757	687	572	477	397	304	334	+ 68
5. Cum. Net Cash Flow	-2555	-8450	-7050	-5005	-2600	- 340	2120	4580	7040	9500	11760	2485	14245

SCHEDULE 10-14 Cash Flow and NPV With Outside Financing

Unit 1000 Sf.

Period	Construct.		Start-up		Full Capacity							Salvage value	TOTAL
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993		
Prod.Programme		30%	80%	90%	100%	100%	100%	100%	100%	100%	100%		
A Sales Revenue		1420	4050	4580	5075	5075	5075	5075	5075	5075	5075		45575
B Cash Outflow	-2555	-4110	-3360	-3435	-3500	-3640	-3375	-2615	-2615	-2615	-2815	2485	-32150
1. Total Invest.	-2555	-3100	-1010	- 950	- 885	-1025	- 760				- 200	2485	- 8000
-Equity	-2555	-3100										2485	- 3170
-Replace of cars						- 200					- 200		- 400
-Repay of credit			- 700	- 700	- 700	- 700	- 700						- 3500
-Interest			- 310	- 250	- 185	- 125	- 60						- 930
2. Operating Costs		-1010	-2350	-2485	-2615	-2615	-2615	-2615	-2615	-2615	-2615		-24150
C Net Cash Flow	-2555	-2690	- 690	1145	1575	1435	1700	2460	2460	2460	2260	2485	13425
D NPV (20%)	-2129	-1868	- 399	552	633	481	474	572	477	397	304	334	626
24%	-2060	-1749	362	484	537	395	377	440	355	286	212	233	
23%	-2077	-1778	371	500	559	414	399	470	382	310	232	255	

$$IRR = 23 + \frac{37}{165}$$

$$IRR = 23 \text{ , } 22$$

Table 3.1. Housing Construction in Greater Paramaribo

Period	Public	Private	TOTAL
1970 - 1971	150	1 138	1 288
1971 - 1972	400	1 075	1 475
1972 - 1973	-	1 491	1 491
1973 - 1974	50	1 398	1 448
1974 - 1975	50	1 255	1 305
1975 - 1976	100	1 055	1 155
1976 - 1977	-	-	-
1977 - 1978	-	-	-
1978 - 1979	385	948	1 333
1979 - 1980	385	812	1 197
1980 - 1981	1 200	n.a.	1 800 1/
1981 - 1982			1 800 1/

Source: An Integral Approach to Housing, March 1980, p.g. 35

1/ Estimate of Mine

Table 3.2. Population per District

District	1950	1964	1972	1980
Nickerie	16 166	30 472	34 853	34 598
Coronie	3 153	3 782	3 114	2 756
Saramacca	8 195	11 952	11 480	10 333
Suriname	54 490	111 694	152 135	164 879
Paramaribo	71 715	110 867	103 738	67 718
Para	-	-	16 478	14 640
Brokopondo	-	11 531	15 552	20 448
Commewijne	18 895	20 700	16 791	14 082
Marowijne	3 974	23 013	25 406	22 582
TOTAL Suriname	177 788	324 011	379 607	352 041

Source: Demografische DATA - Algemeen Bureau de Statistiek 1981

Table 3.3. Gross and Net Population

Year	Gross Population	Net Migration	Net Population	Growth %
1970	382 209	- 5 226	367 983	2.2
1971	389 961	- 5 061	384 900	2.1
1972	397 724	- 4 356	393 368	2.2
1973	404 127	- 6 825	397 302	- 1.0
1974	415 137	- 23 000	392 137	- 1.3
1975	410 830	- 43 200	367 630	- 6.2
1976	380 450	- 2 000	378 450	2.9
1977	n.a.	n.a.	1/ 381 000	-

Source: Table I of Programme Voor de Sociall-Economische Ontwikkeling Van Suriname

1/ Economic Survey of L. America

Table 3.4. Retail Prices of Wall and Floor Tiles

Type	Colour	Decor	Size	Price per sq.m.
Undecor.	white	-	15x15	27.50
Wall Tiles	blue	-	15x15	37.40
	green	-	15x15	44.00
	brown	-	10x10	48.00
	yellow	-	10x20	50.00
Decor.	white	screen pr.	15x15	48.50
Wall Tiles	blue	react.glaze	15x15	70.00
	brown	react.glaze	15x15	47.50
	green	react.glaze	15x15	56.00
	brown	screen pr.	20x10	65.00
Undecor.	yellow	-	15x15	50.00
Floor Tiles	brown	-	15x15	53.50
Decor.	blue	react.glaze	15x15	75.00
Floor Tiles	beige	screen pr.	15x15	70.00
	beige	react.glaze	20x20	100.00
	green	react.glaze	15x15	121.00

Table 3.5. Production of Wall and Floor Tiles in America

thousand sq.m.

Year	USA	North America	Brazil	Colombia	South America	America
1970	23.049	23.730	-	2.530	29.832	53.562
1971	25.110	26.408	31.666	-	35.305	61.713
1972	28.911	30.870	32.230	2.596	36.176	67.046
1973	27.340	29.773	37.949	2.428	41.429	71.202
1974	25.380	28.292	42.204	2.224	46.522	74.814
1975	23.383	26.093	44.951	-	49.240	75.333
1976	25.751	28.225	50.291	-	53.959	82.184
1977	24.619	27.920	-	-	57.126	84.416
1978	28.028	31.378	-	-	61.352	92.730
1979	29.198	32.816	-	-	65.285	98.101

Source: Yearbook of Industrial Statistics, 1979 - Edition/II

Table 3.6. Consumption of Wall and Floor Tiles in the USA

Year	mil.sq. feet
1976	410
1977	477
1978	549
1979	599
1980	552
1981	544

Source: CER No. 6-7, July - August 1982

Table 3.7. Prices CIF in Trinidad and Tobago

Glazed and Unglazed Wall and Floor Tiles Imported

Year	import 1000 p.c.	ton	import 1000 US $	US $/p.c.
1978	6 819	1 604	1 783	0.26
1979	10 092	n.a.	1 460	0.14
1980	6 970	n.a.	1 493	0.21
1981 1/	3 453	n.a.	700	0.20

Source: T and T Oversea Trade 1982

Note 1/ from January to February

Implications:

Average weight of a piece in 1978 = 0.235 kg

average weight of wall and floor tiles is 17 kg, from which necessitates 72 pieces per sq.m.

Prices US $/sq.m.

Year	import 1000p.c.	1000 sq.m.	import 1000 US $	US $ /sq.m.
1978	6 819	94.7	1 783	18.83
1979	10 092	140.0	1 460	10.43
1980	6 970	96.8	1 493	15.42
1981	3 453	48.0	700	14.58

Table 4.1. Chemical Composition of Suriname Kaolins

(Samples NM I, NM II, NM III)

	NM I	NM II	NM III
L.O.I.	14.02	14.19	14.22
SiO_2	44.82	44.66	45.83
Al_2O_3	37.92	38.08	36.96
Fe_2O_3	1.07	0.99	1.04
TiO_2	1.78	1.70	1.62
CaO	0.15	0.20	0.12
MgO	0.11	0.10	0.08
K_2O	0.05	0.06	0.02
Na_2O	0.10	0.02	0.06
	100.02	100:00	100.00

Source: Report - Technological Tests of Suriname Kaolins (Research Institute for Ceramics, Refractories and Non-metallic Raw Materials, Pilsen, Czechoslovakia) July 1981

Table 4.2. Batch Composition - Chemical Composition and Physical Properties

Feed: Raw kaolin	NM I	10%
Raw kaolin	NM II	10%
Raw kaolin	NM III	10%
Finely ground limestone		15%
ball clay		15%
siliceous sand		40%

Chemical Composition %	Dry Condition	Annealing
L.O.I.	13.33	-
SiO_2	59.99	69.21
Al_2O_3	16.39	18.91
Fe_2O_3	0.63	0.73
TiO_2	0.87	1.00
CaO	8.26	9.53
MgO	0.20	0.23
K_2O	0.32	0.37
Na_2O	0.08	0.09
	100.07	100.07

Green strength	0.620 MPa
Total shrinkage	0
Water absorption	17.3
Resistance to changes in temp.	200°C

Source: Report - Technological Tests of Suriname Kaolins (Research Institute for Ceramics, Refractories and Non-metallic Raw Materials, Pilsen, Czechoslovakia) July 1981

Table 4.3. Wall Tile Production - Raw Material Flow Annual Production - 105 000 sq.m.

Department	Input kg/sq.m.	Output kg/sq.m.	Change %	Total Input kg/year	Total Output kg/year	Total Change kg/year
Supply Programme						
Glazes	1.05	1.05	-	110 250	110 250	-
Quartz sand	5.28	5.28	-	554 400	554 400	-
Plastic clay	1.98	1.98	-	207 900	207 900	-
Limestone	1.98	1.98	-	207 900	207 900	-
Raw kaolin	3.96	3.96	-	415 800	415 800	-
Water	5.30	5.30	-	556 500	556 500	-
Total supply	19.55	19.55	-	2052 750	2052 750	-
Body Slip Prep.	18.50	18.50	-	1942 500	1942 500	-
Spray Drying 1/2/	18.50	12.00	-35	1942 500	1260 000	- 682 500
Pressing 3/	12.00	11.90	- 1	1260 000	1249 500	- 10 500
Tunnel Drier 4/	11.90	11.20	- 6	1249 500	1176 000	- 73 500
Bisque Firing 5/	11.20	10.10	-10	1176 000	1060 500	- 115 500
Glazing 6/	11.15	11.15	+10	1170 750	1170 750	+ 110 250
Glost Firing 7/	11.15	11.10	-	1170 750	1165 500	- 5 250
Selection 8/	11.10	10.00	-10	1165 000	1050 000	- 115 500
Market	10.00			1050 000		

Note: 1/ Losses 3%; 2/ Evaporated water 32% - 621 600 kg/per annum; 3/ Losses 0.5 - 1%; 4/ Evaporate water - rest 6% - 73 500 kg/per annum; 5/ Loss on ignition - 10%, 6/ Input glazes 1.05 kg; 7/ Loss on ignition (glazes 0.05 kg); 8/Rejects 10%

Table 4.4. Floor Tile Production - Raw Material Floow

Annual Production - 55 555 sq.m.

Department	Input kg/sq.m.	Output kg/sq.m.	Change %	Total Input kg/year	Total Output kg/year	Total Change kg/year
Supply Programme						
Glazes	1.05	1.05	-	57750	57750	-
Quartz sand	8.00	8.00	-	440000	440000	-
Plastic clay	3.00	3.00	-	165000	165000	-
Limestone	3.00	3.00	-	165000	165000	-
Raw kaolin	6.00	6.00	-	330000	330000	-
Water	7.80	7.80	-	429000	429000	-
TOTAL Supply	28.85	28.85	-	1586750	1586750	-
Body slip preparation	27.80	27.80	-	1529000	1529000	-
Spray drying 1/2/	27.80	18.10	-35	1529000	995500	-533500
Pressing 3/	18.10	17.95	- 1	995500	987250	- 8250
Tunnel drier 4/	17.95	17.05	- 6	987250	987750	- 49500
Bisque firing 5/	17.05	15.50	-10	937750	852500	- 85250
Glazing 6/	15.50	16.55	+ 7	852500	910250	+ 57750
Glost firing 7/	16.55	16.50	-	910250	907500	- 2750
Section 8/	16.50	15.00	-10	907500	825000	82500
Market	15.00			825000		

Note: 1/ Losses 3%
2/ Evaporated water 32% - 487 750 kg per annum
3/ Losses 0.5 - 1.0%
4/ Evaporated water 6%
5/ Loss on ingnition
6/ Input glazes
7/ Loss on ignition
8/Rejects 10%

Table 4.5. Material and Energy Consumption during Full Capacity

Item	Consumption per Unit			Denominator	Total Input Units 1987 - ... /production/			Quantity per Year /Consumption/		
	Wall tiles	Floor tiles	Total		Wall tiles	Floor tiles	Total	Wall tiles	Floor tiles	Total
raw kaolin 1/	3.96	6.00	-	1000 sq.m.	105	55	160	416000	330000	746000
silica sand 1/	5.28	8.00	-	1000 sq.m.	105	55	160	544400	440000	995000
plastic clay 1/	1.98	3.00	-	1000 sq.m.	105	55	160	208000	165000	373000
kaolin (glazes) 1/	0.095	0.095	0.095	1000 sq.m.	105	55	160	-	-	15000
frits 1/	0.915	0.85	-	1000 sq.m.	105	55	160	96075	46750	142825
stains 1/	0.04	0.04	0.04	1000 sq.m.	105	55	160			6400
zircon-silicate 1/		0.065		1000 sq.m.		55			3575	3575
limestone 1/	1.98	3.00		1000 sq.m.	105	55	160	208000	165000	373000
industrial water 1/	5.3	7.8		1000 sq.m.	105	55	160	556500	429000	986500
heat in tunnel drier 2/	0.3	0.3	0.3	evap.wat.tons	73.5	49.5	123	22050	14850	36900
heat in spray drier 2/	0.9869	0.9869	0.9869	evap.wat.tons	682.5	533.5	1216	673559	526611	1200070
heat in bisque fir. 3/	1.16	1.16	1.16	input tons	1176	937.75	2113.75	1364160	1087790	2451950
heat in glost fir. 3/	1.61	1.51	1.57	input tons	1170.75	910.25	2081	1884908	1374478	3259386
light oil 1/	3.38	4.92	3.91	1000 sq.m.	105	55	160	355022	270326	625348
el.power for machinery 4 /			4.34	1000 sq.m.	105	55	160			694800
libricants and other fact. supplies										60000
packing material 5/	1.00	1.00	1.00	1000 sq.m.	105	55	160	105000	55000	160000
spare parts										100000
drinking water				tons						330
el. power for other reasons				kWh						100000

Note: 1/ kg/sq.m. ; 2/ kWh/l.wat. ; 3/ kWh/kg ; 4/ kWh/sq.m. ; 5/ Sf./sq.m.

Table 4.6. Material and Inputs During Start-up

Item Description	Unit	Consumption for Unit			1984 Quantity			1985 Quantity			1986 Quantity		
		wall tiles	floor tiles	Total	wall tiles	floor tiles	Total	wall tiles	floor tiles	Total	wall tiles	floor tiles	Total
Production	1000sq.m.	-	-	-	31	17	48	84	44	128	94	50	144
raw kaolin	kg/sq.m.	3.96	6.00	-	123	102	225	333	264	597	373	300	673
plastic clay	kg/sq.m.	1.98	3.00		61	51	112	166	132	298	186	150	336
silica sand	kg/sq.m.	5.28	8.00		163	136	299	444	352	796	496	400	896
limestone	kg/sq.m.	1.98	3.00		61	51	112	166	132	298	186	150	336
frits	kg/sq.m.	0.915	0.85		28.4	14.5	42.9	76.9	37.4	114.3	86	42.5	128.5
stains	kg/sq.m.	0.04	0.04	0.04	1.24	0.68	1.92	3.36	1.76	5.12	3.70	2	5.76
zircon-silicate	kg/sq.m.	-	0.65	-	-	1.1	1.1	-	2.9	2.9	-	3.3	3.3
packaging	pc/sq.m.	1	1	1	31	17	48	84	44	128	94	50	144
other													
auxiliary	1000 Sf.						40			48			54
spare parts	1000 Sf.						30			105			105
water industr.	kg/sq.m.	5.3	7.8		16.4	133	297	445	343	788	498	390	888
el. power-drive	kWh/sq.m.			4.34			208			556			625
light oil	kg/sq.m.	3.38	4.92	3.91	105	84	189	284	216	500	318	246	564

Note: Quantity in tons
in case of packaging material 1000 p.c.
in case of electricity MW h

Table 4.7. Material and Inputs Costs during Start-up

Item	Unit	Unit	1984		1985		1986		1987	
		Cost	Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost
Raw kaolin	ton	40	230	9200	600	24000	680	27200	760	30400
Plastic clay	ton	15	115	1725	300	4500	340	5100	380	5700
Silica sand	ton	10	300	3000	800	8000	900	9000	1000	10000
Limestone	ton	350	113	39550	298	104300	337	117950	373	130550
Frits	kg	1.7	42900	72930	114300	194310	131900	224230	142825	242800
Zircon-sil.	kg	1.35	1100	1500	2900	2900	3300	4500	3600	4900
Stains	kg	18.1	1950	35290	5200	94120	5800	104980	6400	115840
Packaging m.	p.c.	10	48000	48000	128000	128000	144000	144000	160000	160000
Other aux.				40000		60000		60000		60000
Spare parts				30000		105000		105000		105000
Water	cub.m.	1.5		900	1100	1650	1250	1880	1350	2000
El.power	MWh	250	400	100000	660	165000	750	187500	850	212500
Light oil	ton	550	250	137500	500	275000	570	313500	625	343750
TOTAL				519595		1167780		1304840		1423440

Table 7.1. Overhead Costs During Start-up

Unit 1000 Sf.

Item	x/ 1984		1985		1986	
	Factory	Admin.	Factory	Admin.	Factory	Admin.
Wages Salaries	113	150	226	307	226	307
Material	95		190		190	
Other Overheads		30	43	60	43	60
SUBTOTAL	208	180	459	367	459	367
Depreciation		377		755		755
TOTAL	208	557	459	1 122	459	1 122

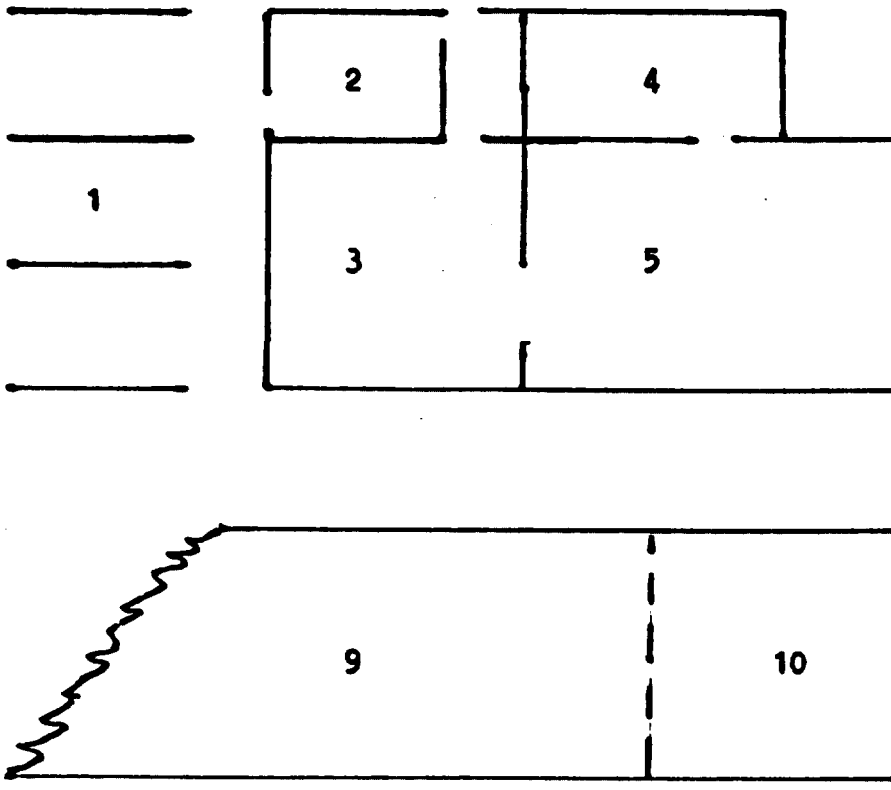
x/ 6 months of operation at 60% capacity utilization is supposed.

Table 9.1. Investment During Implementation

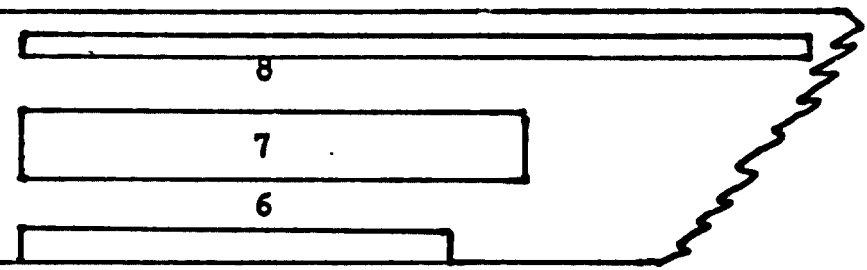
Unit 1000 Sf.

Month/Year	Implement. Management	Engineering	Training	Mounting-up	Trial Run	Land	Technology	Site Preparation Build.	Prod. Equipment	Other Equipment	T O T A L
01/83	7.5										7.5
02/83	7.5										7.5
03/83	7.5										7.5
04/83	7.5	100									107.5
05/83	7.5					45					52.5
06/83	7.5							265			272.5
07/83	7.5							265			272.5
08/83	7.5							265			272.5
09/83	7.5							265			272.5
10/83	7.5							265			272.5
11/83	7.5		71					265			343.5
12/83	7.5		71				160	267			505.5
1983		100	142			45	160	1857			2394.0
1983	30										
01/84	30			61							91
02/84	30			61							91
03/84	30			63							93
04/84	30				135				3506	1560	5231
05/84	30				135						165
06/84	30				134						164
TOTAL	270	100	142	185	404	45	160	1857	3506	1560	8229

SCHEME 6.1. CERAMIC PLANT



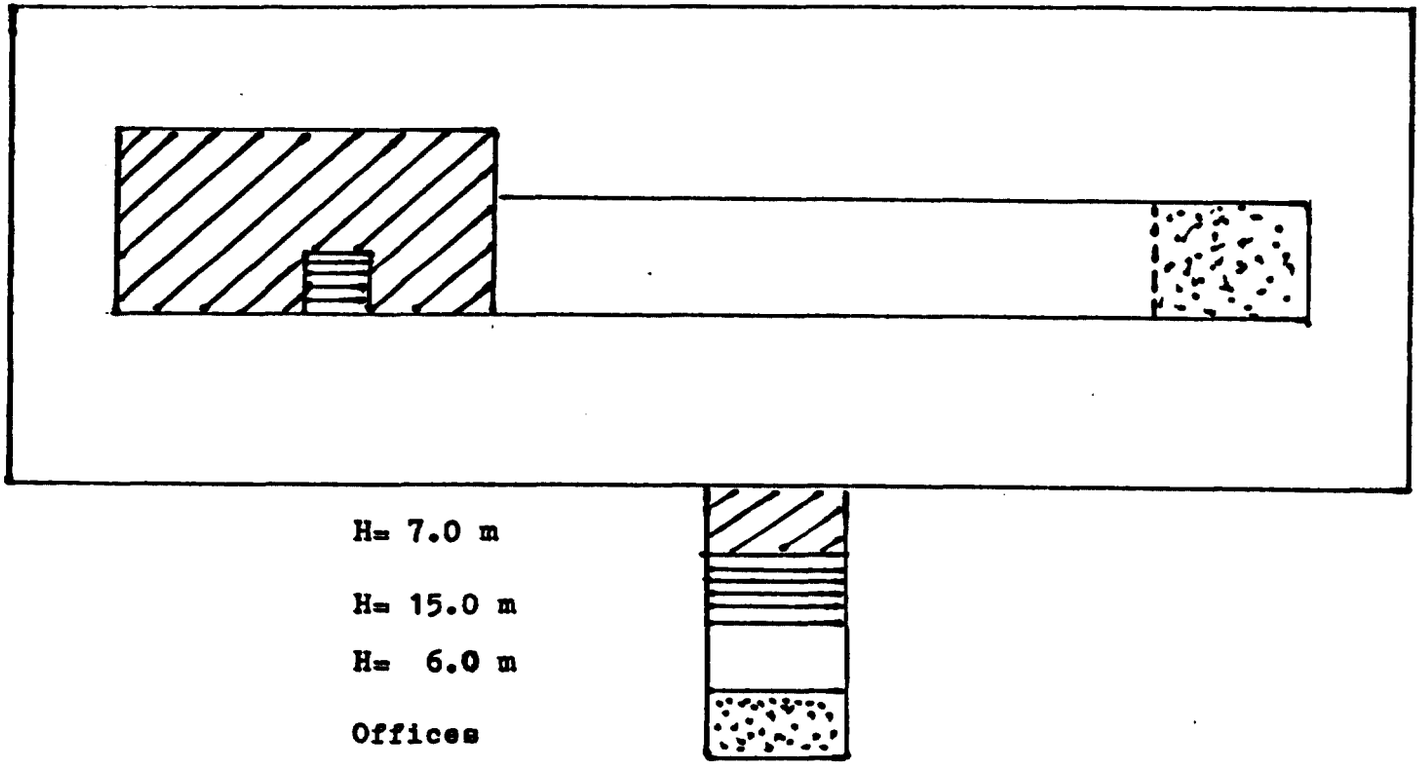
Scale 1:500



DESCRIPTION

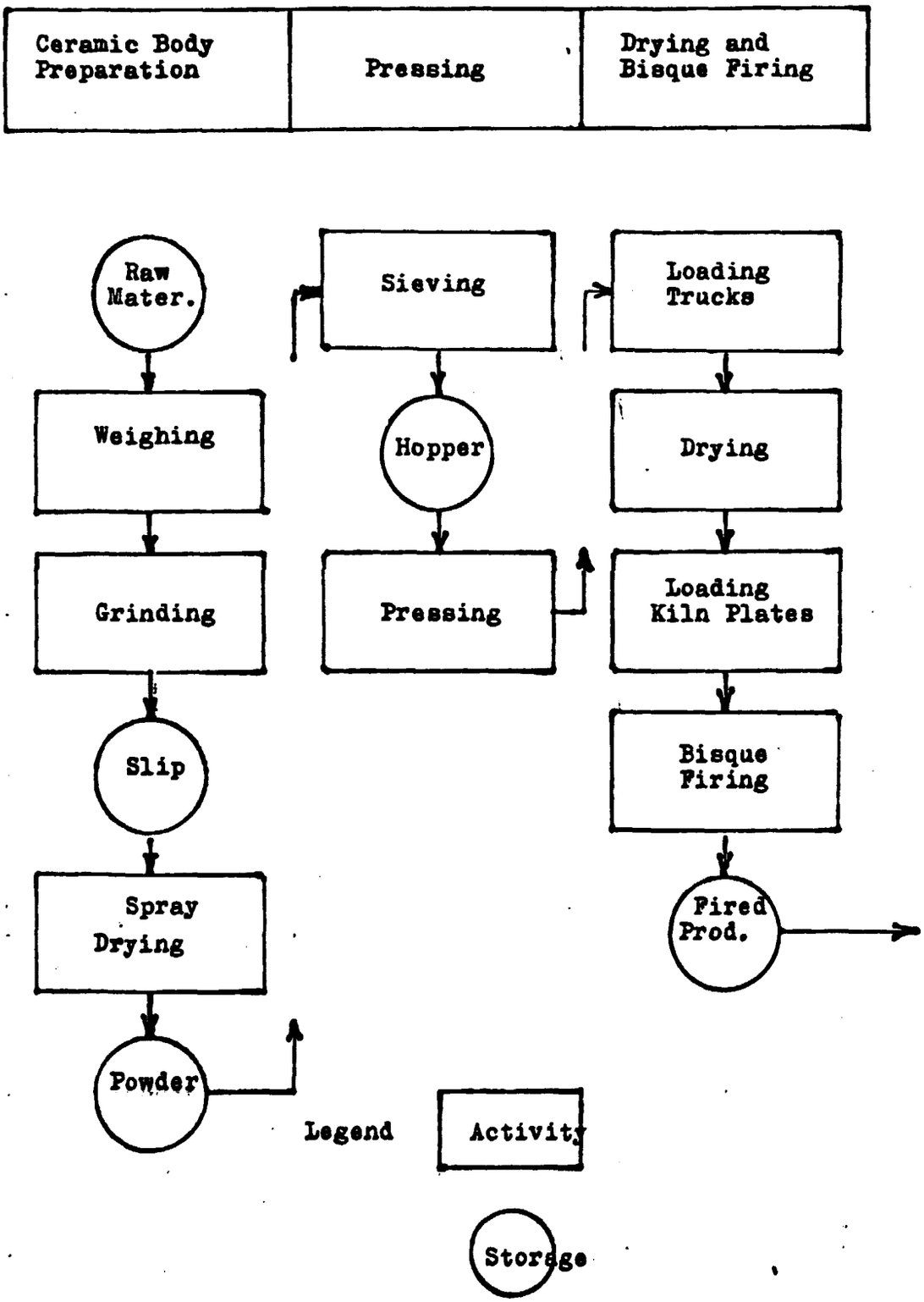
1 Raw Material Storage
2 Auxiliary Services
3 Body and Powder Preparation
4 Glaze Preparation
5 Pressing Section
6 Tunnel Drier
7 double Channel Kiln
8 Glazing Line
9 Sorting Section
10 Warehouse and Offices (1st floor)

SCHEME 6.2. CERAMIC PLANT

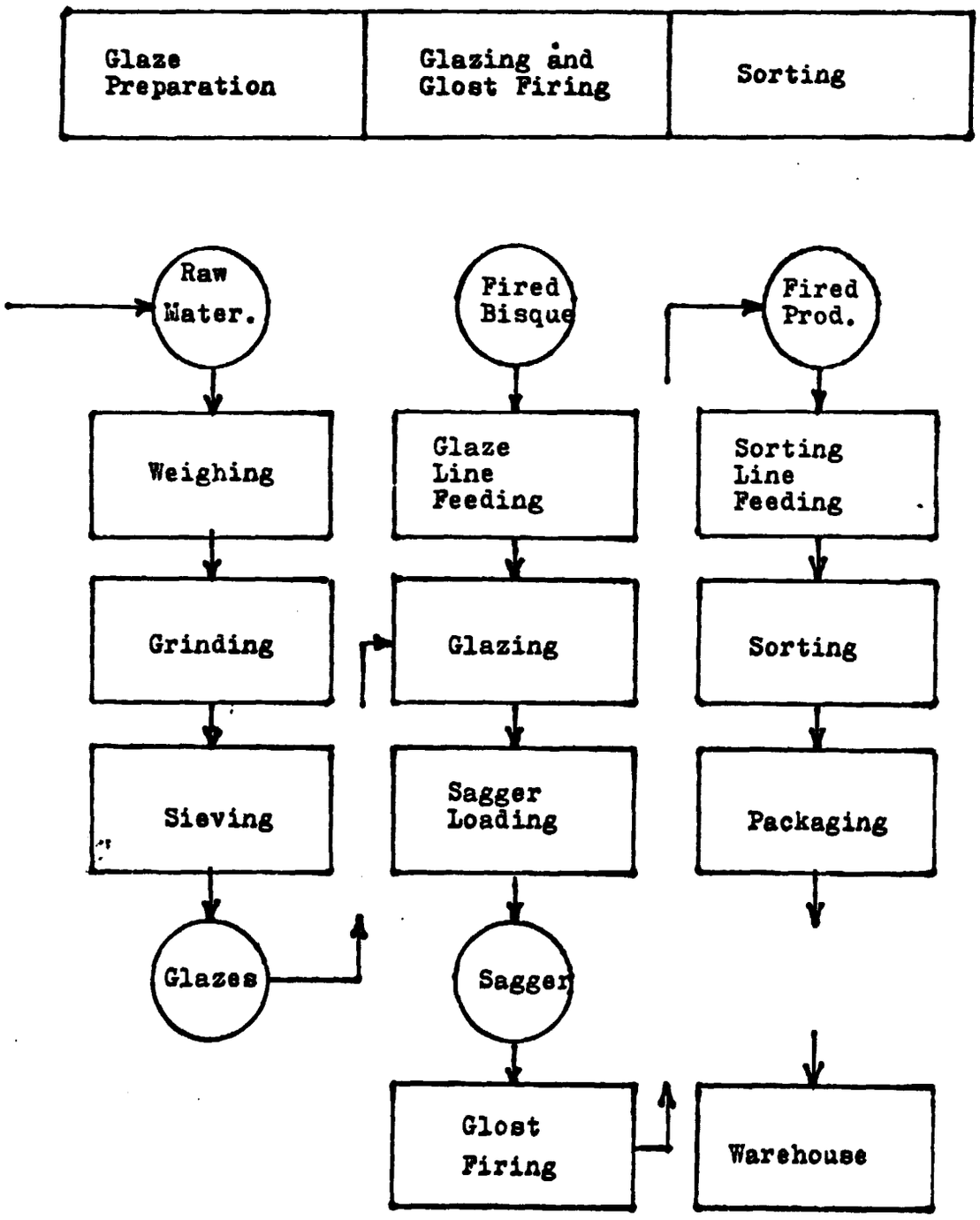


Scale 1:1,000

SCHEME 6.3. TECHNOLOGICAL FLOW SHEET

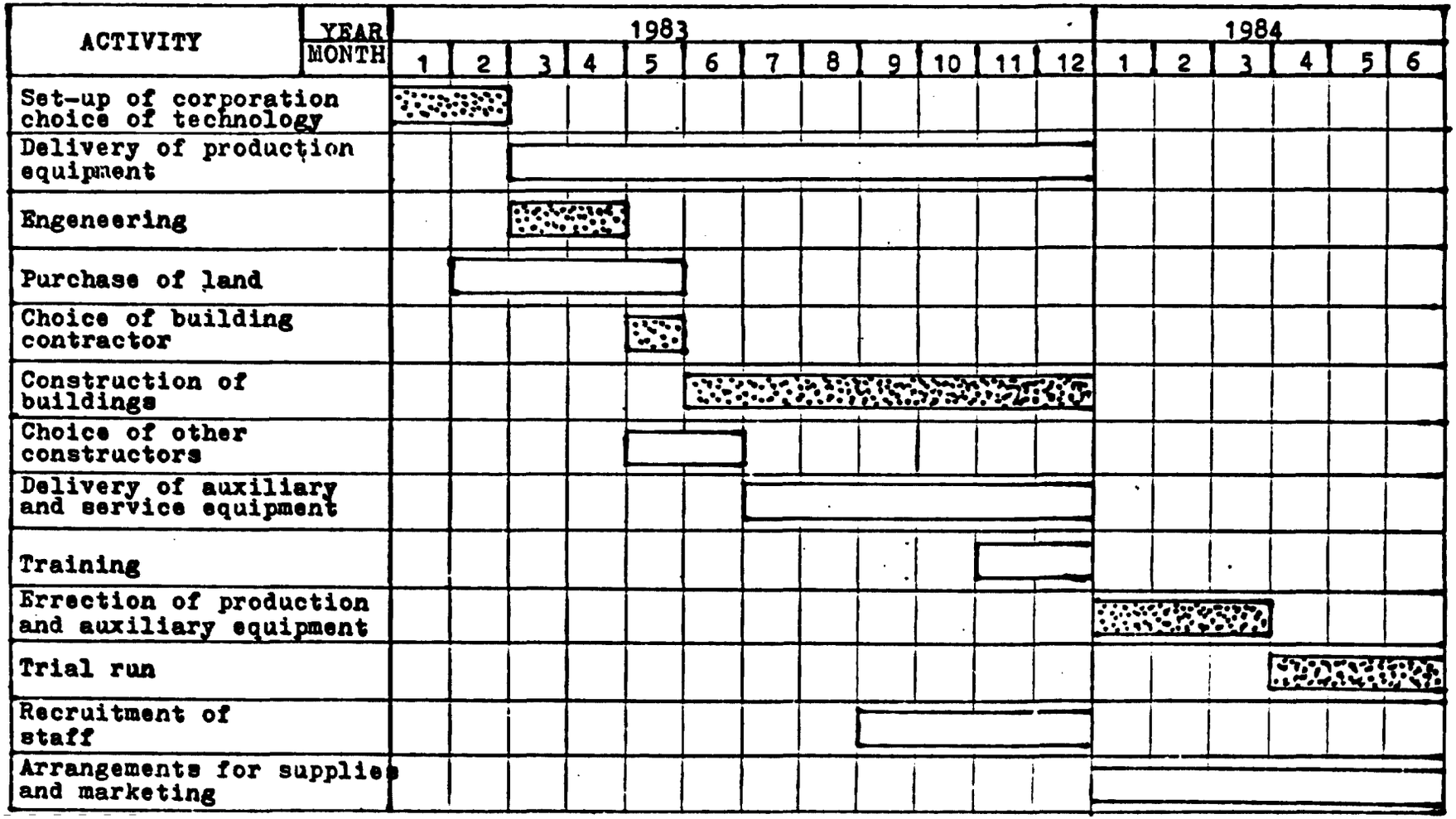


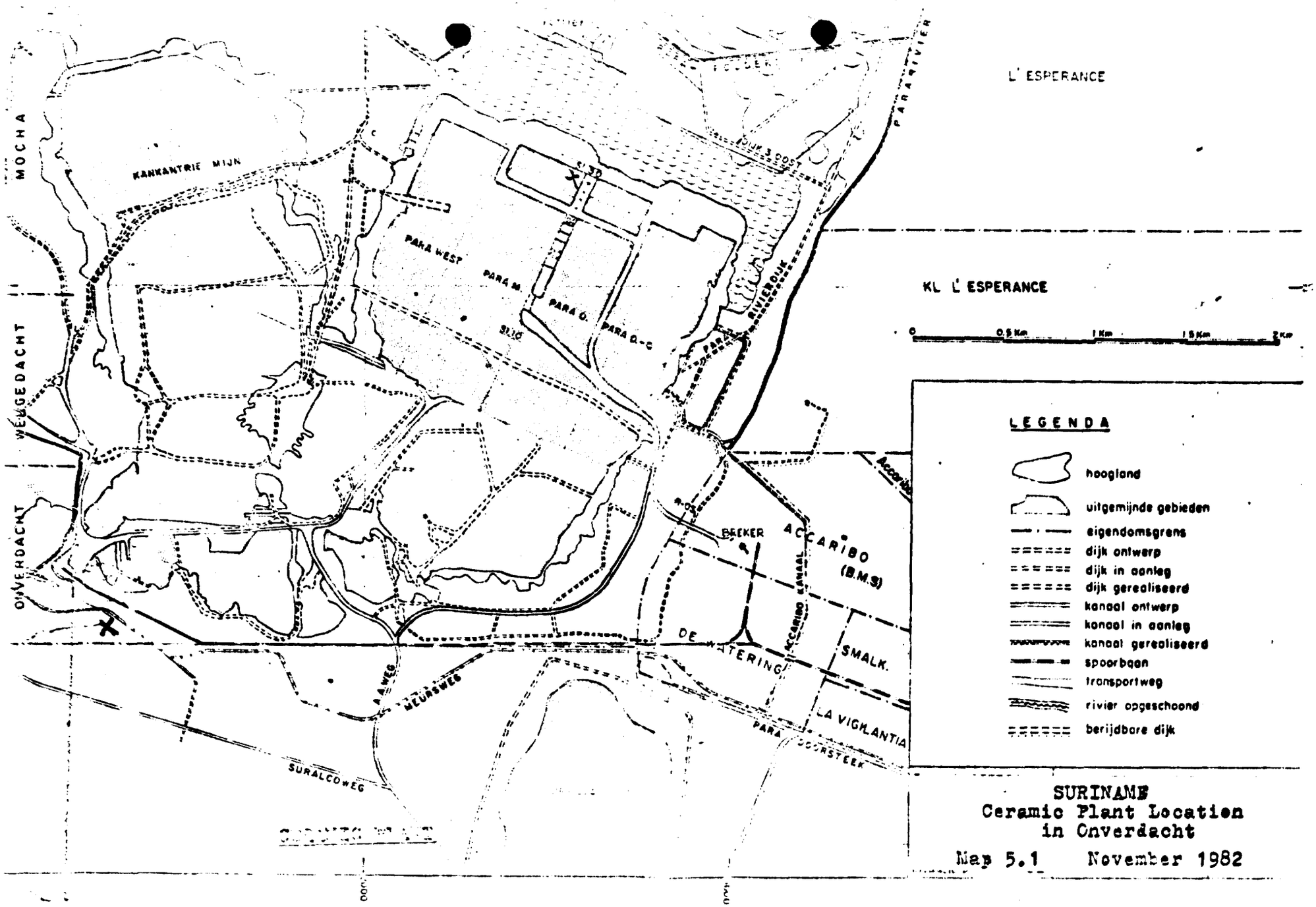
Scheme 6.3. Technological Flow Sheet



SCHEME 9.1. IMPLEMENTATION TIMING

Critical Path





SURINAME
Ceramic Plant Location
in Onverdacht

Map 5.1 November 1982

ANNEX 1

Variants of Production Programme

With regard to the home market capacity (90 000 - 120 000 sq.m.), there are some variants to choose when the plant capacity is considered.

Variant A - to meet the home demand with a brink which subdues risks of volatile demand, 90 000 sq.m. of annual production is considered only for the home market.

Variant B - to utilize the "economy of scale", variant B is taken into consideration. Lest risks related to the export should be too high, the plan to produce 160 000 sq.m. wall and floor tiles annually seems to be prudent. In case of the total failure of the export possibilities, there is a space in the home market to sell at least 60 - 75% of the production. Taking into consideration the break even point 88 000 sq.m., the probability of the red ink economy is not too high in this case.
Larger exports than 45% from the full capacity would not be reasonable in case of a beginner.

The economic evaluation of both the variants is based on the following presuppositions:
- the production technology is supposed to be identical;
- the time of implementation is supposed to be the same in both the cases;
- the estimated costs in the production equipment are based on the estimated differences of the used equipment weights.

1. Production Equipment

(The production equipment used in case of the variant B is described in Chapter 6)

1.1. Body preparation section

With regard to the 50% amount of the inputs, costs in this equipment are estimated as follows:

- Variant A 250 000 Sf.
- Variant B 500 000 Sf.

1.2. Atomizer

The price of a smaller atomizer and the related equipment is estimated to be 70% of the price in case of the variant B.

- Variant A 400 000 Sf.
- Variant B 580 000 Sf.

1.3. Pressing section

To manage the production of both wall and floor tiles without difficulties, the same equipment would have to be installed in both the cases.

- Variant A 520 000 Sf.
- Variant B 520 000 Sf.

1.4. Drying and firing section

The drier and the kiln of the same type but 60% capacity are anticipated in case of the Variant A. The price of kiln and drier is estimated to be 75% in case of the Variant A. There will be used 50% trucks and saggers and the same regulation.

Cost (1000 Sf.)	Variant A	Variant B
kiln	500	670
drier	81	107
trucks	57	114
saggers	41	83
regulation	89	89
Section	768	1 063

1.5. Glaze preparation section

With regard to the 50% inputs, costs in this equipment are estimated.

- Variant A 130 000 Sf.
- Variant B 259 000 Sf.

1.6. Glazing line

The cost in the Variant A is estimated to be 70% from the price of the Variant B equipment

- Variant A 210 000 Sf.
- Variant B 310 000 Sf.

1.7. Selection line

The same difference of costs as in case of the glazing line is supposed.

- Variant A 32 000 Sf.
- Variant B 46 000 Sf.

Total costs in the production equipment

- Variant A 2 310 Sf.
- Variant B 3 278 Sf.

2. Auxiliary and Service Plants

The estimate is based on the same ratio between both the variants as the ratio in case of the production equipment is.

Investment Costs in Equipment 1000 Sf.

Item	Variant A	Variant B	% A/B . 100
1. Production equip.	2 310	3 278	70
2. Technol. lab.	123	123	100
3. Transport centre	140	200	70
4. Utility supply equip.	490	700	70
5. Metallic structures	147	210	70
6. Other auxil. equip.	140	200	70
7. Office equipment	140	200	70
8. Other services	35	50	70
TOTAL	3 595	5 066	

3. Initial Investment Costs

- Buildings and related costs are estimated to correspond to the production equipment.
- Technology and know-how will cost the same amounts.
- Implementation is estimated to cost 80% in case of the Variant A.
- Working capital is related to the production - 55% from the Variant B is cost in the Variant A.

Initial Investment Costs 1000 Sf.

Item	Variant A	Variant B	% $\frac{A}{B} \cdot 100$
1. Land	31	45	70
2. Site preparation	230	330	70
3. Buildings	1 055	1 507	70
4. Technology	160	160	100
5. Equipment	3 595	5 066	71
6. Implementation	885	1 106	80
7. Working capital	520	945	55
Total Investment	6 480	9 160	71

4. Manpower

4.1. Factory workers (direct costs)

Workers in the production are regarded as necessary operators of the used equipment with addition of 20% to cover sickness etc.

Section	Variant A	Variant B
1. Body preparation	2	4
2. Atomizer	3	3
3. Presses	4	4
4. Drier and kiln	8	12
5. Glazing and sel.	5	9
6. Handling mat.	1	1
7. Other (supplements)	4	7
TOTAL workers	27	40

4.2. Factory services and supervisors (fixed costs)

Category	Variant A	Variant B
1. Supervisors	4	4
2. Maintenance	2	4
3. Drivers	2	2
4. Cleaning	1	2
5. Guard	4	4
TOTAL	13	16

4.3. Staff (administrative costs)

Category	Variant A	Variant B
General manager	1	1
Production manager	1	1
Sales manager	1	1
Book-keeping	2	2
Sale	1	1
Technologist	1	1
Laboratory	1	1
Designer	1	1
Clerks	2	3
TOTAL	11	13

4.4. Wages and salaries

- average wages per year (direct costs) 12 000 Sf.
- average wages per year (indirect costs) 14 100 Sf.
- average salary per year (admin. costs) 23 600 Sf.

	Variant A	Variant B
- direct labour	324 000 Sf.	480 000 Sf.
- factory overheads	183 000 Sf.	226 000 Sf.
- admin. overheads	260 000 Sf.	307 000 Sf.

5. Direct Material and Inputs

Costs in direct material and inputs are dealt with in Chapter 4 and they are 7.72 Sf./sq.m.

6. Other Factory Overheads

These costs are composed by spare parts, lubricants, auxiliary materials and utilities, when totaled and related to the direct labour, they are 49% from the cost in direct labour (Chapter 4).

7. Other Administrative Overheads

These costs are estimated to be 20% from salaries.

Total Manufacturing Costs

Item	Unit	Variant A (90 000)		Variant B 160 000)	
		cost 1000 Sf.	cost per unit	cost 1000 Sf.	cost per unit
1. Direct mater.	sq.m.	695	7.72	1 235	7.72
2. Direct labour	sq.m.	325	3.61	480	3.0
3. Factory overh.		341		460	
fixed wages		183		226	
other overh.	direct labour	158	49%	234	49%
4. Admin.overheads		315		370	
Salaries		260		310	
Other overheads	salaries	55	20%	60	20%
5. Distribution costs	sq.m.	40	0.44	70	0.44
Operating Costs		1 715		2 615	
6. Financial costs		130		190	
7. Depreciation		540		755	
Manufacturing Costs		2 385		3 560	

8. COMPARISON OF BOTH VARIANTS

8.1. Break even analyses

f = fixed costs
v = variable costs
p = price

$$BEP = \frac{f}{p-v}$$

VARIANT A	VARIANT B
f = 1365	f = 1840
v = 11.3	v = 10.7
p = 27	p = 31.7
BEP = 86.900 sq.m. or 96.6% cap.	BEP = 87600 sq.m. or 54.8% cap.

Note: price in case of Variant A is derived from prices of the 85/15 ratio between undecor. and decor sets in case of the anticipated home demand.
In case of the exported tiles the same ratio is anticipated to be 15/85.

8.2. Simple rate of return

$$R = \frac{NP + l}{K} .100$$

NP = net income (after depreciation and interest)
l = interest
K = investment

	VARIANT A	VARIANT B
NP	45	1515
l	130	190
K	6480	9160
R	2.7%	18.6%

8.3 Sensitivity analyses

a) prices in export cut off by 30%

VARIANT A	VARIANT B
f = 1365	f = 1840
v = 11.3	v = 10.7
p = 27	p = 27
BEP =86.900(96.6%)	BEP = 112900 (70.6%)

b) average price cut off by 10%

VARIANT A	VARIANT B
f = 1365	f = 1840
v = 11.3	v = 10.7
p = 24.3	p = 28.5
BEP=105000(116.7%)	BEP = 103400 (64.6%)

c) variable costs increased by 10%

VARIANT A	VARIANT B
f = 1365	f = 1840
v = 12.4	v = 11.8
p = 27	p = 31.7
BEP=93500(103.9%)	BEP = 92.500(57.8%)

d) fixed costs increased by 10%

VARIANT A	VARIANT B
f = 1500	f = 20
v = 11.3	v = 10.7
p = 27	p = 31.7
BEP = 95500(106.2%)	BEP = 96400 (60.3%)

e) the above-mentioned contingencies met simultaneously

VARIANT A	VARIANT B
f = 1500	f = 2025
v = 12.4	v = 11.8
p = 24.3	p = 24.3
BEP =126000(140%)	BEP = 162000(101.2%)

9. CONCLUSIONS

9.1. Variant A would not be a sound investment because of the very small return.

9.2. Variant B is in any case worth of consideration for the low probability of being red and very good return on investment

ANNEX 2

Analysis of Heat Units

This Annex deals with the question which type of kilns shall be used in the wall and floor tile production in Suriname. There are two possible types of kilns which could be installed, electric power fired kiln or oil fired one from the point of view of fuel availability in Suriname. To decide which type of fuel shall be applied, the criterion of production costs was taken into consideration.

The application of the electric fired kilns shows the following advantages:

- better efficiency of fuel, consumption of heat energy in case of the electric power fired kilns is in general 2 - 3 times lower than that of other types of kilns,
- easier regulation and therefore more comfortable operation,

and the main drawback is higher cost in installation.

Investment Costs	- electric power fired kiln	1 150 th. Sf.
	- oil fired kiln	775 th. Sf.
	Difference	375 th. Sf.

Operating costs

Electric power fired kiln consumes 0.75 kWh per 1 kg of products. Muffled oil fired kilns consume in average 9.8 MJ/kg or 2.72 kWh/kg (i.e. 3.63 times higher than the electric one).

Consequently, the annual heat consumption in the plant's 160 000 sq.m. production will be in case of the electric power fired kiln 1 406 MWh and 5 000 MWh in case of the oil fired kiln. (Calorific value of light oil is 40 GJ/ton or 11.11 MWh/ton or 11.11 KWh/kg).

Consequently, the annual consumption will be in case of the oil fired kiln 450 ton (550 Sf./ton) and costs 247 500 Sf.

In case of the electric power fired kiln, costs will be
350 000 Sf. (250 Sf./MWh).
Difference 102 500 Sf.

But there is one question to be taken into account. After the governmental projects of water electric power stations are realized completely the price of 1 MWh is expected to be 70 Sf. A formula describing the break even for the electric power from the point of view of cash flow can be as follows:

$$F + C \times (1 + a)^t = L$$

F = 24 566 (economic life of kilns considered 15 years initial higher investment: 375 000 : 15 = 25 000)

C = 140 000 (kWh of electric power per 160 000 sq.m. products)

a = 0.22 (22% required rate of return)

t = numeral related to the year of starting supplies of cheaper electric power (e.g. 1985 = 1 then 1990 = 6)

L = 247 500 cost in oil firing

x = price of electric power at which cash flow will be the same

then $x = 0.16 \times 1.22^t$

e.g. the change of electric power price sets in in 1984, then the costs in firing by both the fuels will equal only if 1 kWh of electric power is 0.16 Sf.

The following table shows prices of 1 MWh in successive years of the change of el. power at which the cost in firing by either light oil or el. power will be the same:

Year of price change	t	x = price of el. power MWh
1984	0	160 Sf.
1985	1	130 Sf.
1986	2	110 Sf.
1987	3	90 Sf.
1988	4	70 Sf.

If the governmental projects started delivering electric power priced 70 Sf/MWh before 1988, using an electric power fired kiln would be cheaper. However, because there can be contingencies related to both the start-up and the planned price, installation of the oil fired kiln is recommended. The application of electricity for ceramic firing will be taken into consideration during projecting works on expansion of the ceramic industry in Suriname artistic, sanitary ware and dinnerware making.