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ADVISORY ASSISTANCE FOR THE IDENTIFICATION OF INDUSTRIAL OPPORTUNITIES

UC/UAE/87/111

UNITED ARAB EMIRATES

Terminal report*

Prepared for the Government of the United Arab Emirates
by the United Nations Industrial Development Organization

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United Nations Industrial Development Organization

Vienna

* This document has not been edited.

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I. INTRODUCTION

A. BASIC INFORMATION

The United Arab Emirates (UAE) is a Federation of seven Emirates comprising Abu Dhabi, Dubai, Sharjah, Ras Al Khaima, Fujairah, Ajman and Al Qaiwain. Each Emirate is located on the coast, some of them have inland enclaves.

The UAE lies in the dry tropical zone. The coastal areas are very hot and humid in summer (May - October) with temperatures reaching 48°C and 100 percent humidity. By contrast the winter season is mild with an average rainfall of only 42 m/m.

The total population increased considerably in the past two decades reaching an estimated 1.9 mn in 1989. This was due mainly to the importation of workers which explains also the predominance of the male component reaching some 69 percent of the total. The most populated Emirate is Abu Dhabi with 41 percent of the total population, followed by Dubai with 28 percent and Sharjah with 15 percent.

The total working population was estimated at 635,000 in 1989. The majority of the labor force is engaged in the construction sector, government services, trade and catering. Less than 10 percent of the working population is employed by the manufacturing sector. The unemployment rate is negligible.

The UAE economy is heavily dependent on oil and gas produced mainly in Abu Dhabi and to a lesser extent in Dubai, Sharjah and Ras Al Khaimah. Thus, periods of economic growth are associated

with higher oil prices as in 1975-77, 1979-81 and 1987. However, gross domestic product registered negative real growth during the period 198[illegible] - 1988. At 1980 prices GDP fell by about 34 percent. The total GDP for 1986 at market prices was estimated at US$ 21,582 mn.

The manufacturing sector contributed 12.5 percent of GDP at current prices in 1986. The dominant sub-sector is chemicals and petroleum refining including petrochemicals, rubber and plastics which account for about 60 percent of total manufacturing value added. Other important manufacturing sectors are metal products and machinery; basic metals; food, beverages and tobacco; and construction materials.

The factors which favor industrial investment are the following:

- Geographical location manifested in the development of entrepôt trade in Dubai.
- Accessibility to the GCC market, the membership of which consists of six Gulf States namely: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE. To enjoy exemption from custom duties within the GCC market, the value added domestically must be not less then 40 percent of the value ex-factory.
- Availability of cheap capital, thus encouraging the setting-up of capital intensive industries. By contrast labor intensive industries are not a priority objective of the government as such labor is imported.
- Cheap utilities, namely energy and water which are provi-

ded at subsidized prices.

- Excellent infrastructure including communications, port facilities, air connections and telecommunications.
- Fiscal incentives comprising exemptions from customs duties for an unlimited period on imported raw materials, intermediate products and machinery for industry; tax holidays are granted to joint ventures in an industrial project for 5 years which are renewable, whereas national industrial projects are exempt from income and company taxes.
- Financial incentives comprising subsidized loans are available through the Emirates Industrial Development Bank which charges interest at 5 percent. Joint ventures are allowed provided foreign capital (non-GCC origin) does not exceed 49 percent of the total capital. GCC capital can be invested without being associated with local capital.
- Subsidized land is available within the many established industrial areas and the industrial free zones.

B. INVESTMENT OPPORTUNITIES

The policy of the government aims at diversifying the sources of national income. The many incentives summarized above are conducive to realizing that goal. The main constraint, however, is the relatively small domestic market and the paucity of the natural resources apart from oil and gas.

The UAE's membership in the GCC market could provide opportunities for industrial investment provided industrial coordination at the planning level is strictly pursued by the member countries. The aim of such ploicy is to evolve a complementary

production structure within the GCC sub-region which may be expanded through established regional mechanisms to include other countries within the Arab region.

The initiation of manufacturing enterprises appears to be hampered by the lack of viable projects. For this reason UNIDO financed the project UC/UAE/87/111 entitled "Advisory Assistance for the Identification of Industrial Opportunities". Two consultants were recruited to identify 20 opportunity studies. The duration of their assignment extended from December 1989 to March 1990. Their field work was reportedly rendered difficult by the lack of readily available data and statistics. The weakest element in the studies was that concerning the market. Furthermore, it was difficult for them to obtain prices and costs of certain inputs. Out of twenty project opportunities proposed by the consultants, only eleven were accepted and revised by UNIDO. These are presented in this report with recommendations for follow up action. In the majority of cases, it is recommended that a market survey or raw material study be undertaken prior to the preparation of a feasibility study. In some cases, it is advised that a joint venture agreement or license agreement be negotiated as well with the foreign producer of the selected product in order to facilitate both its domestic marketability and the transfer of technology. A list of the eleven opportunity studies is shown in table 1 on page 7.

Under the assumed parameters the proposed projects have the following common features:

- The products are not being manufactured locally and in

most cases are not manufactured within the GCC countries.

- The proposed projects depend largely on the domestic market for the sale of their output, although for some there will be opportunities in the GCC market.
- The proposed capacity of each project is within the prescribed minimum economic size.
- The manufacturing process does not require sophisticated technology, hence the training of local workers does not pose a problem.
- The selected products will substitute for imports and in some cases could contribute to exports.
- The projects are of small and medium scale, and hence would require low capital investment.
- For the sake of simplicity, the required capital investment in each proposal is assumed to be entirely in the form of equity. In practice, however, eligible projects will be partly financed through soft loans from the Emirates Industrial Development Bank.

TABLE 1

LIST OF OPPORTUNITY STUDIES COVERED IN THIS REPORT

TITLE	CAPACITY PER YEAR	INVESTMENT US$ '000	RECOMMENDED FOLLOW UP ACTION
1.Leather Tanning	785,000 sq.ft.	2,125	Market study and raw material study
2.Containers,Dumpers and Tanks for Trucks	1440 units of all three products	11,500	Market study
3.Alkaline Dry Cell Batteries	5 mn units	3,212	Market study, and negotiate a joint venture agreement
4.Electric Cookers	10,000 units	1,150	Market study and negotiate a license agreement
5.Centrifugal Pumps	10,000 units	3,250	Market study and negociate a licence agreement
6.Lead Acid Automotive Batteries	250,000 units	11,793	Market study and negotiate a joint venture agreement
7.Date Processing and Packaging	2800 tons	7,236	Feasibility study
8.Welded Steel Pipes	82,000 tons	23,000	Market study
9.Glass Bottles	89,031 gross bottle	3,358	Raw material study
10.Sanitary Paper	3000 tons	3,223	Feasibility study and negotiate with existing end users
11. Fish meal/ Fish oil	475 tons/ 75 tons	610	Feasibility study

Table 2 below gives the list of industries proposed by the consultants but not included in this report for lack of sufficient justification.

TABLE 2

LIST OF PROJECT IDEAS TO BE RE-EXAMINED

1. Industrial Gate Valves

   This project may be examined in conjunction with that of the centrifugal pumps.

2. Electric Meters
3. Water Meters
4. Elements for Electric Water Heaters
5. Door Hinges
6. Door Knobs
7. Door Locks
8. Galvanized Steel Pipes

   This project should be examined in connection with that of the Welded Steel Pipes.

9. Carbon Steel Sheets

   This is a large scale project and the market in the UAE is too small to render it profitable.

II. LEATHER TANNING PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

The purpose of the project is to produce tanned leather from the raw hides and skins of cows, camels, goats, sheep and deer. The tanned leather will be either exported or used locally for producing leather products such as shoes, gloves, garments, upholstery etc. Each type of natural leather is suitable for certain specific uses.

1.2 Justification for Selecting the Product

The tanned leather needed by the local industries is entirely imported; whereas raw hides and skins are exported. The average number of slaughtered animals per year was estimated af follows: goats 42,640 heads, sheep 14,000 heads, cows 7,860 heads, and camels 16,000 heads. The UAE will therefore benefit if the raw hides and skins are processed and supplied to the local industry or exported as it will enjoy a higher value added. On the other hand, with the establishment of a tanning industry, the demand for the raw material will rise, thus stimulating the development of the animal wealth in the country.

1.3 Product Specification

Tanned leather may be produced in different thicknesses, patterns, tannage and colors. The quality of the finished leather should be of high standard as the market is very competitive. For each use of finished leather, certain specifications are

required for example regarding durability, resistance against water, heat, cold and dryness as well as color fastness. The size of each leather price and its thickness may also vary with each kind of animal.

2.1 DEMAND

To assess the domestic market, one needs to know the annual consumption of finished leather in square feet or square meters, broken down by type of animal. Apparently such information is not readily available neither for the present nor for the past. In other words, it is not possible to show what the total domestic demand is at present or will be in the immediate future. In the absence of official statistics, it would be necessary to obtain such information from importers and from current users of finished leather, through a market survey. On the other hand, finished leather is an exportable commodity provided the quality meets international standards and the price is competitive.

2.2 Plant Capacity

In the absence of a market survey, a small scale plant is proposed to process annually the following: 15,000 sheep skins, 25,000 goat skins, 10,000 cow hides, and 10,000 camel hides. The average size of a sheep skin is about 7 square feet, a goat skin 6 square feet, a cow hide 23 square feet, and a camel hide 30 square feet. On this basis, the total annual production capacity will be 785,000 square feet, operating for 300 days a year in one shift of eight hours each. If the above quantity of raw cow

hides is not available locally, then the balance should be imported. This product mix is theoretical and should be adjusted to reflect the results of the market survey.

3 SALES REVENUE

It is assumed that the entire production of finished tanned skins is sold in the domestic market. The average wholesale price per square foot for cow skin is about US$ 3.0, for sheep and goat skin US$ 2.0, and for camel skin US$ 2.5. For inferior quality, the price will be lower. According to these prices, the gross sales revenue equals:

23 x 10,000 x 3.0 =	690,000
7 x 15,000 x 2.0 =	210,000
6 x 25,000 x 2.0 =	300,000
30 x 10,000 x 2.2 =	660,000
Total	1,860,000

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Material

The main raw material is wet-salted raw hides and also chemicals. The source of the raw hides is cows, sheep and goats and to a lesser extent camels. These are to be obtained from the slaughter houses. The availability of an adequate quantity of raw skins should be verified through a survey of slaughter houses. The process of tanning and finishing requires certain industrial grade chemicals all of which will be imported except for lime, salt and sulfuric acid which are available locally.

Factory supplies will also be required, such as, gear oil

and grease. The average cost of the raw cow skin is estimated at US$ 13 per piece, sheep skin US$ 5.0, goat skin US$ 4.0, and camel skin US$ 7.0.

4.2 Utilities

Electricity requirement is at the average rate of 2 KWH per hide or skin, at a cost of US$ 0.02 per KWH.

Water requirement is, at the average rate of 34 gallons per hide or skin at a cost of US$ 0.0041 per gallon.

5 APPROXIMATE LOCATION AND SITE

The tannery should be located near a large supplier of raw skins (slaughter house) and where utilities, and the necessary infrastructure are available including facilities for waste disposal. Sharjah is recommended as a location for the tannery. The area required is 3000 square meters. The cost of buildings and site preparation is estimated at US$ 0.5 mn.

6 PROJECT ENGINEERING

6.1 Process and Technology

The processing of hides and skins can be divided into three distinct phases:

First the production of wet-blue leather, second crust leather and third finished leather. From the international market point of view, wet-blue leather has a strong demand whereas it is difficult to export crust leather and even more difficult to export finished leather. Therefore, a tannery producing

finished leather must ensure a domestic market for its finished leather; otherwise it is more prudent to start with the production of wet-blue leather and then move to the production of crust leather and if market conditions are favourable finished leather may be produced.

The manufacturing process for finished leather is as follows:

- The salted hides are weighed and washed with water and trimmed.
- The hides are limed and then drained and washed in water.
- The flesh is removed from the pelts (limed hides) in the splitting machine.
- The lime is washed away in a drum containing water and ammonium sulfate.
- The pelts are then pickled and tanned. The resulting product is known as chrome wet-blue leather.
- The leather is shaved to the desired thickness and re-tanned.
- The leather is dried and then flat liquored.
- In the finishing process the leather is staked, buffed, sprayed with paint pigment, dried, polished, ironed and/or plated. See attached flow Chart.

6.2 Main Machines and Equipment

- Soaking drums
- Liming drums
- Fleshing machines
- Splitting machine

- Shaving machines
- Chrome tanning drums
- Flat liquoring drum
- Drying tunnel
- Sammying machine
- Setting out machine
- Spraying cabinet with exhaust removal
- Stacking machine
- Buffing machine
- Pin wheel measuring machine

6.3 Auxiliary Equipment

- Compressed air installation
- Water treatment and recycling equipment
- Maintenance workshop
- Materials handling equipment

The total cost for machinery and equipment is estimated at US$ 1,350,000.

7 MANPOWER

The manpower requirement as shown in the table below is 35 persons at an annual cost of US$ 300,100. The wages and salaries given represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the supplier of the know-how and equipment.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	3	16,400	49,200
Skilled workers:	27	8,200	221,400
Unskilled workers:	5	5,900	29,500
Total:	35		300,100

8 PROJECT IMPLEMENTATION

The project implementation period is assumed to be 2 years of which 6 months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 2,125,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	500,000
Machinery and equipment :	1,350,000
Technology acquisition and training:	75,000
Working capital:	200,000
Total:	2,125,000

Production Costs

The total production costs amount to US$ 1,110,900. The major categories of production costs are shown in the table below:

Costs	Value in US $	
1 Raw materials:	385,000	
2 + Manpower:	300,100	
3 + Utilities:	11,000	
4 + Maintenance:	44,000	
5 + Other factory overhead:	100,000	
6 = Factory costs:		830,100
7 + Insurance:	20,000	
8 + Marketing, sales & distribution:	55,800	
9 + Other administrative overhead:	50,000	
10 = Operation costs:		125,800
11 + Depreciation:		155,000
12 = Total production costs:		1,110,900

9.3 Commercial profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue = US$ 1,860,000
Minus total production costs = 1,110,900
Equals Net profit = 749,100

$$\text{Therefore, RR} = \frac{749,100}{2,125,000} \times 100 = 35.2 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{2,125,000}{749,100 + 155,000} = 2.3 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

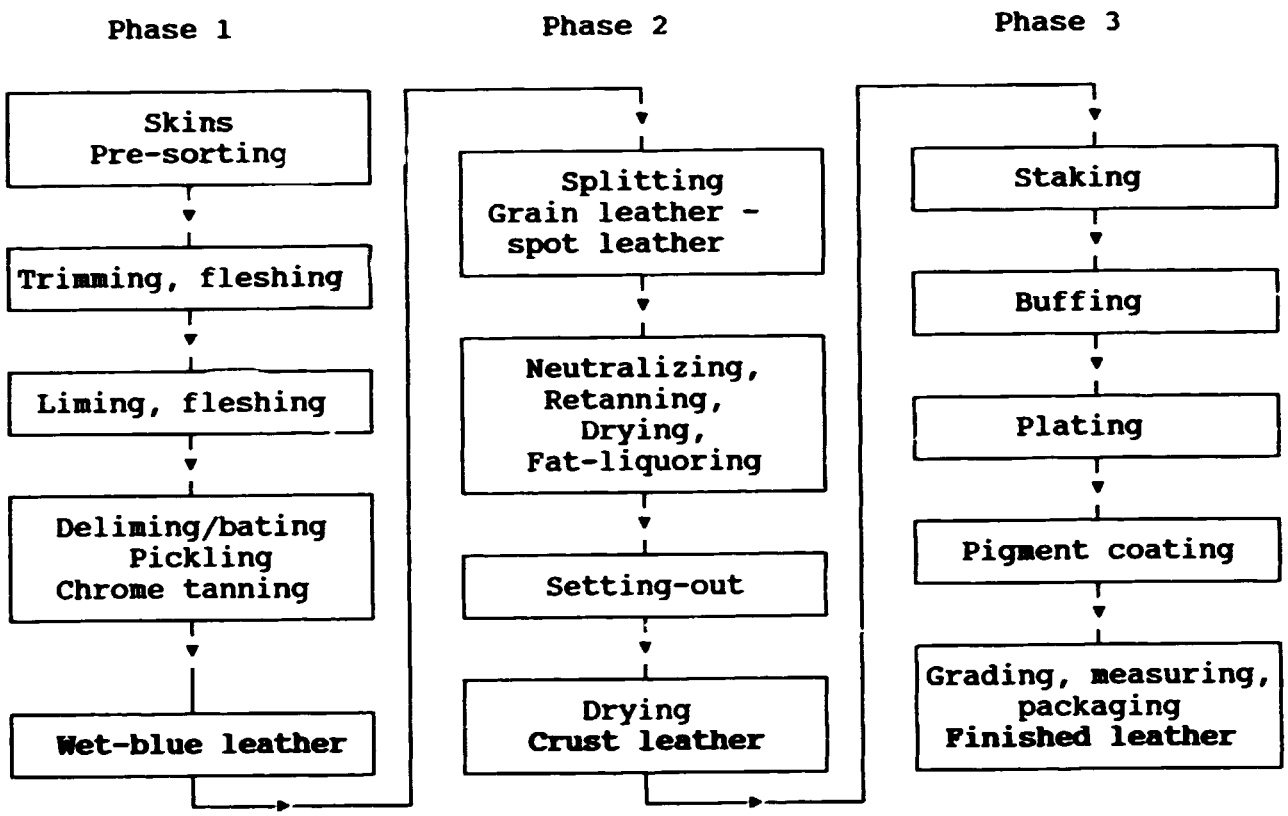
The financial evaluation shows a favourable commercial profitability with the RR at 35.2 percent and a PB of 2.3 years after operation. However, as pointed out above, it is essential to undertake a market and raw material survey which will determine:

(a) What product mix will the domestic market require and whether this demand will qualify the setting up of a plant.

(b) whether an adequate quantity of raw hides and skins is available locally to supply the tannery, and if not what quantities should be imported.

(c) What are the export opportunities for processed hides/skins.

FLOW CHART
LEATHER TANNING PLANT



III. CONTAINERS, DUMPERS AND TANKS FOR TRUCKS MAKING PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

This plant will produce three different components to equip medium- and heavy-duty trucks. These are:

- Secure, weather proof containers for transporting goods.
- Tiltable dumpers for transportation of building materials, stones and other materials, which are not affected by weather conditions.
- Tanks for transportation of water or other fluids.

The components will be mounted on the chassis of the imported trucks.

1.2 Justification for Selecting the Product

There is no national production of containers, dumpers or tanks. These components are imported mainly from Kuwait. The production process is relatively simple and does not need any sophisticated equipment. This project therefore, will be a good case, for import substitution.

1.3 Product Specifications

The exact specifications will depend on the chassis of the trucks. However, the following specifications will always be valid:

a) Containers will be manufactured from hot rolled carbon steel sheets with a thickness between 3 and 4 mm.

b) Dumpers will be manufactured from hot rolled carbon steel

sheets of 4 mm thickness. The tilting mechanism will be a hydraulic jack operated by a gear pump, driven by the truck engine.

c) Tanks will be manufactured from hot rolled carbon steel sheets of 3 mm thickness. The tank will have valves for loading and discharging. It will have an anti-corrosion coating from the inside.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

Though all of the present supplies come from imports, official statistics on imports of containers, dumpers and tanks are not readily available. Demand is influenced by the number of trucks on the road, new imports of trucks, life span of the trucks and general economic conditions. The number of vehicles used for transportation of goods and heavy materials is estimated at 100,000. However not all trucks will need the components offered by this project. Accordingly, a rough estimate of demand is conservatively made at 5000 components per year. In addition, exports to neighboring markets might be explored.

2.2 Plant Capacity

For this plant it is assumed that the annual sales of all three products will be 1440 units. The plant will operate in one shift of 8 hours a day and 300 days per year. It is further assumed that the plant will produce annually 720 containers, 360 dumpers and 360 tanks. However, the production-mix may be adjusted to match the actual market demand.

3 SALES REVENUE

The wholesale prices of each of the products are assumed as follows:

- Container = US$ 6,000
- Dumper = US$ 9,000
- Tank = US$ 7,000

Accordingly gross sales revenue equals:

- Containers	720 x 6,000	= US$	4,320,000
- Dumpers	360 x 9,00(	= US$	3,240,000
- Tanks	360 x 7,000	= US$	2,520,000
Total		= US$	10,080,000

4 SUPPLY OF RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The chassis of the vehicle are imported unequipped. The following are the requirements of raw materials.

- Carbon steel sheets t/unit of containers 1.5
- Carbon steel sheets t/unit of dumper 2.3
- Carbon steel sheets t/unit of tanks 2
- Hot rolled steel channels t/unit of dumper 0.2
- Hydraulic equipment/unit of dumper 1
- Electrodes box of 50 electrodes/unit 4
- Wood blocks (red wood) 3" x 7" length 20 feet/unit 2
- Anti-corrosion compound Kg/unit of tanks 4
- Synthetic paint Kg/unit 4.5

The cost of the above raw materials are:

For one container = US$ 2,000

For one dumper = US$ 3,700

For one tank = US$ 2,200

4.2 Utilities

Electricity: 350 KWH per unit at $ 0.02/KWH

Water: 50 gallons per unit at $ 0.0041/gallon

5 LOCATION AND SITE

It is proposed to locate the plant near the main workshops for trucks. The final location should also be close to the port facilities, to minimize the transport costs of raw materials. The proposed location is in the Abu Dhabi Emirate. The required site area is 10,000 square meters. The cost of buildings and site development is estimated at US$ 1.5 mn.

6 PROJECT ENGINEERING

6.1 Process and Technology

a) Preparation Section:

For the 3 kinds of products, the raw materials are delivered from the dump stores to the preparation section, where the different constituents of products are cut to size and folded to the required shapes.

b) Container production line:

The different parts are assembled together by welding

operations. The assembled container is transported to the assembly area, where it is mounted on the truck chassis, then it is moved to the painting section where it is cleaned and painted with the desired color.

c) Dumper production line:

The parts of the dumper are transferred from the preparation section to the assembly area, where the dumper is assembled. The under carriage of the dumper is also assembled in this area. The dumper and the under carriage, are transferred to the assembly area where they together with the hydraulic equipment are mounted on the chassis. The truck is moved to the painting section where it is cleaned and painted with the desired colors.

d) Tank production line:

After the parts are prepared and cut to size, the body of the tank is rolled according to the needed capacity, then it is assembled with the two end sides, after assembling it is transferred to the inside coating section, where it is sandblasted and coated with anti-corrosion chemical painting, then the tank is transferred to the assembly area, where it is mounted on the chassis of the truck. Finally, the truck is moved to the cleaning and painting area where it is cleaned and painted in the desired color.

See the flow chart, attached at the end of the study.

6.2 Main Machines and Equipments

- Guillotine shear
- Hydraulic press
- Universal shear
- Disc saw
- Column drill
- Mechanical press
- Grinding machine
- Rolling machine
- Arc welding equipment
- Wood saw
- Sand blast installation
- Anti-corrosion coating installation
- Painting installation

6.3 Auxiliary Equipments

- Maintenance Workshop
- Overhead cranes
- Transporting and handling equipments

The total cost for machinery and equipment is estimated at US$ 7.5 mn.

7 MANPOWER

The manpower requirement is shown in the table below. The wages and salaries represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the supplier of the know-how and equipment.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	3	16,400	131,200
Skilled workers:	35	8,200	287,000
Unskilled workers:	15	5,900	88,500
Total:	58		406,700

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2.5 years of which one year is for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 11,500,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	1,500,000
Machinery and equipment:	8,000,000
Technology acquisition and training:	1,000,000
Working capital:	1,000,000
Total:	11,500,000

Production Costs

The total production costs per year amount to US$ 6,306,700. The major categories of production costs are shown in the table below.

Production costs

Costs	Value in US $	
1 Raw materials:	3,564,000	
2 + Manpower:	506,700	
3 + Utilities:	11,000	
4 + Maintenance:	44,000	
5 + Other Factory overhead:	780,000	
6 = Factory costs:		5,021,700
7 + Insurance:	90,000	
8 + Marketing, sales & distribution:	100,000	
9 + Other Administrative overhead:	220,000	
10 = Operation costs:		410,000
11 + Depreciation:		875,000
12 = Total production costs:		6,306,700

9.3 Commercial profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue = US$ 10,080,000
Minus total production costs = 6,305,700
Equals Net profit = 3,773,300

$$\text{Therefore, RR} = \frac{3,773,300}{11,500,000} \times 100 = 32.8 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

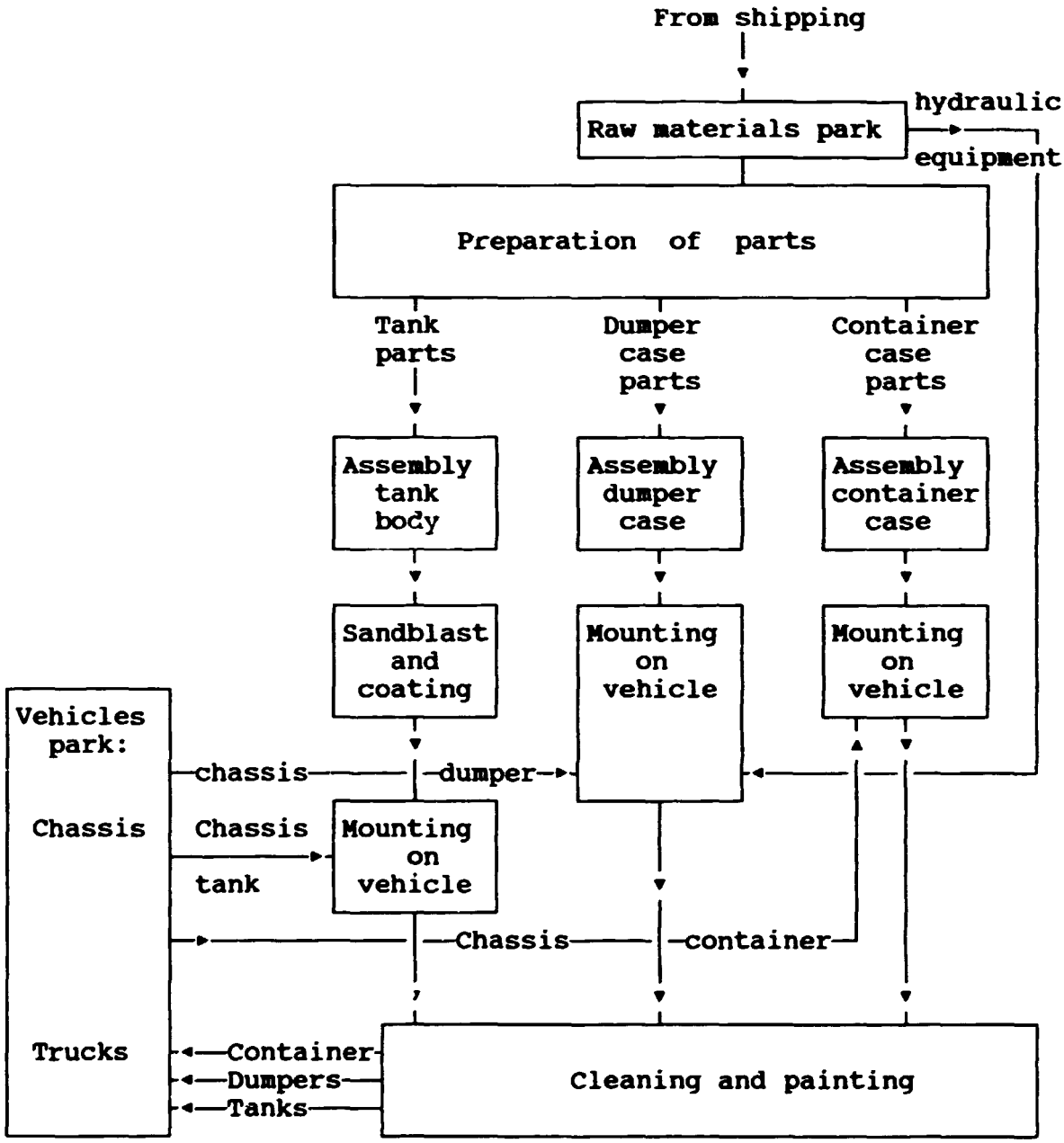
$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{11,500,000}{3,773,300 + 875,000} = 2,5 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

The financial evaluation shows very favorable results. The simple rate of return is 32.8 percent, and the payback period is 2.5 years. It is recommended to undertake a market survey to justify the product mix, and to explore the possibility of a joint venture with the Kuwaiti manufacturer of similar compo-

nents. This to be followed by a feasibility study. If the project is succesfully implemented it can later be extended to produce trailers and semi-trailer chassis.

FLOW CHART
CONTAINERS, DUMPERS AND TANKS
FOR TRUCKS MAKING PLANT



IV. ALKALINE DRY CELL BATTERIES PLANT

1.GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

The dry cell is a tool which converts the free energy decrement caused by a chemical reaction of its constituent elements into electric energy. There are three main kinds: R20, R14 and R6 which are used for the following applications:

- R20 : flash lights, radios, tape recorders, toys etc.
- R14 : flash lights, radios, tape recorders, clocks and miniature equipment.
- R 6 : flash lights, radios, cameras, calculators, hearing aids and other miniature equipment.

1.2 Justification for Selecting the Product

The demand for the product is high in the UAE and in the Gulf Region and is expected to continue to increase. Up to this date there is no dry cell battery manufacturing unit in the Region. In the UAE, the R20 dry cell commands the higest demand followed by the R6 dry cell.

1.3 Prcduct Specification

The international specifications of the various kinds of dry cell batteries are readily obtainable. This study is concerned with the basic 1.5 volt cells which are of circular cross-section. However, consumers usually give weight to certain indicators of quality, namely: service life, reliability and leak proof.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

Though the entire consumption of dry cells is imported, official statistics on dry cell imports are not readily available. However, the country is known to be liberal in its import policy and electric gadgets that require dry cells are widely in use. Per capita income is relatively high, literacy rate is above average and urbanization is prevalent. The average demand has been crudely estimated at 12 mn dry cells annually for all three kinds. Nevertheless, in future studies on this subject, demand for each kind of dry cells should be worked out in detail and consumer preferences assessed.

2.2 Plant Capacity

It should be noted that this is an industry in which maximum returns are directly proportional to scale of production. The minimum available automatic lines are designed to produce 5 million units of one type of cell in one shift. In the UAE this corresponds to the R20 dry cell whose demand is assumed to be equal to 5 million units annually. The consumption of the other two types fall short of this figure. Therefore an automatic or even a semi-automatic line for either cannot be considered. A hand-line may be utilized for the less popular types of batteries, producing a minimum of 500,000 units annually. But this additional production line is not considered in this study.

3 SALES REVENUE

The wholesale price per unit of the R20 dry cell is taken at US $ 0.7. Therefore, gross sales revenue equals:

5 mn x $ 0.7 = US $ 3.5 mn

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The following raw materials are required all of which are to be imported except the packaging material, which is produced in the country.

- Potassium hydroxide
- Nickelic hydroxide
- Acetylene carbon black
- Zinc plates
- Steel strips (printed) for the jacket including the battery base
- Nickel plated steel strips
- Polystyrene strips
- Packing material

For a gross (144 units) of R20 dry cells the raw material requirements by weight in kilograms is:

- Cadmium oxide, Nickelic hydroxide and Potassium hydroxide	1.44
- Zinc plates	2.8

- Steel strips	8.64
- Polystyrene strips	0.57
- Acetylene carbon black	1.44
Total in kg	14.89

The cost of the above material per gross of R20 dry cells is US $ 40.

4.2. Utilities

For R20 dry cells electricity requirement per gross is 20 KWH

Cost of 1 KWH is US $ 0.02

Water requirement per gross is 6.6 gallons

Cost of one gallon is US $ 0.0041.

5 APPROXIMATE LOCATION AND SITE

It is proposed that the plant will be located in Dubai. The required area for plant site is 2500 sq.m. The cost of buildings and site development is US$ 500,000. It is important to mention that climatic conditions bear heavily on the manufacture of dry cells. The ideal temperature is about 20 degrees centigrade with relatively dry air. In the UAE, where the temperature and the humidity are high, most of the year, it is necessary to install air conditioning at the plant.

6 PROJECT ENGINEERING

6.1. Process and Technology

Dry cell manufacturing is essentially the assembling of constituent parts. The automated assembly system is recommended, as it will yield savings in raw material costs and utilizes labor-saving machinery for consistent quality and reliability.

The positive active material is Nickelic hydroxide mixed with graphite to give it high conductivity. The negative active material is Cadmium oxide, both materials are used in powder form and inserted into a Zinc can to fill the space between the flat perforated Zinc plates, i.e. the negative and positive plates. The separation which are thin strips of polystyrene are inserted in the Zinc can. The entire plate assembly is fitted into a steel jacket.

The electrolyte is prepared in the plant by mixing the Potassium hydroxide with the Acetylene carbon black. The steel jacket is adjusted in the plant to the required thickness. Also the Zinc can is prepared in the plant and brought to the assembly line.

Packing boxes are prepared from semi-finished printed cardboard which is produced in the country. A flow chart is shown at the end of the study.

6.2 Main Machines and Equipment

- Electrolytic mixing machines
- Pitch boilers
- Zinc can making equipment
- Separator inserting machine
- Electrolyte pouring machine
- Carbon rod inserting machine
- Metal packet making equipment
- Zinc plates making equipment
- Packing box making machine
- Automatic assembling equipment, ~~for each production line.~~

6.3 Auxiliary Equipment

- Air conditioning installation
- Inspection equipment
- Maintenance workshop
- Transport and handling equipment

The total cost for machinery and equipment is estimated at US $ 2 mn.

7 MANPOWER

The manpower requirement is shown in the table below. The wages and salaries represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the supplier of the know-how and equipment.

Category	Number	Annual Cost per person	Total cost in US $
Management staff:	8	16,400	131,200
Skilled workers:	27	8,200	221,400
Unskilled workers:	6	5,900	35,400
Total	41		388,000

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US $ 3,212,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	500,000
Machinery and equipment:	2,000,000
Technology acquisition and training:	360,000
Working capital:	352,000
Total:	3,212,000

9.2 Production Costs

The total production costs per year amount to US $ 2,457,000. The major categories of production costs are shown in the table on the table below.

Production Costs

Costs	Value in US $	
1 Raw materials:	1,389,000	
2 + Manpower:	388,000	
3 + Utilities:	15,000	
4 + Maintenance:	65,000	
5 + Other Factory Overhead:	150,000	
6 = Factory costs:		2,007,000
7 + Insurance:	25,000	
8 + Marketing, sales & distribution:	100,000	
9 + Other Administrative Overhead:	100,000	
10 = Operation costs:		225,000
11 + Depreciation:		225,000
12 = Total production costs:		2,457,000

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue	= US $	3,500,000
Minus total production costs	=	2,457,000
Equals Net profit	=	1,043,000

$$\text{Therefore, RR} = \frac{1{,}043{,}000}{3{,}212.000} \times 100 = 32.4 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

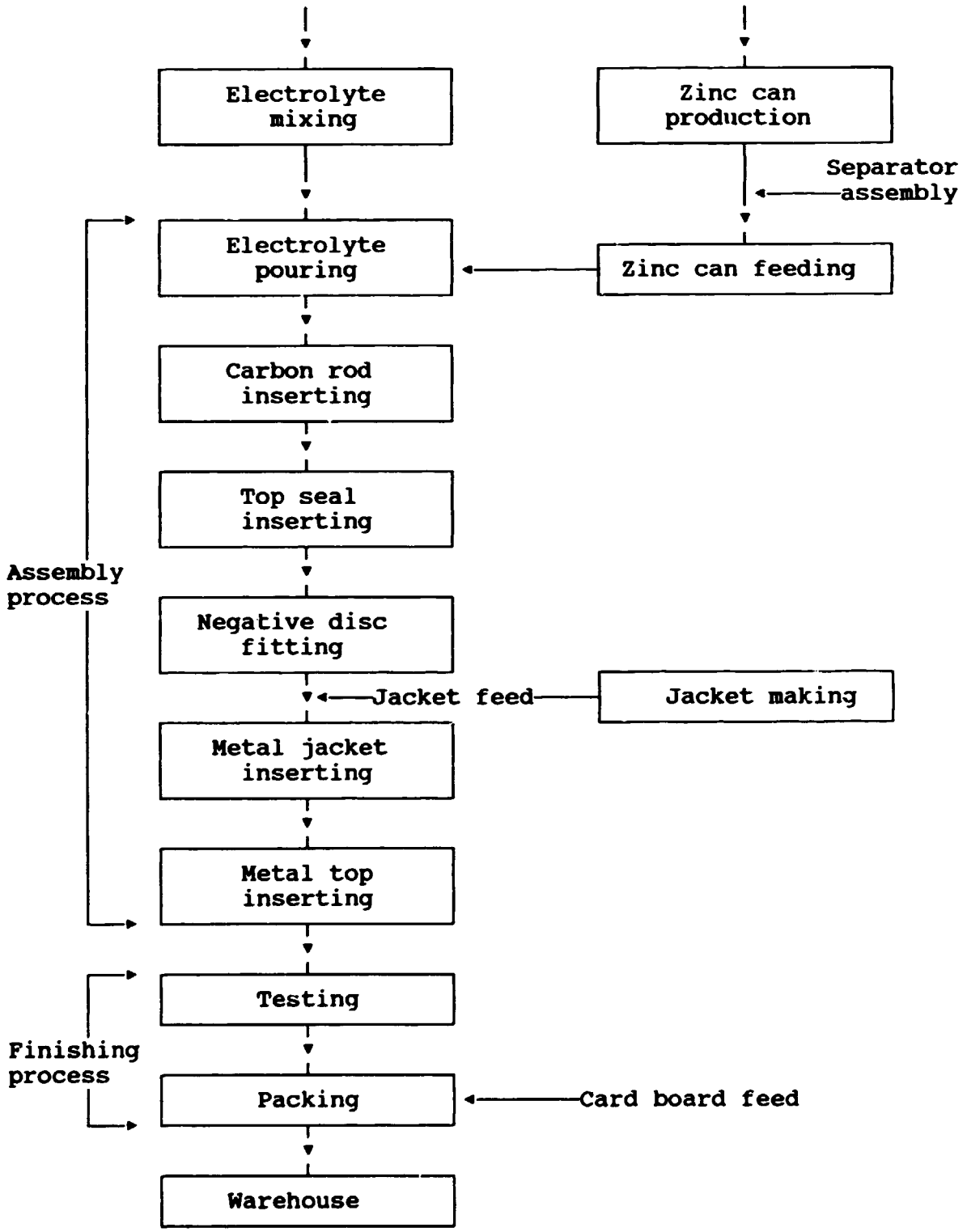
$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{3{,}212{,}000}{1{,}043{,}000 + 225{,}000} = 2.5 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

The financial evaluation shows very favorable results. The simple rate of return is 32.4 percent, and the payback period is 2.5 years. As the machinery and equipment needed for the manufacture of the R14 dry cell is basically the same, this kind

of batteries may also be produced if the market condition warrants. It is recommended to pursue the proposal in greater detail with the objective of obtaining reliable statistics on the market. It is also recommended that a joint venture agreement may be negotiated between the local sponsors and one of the international manufacturers of dry cells to facilitate the transfer of technology and train the required skilled workers.

FLOW CHART
ALKALINE DRY CELL BATTERIES PLANT



V. ELECTRIC COOKERS PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

The electric cooker is an apparatus used for preparing food by making use of electric engergy. It is used in private homes, restaurants and hotels. The proposed cooker in this study will have four electric hot plates for heating and boiling purposes and an oven capable of backing.

1.2 Justification for Selecting the Product

With improvements in the living standards, household cooking has become an important part of daily work for the family. With the introduction of the electric cooker, this work became simpler and more time efficient. The electric cooker manufacturing plant does not require a sophisticated technology or large investments in facilities.

Up to this date, there is no electric cooker manufacturing plant in the UAE, and all such appliances are imported. Importation is relatively expensive because of the high transportation costs of the finished cookers. Therefore, it would be a good case for import substitution if the cookers were imported in a knock down state and assembled locally.

1.3 Product Specification

The electric cooker will be used primarily for household

cooking and conforms to local voltage and cycle (220 Volts), having four electric hot plates and an electric oven with grill. The cabinet will be of strong coated steel plates. The exact specifications will be given under license. However, the contemplated cooker in this project will be of a small size.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

Though the entire demand for electric cookers is imported, official statistics on imports are not readily available. However, the UAE population is rising, per capita income is relatively high and urbanization is prevalent. Based on discussions with importers, the demand for electric cookers has been crudely estimated at 16,000 units annually. Nevertheless, in future studies, the domestic demand should be assessed accurately giving details on consumer preferences for different sizes of electric cookers and between electric and gas cookers.

2.2 Plant capacity

The plant capacity is assumed at 10,000 units. The plant will operate in one shift of 8 hours per day and 300 days per year.

3 SALES REVENUE

The wholesale price per cooker is taken at US$ 185. Therefore gross sales revenues equals:

10,000 x US$ 185 = US$ 1,850,000.

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The following raw materials are required, all of which are to be imported, except the packaging material, which is produced in the country.

- Steel plates for cooker body and top
- Electric hot-plates
- Electric oven-element
- Electric resistances and wires
- Oven-door, including window
- Oven shelves and grids
- Packaging materials

The cost of the above raw materials is estimated at US$ 100 per unit of finished product.

4.2 Utilities

Electricity requirement per unit is 30 KWH. The cost of one KWH is US$ 0.02.

Water requirement per unit is 1.3 gallons. Cost of one gallon is US$ 0.0041.

5 APPROXIMATE LOCATION AND SITE

It is proposed that the plant will be located in the Dubai region. The required area for the plant site is 2000 square meters. The cost of buildings and site development is US$ 200,000.

6 PROJECT ENGINEERING

6.1 Process and Technology

First the cabinet is assembled, then it is transported to the oven assembly section. The oven-element and the hot-plates are assembled and attached to the cabinet. After wiring and arranging various lead lines, an electric-test is conducted. The oven-door is fixed to the cabinet. Other components are assembled and interiors are inserted prior to the final test. The electric cooker thus finished, is packed and transported to the store room. A flow chart is attached at the end of the study.

6.2 Main Machines and Equipment

- Assembly benches and shelves
- Jigs and fixtures
- Roller conveyors
- Electrical testing equipment
- Air compressor
- Assembly tools
- Hand drills
- Bench drills

6.3 Auxiliary Equipment

- Inspection equipment
- Maintenance workshop
- Transport and handling equipment

The total cost for machinery and equipment is estimated at US$ 400,000.

7 MANPOWER

The manpower requirement is shown in the table below. The wages and salaries given represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the supplier of the know-how and equipment.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	3	16.400	49,200
Skilled workers:	12	8,200	98,400
Unskilled workers:	5	5,900	29,500
Total:	20		177,100

8 Project Implementation

The project implementation period is assumed to be 2 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 1,150,000. The breakdown by major items is given in the following table.

Cost items	Value in US$
Land:	Nominal value
Building and civil works:	200,000
Machinery and equipment:	400,000
Technology acquisition and training:	250,000
Working capital:	300,000
Total:	1,150,000

Production costs

The total production costs per year at full capacity amount

to US$ 1,507,200. The major categories of production costs are shown in the table below:

Production costs

Costs	Value in US$	
1 Raw materials:	1,000,000	
2 + Manpower:	177,100	
3 + Utilities:	6,100	
4 + Maintenance:	14,000	
5 + Other Factory overhead:	150,000	
6 = Factory costs:		1,347,200
7 + Insurance:	6,000	
8 + Marketing, sales & distribution:	50,000	
9 + Other Administrative overhead:	55,000	
10 = Operation costs:		110,000
11 + Depreciation:		50,000
12 = Total production costs:		1,507,200

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue	= US$	1,850,000
Minus total production costs	=	1,507,200
Equals Net profit	=	342,800

$$\text{Therefore, RR} = \frac{342{,}800}{1{,}150{,}000} \times 100 = 29.2 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{1{,}150{,}000}{342{,}800 + 50{,}000} = 2.9 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

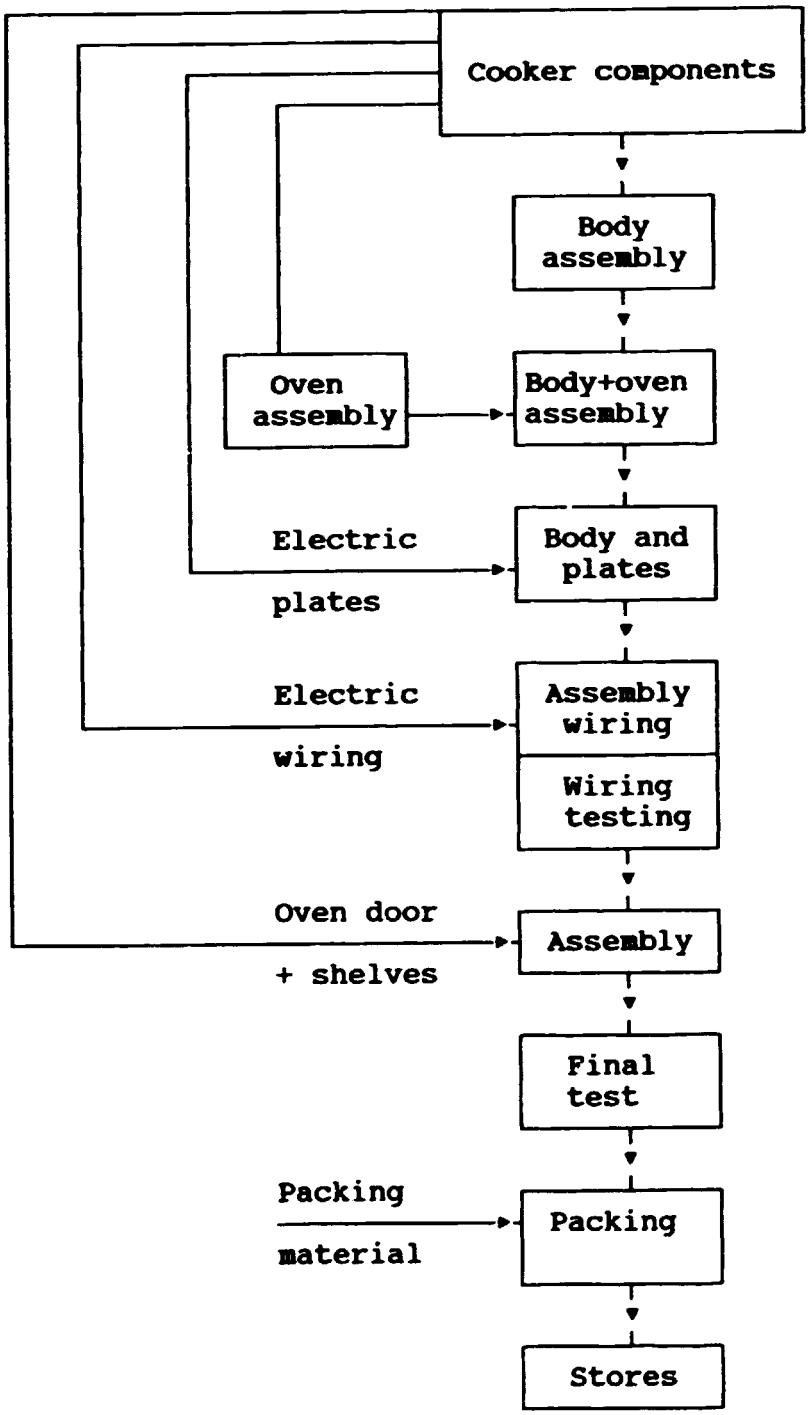
The financial evaluation shows very good results. The simple rate of return (RR) is 29.8 percent, and the payback period is 2.9 years.

It is recommended to pursue the proposal in greater details

with the initial objective of obtaining accurate information on the market aspects and subsequently to prepare a feasibility study.

It is also recommended that the local sponsor of the project should obtain a license from an international manufacturer of cookers to ensure a high quality product and to facilitate the transfer of technology including the training of skilled workers.

FLOW CHART
ELECTRIC COOKERS PLANT



VI. CENTRIFUGAL PUMPS PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

The pump is a hydraulic machine which by developing pressure is used to move fluids (such as water) to higher levels or force it through pipes and other delivery systems. The most widely used pumps are centrifugal pumps and axial flow pumps. The centrifugal pumps which are the subject of this study are used in cases where a greater lift is required. By contrast the axial flow pump is used where a low-lift (up to about 6 meters) is required. The centrifugal pumps are used mainly for industrial water, civil works, agricultural irrigation, drainage, and circulation of both cold and hot water in buildings. The pump recommended for assembly in this project is of the single suction volute type. The characteristics of the single suction is that it admits water on only one side of the impeller which itself is surrounded by a spiral case bounded by a curve called a volute.

1.2 Justification for Selecting the Product

The UAE imports all its needs for pumps which are widely used in civil construction, industry and agriculture. Because of the harsh weather conditions, the wear and tear is high and accordingly replacement is high. The life of a pump is estimated to be 10 years, if properly maintained, otherwise its life could be less than that. The local production of pumps could also have the advantage of lowering the cost of repair and maintenance.

1.3 Product Specification

Two types of the single suction pumps will be assembled.
- Horizontal shaft pumps for use mainly in building construction, will have a capacity of 4500 gallons/hour and monometric lift of 500 feet (152 meters).
- Vertical shaft pumps for use mainly in irrigation, will have a capacity of either 4500 gallons/hour and monometric lift of 500 feet (152 meters) or 6500 gallons/hour and monometric lift of 800 feet (244 meters).

2 DEMAND AND PLANT CAPACITY

2.1 Demand

Though the entire consumption of pumps is imported, official statistics on the total import of pumps is not readily available. However, the total number of pumps imported for irrigation purposes is estimated at 16,000 units per year. The demand for other purposes is estimated to be at least twice as high. Therefore, a crude estimate of demand at 50,000 units per year could be considered reasonable.

2.2 Plant Capacity

The plant will have a capacity of 10,000 units per year of which 6500 will be horizontal pumps and 3500 vertical pumps. The plant will operate in one shift of 8 hours per day and 300 days per year.

3 SALES REVENUE

The average wholesale price per pump is taken at US$ 500. Therefore the sales revenue equals:

10,000 x US$ 500 = US$ 5,000,000

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The pumps, will be assembled from parts imported in CKD and in semi-finished form. The packaging material is produced in the country. The main parts are:

- body and support in cast iron
- impeller and volute
- stuffing box
- shaft in chrome stainless steel
- mechanical seal
- roller bearings and ball bearings and covers
- sleeves and rings
- electrical motor and motor body
- packaging material

The cost of the above materials is US$ 300 per unit delivered to the plant. The total weight of each pump is 100 kilograms.

4.2 Utilities

To produce one pump the electricity requirement is 60 KWH. Cost of 1 KWH is US$ 0.02.

Water requirement per unit is 125 gallons. The cost of one gallon is US$ 0.0041.

5 APPROXIMATE LOCATION AND SITE

It is proposed that the plant will be located in the Abu Dhabi Emirate. The plant should be located in an industrial area where the required services are available. The required area of land is 3,000 square meters. The cost of buildings and site development is US$ 500,000.

6 PROJECT ENGINEERING

6.1. Process and Technology

The proposed plant is essentially the assembling of constituent parts; the process is therefore relatively simple and is performed in batches. The pump body, the impeller, the driving shaft, the wear rings and the stuffing box are machined through different machining operations. After static and dynamic balance tests of the rotating parts, the various parts are collected in the assembly area, where the pumps are mounted. Then the pump and the motor are assembled. See attached Flow Chart.

All pumps need a thorough inspection and testing for the following:

- Appearance inspection and dimensions inspection
- Hydrostatic pressure inspection
- Operating inspection
- Performance inspection
- Materials inspection
- Manufacturing inspection

- Balance and vibration inspection

Finally the pumps are painted and packed for storage.

6.2 Main Machines and Equipment

The equipment will mainly consist of:

- Assembly benches equipped with pneumatic and normal tools
- Lathes
- Boring machines
- Welding machine
- Shaping machine
- Milling machine
- Drilling machines
- Hydraulic Press
- Grinding Machine and Polishing Machine
- Painting and surface-coating machine

6.3 Auxiliary Equipment

- Testing and inspection equipment
- Compressed air equipment
- Maintenance workshop
- Transport and handling equipment, including overhead crane and fork lift.

The total cost for above machinery and equipment is estimated at US$ 1,500,000.

7 MANPOWER

The manpower requirement is shown in the table below. The

wages and salaries represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the supplier of the know-how and equipment.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	3	16,400	49,200
Skilled workers:	20	8,200	164,000
Unskilled workers:	6	5,900	35,400
Total:	29		248,600

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2 years of which six months is for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment costs

Total investment costs is estimated at US$ 3,250,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	500,000
Machinery and equipment:	1,500,000
Technology acquisition and training:	500,000
Working capital:	750,000
Total:	3,250,000

Production costs

The total annual production costs amount to US$ 4,185,600. The major categories of production costs are shown in the table below:

Production costs

Costs		Value in US $
1	Raw materials:	3,000,000
2 +	Manpower:	248,600
3 +	Utilities:	17,000
4 +	Maintenance:	50,000
5 +	Other factory overhead:	400,000
6 =	Factory costs:	3,715,600
7 +	Insurance:	20,000
8 +	Marketing, sales & distribution:	100,000
9 +	Other administrative overhead:	100,000
10 =	Operation costs:	220,000
11 +	Depreciation:	250,000
12 =	Total production costs:	4,185,600

9.3 Commercial profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue = US$ 5,000,000.
Minus total Production Costs = 4,185,600
Equals Net profit = 814,400

$$\text{Therefore, RR} = \frac{814,400}{3,250,000} \times 100 = 25 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

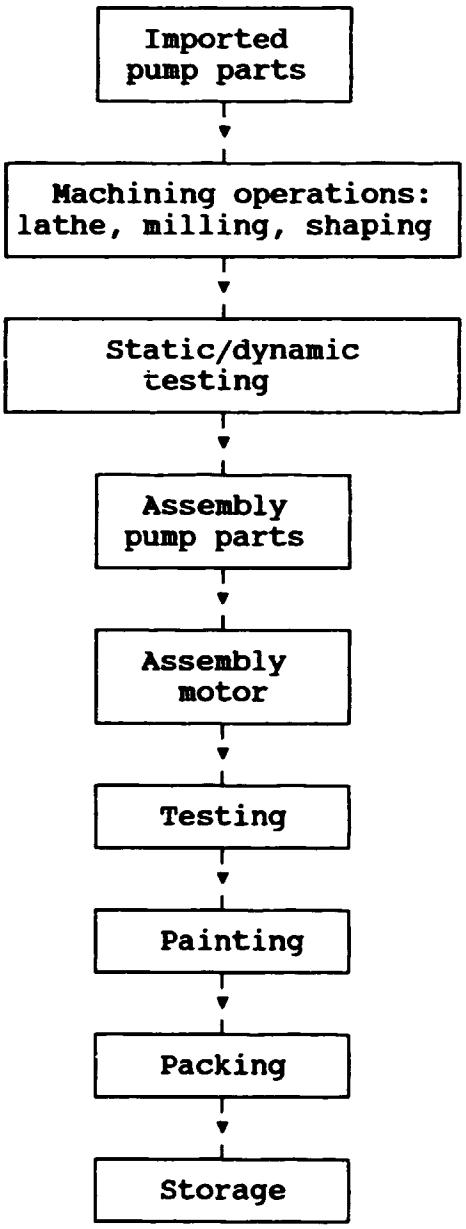
$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{3,250,000}{814,400 + 250,000} = 3 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

The financial evaluation shows favorable results. The simple rate of return is 25 percent. The pay back period is 3 years. It is recommended that a market study be undertaken with a view to determining the type of pumps which have the highest

demand. Moreover it is also recommended to negotiate a license agreement with a well known international manufacturer of pumps to facilitate the transfer of technology and to train the required workers in the initial phase.

FLOW CHART
CENTRIFUGAL PUMPS PLANT



VII. LEAD-ACID AUTOMOTIVE BATTERIES PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

Rechargeable batteries are energy storing devices being used in starting, lighting and igniting vehicles.

1.2 Justification for Selecting the Project

There is no national production of lead-acid vehicle batteries. All requirements are imported mainly from Japan, U.S.A, Germany and South-Korea. The project may be justified on the grounds that the market is expanding with the increase in population and in prosperity, and that some raw materials are locally produced like sulfuric acid and packaging material. Moreover, lead recovered from unused batteries can be recycled with considerable savings in raw material costs.

1.3 Product Specifications

There are various sizes of batteries in terms of dimensions and capacities. However, most vehicles use a 12 volt lead-acid battery with a capacity of 40 to 88 ampere-hours (AH). Such a battery weighs about 14.5 kg and can deliver the 300 to 400 amperes necessary to start an automotive engine. About 65 percent of the battery's weight is lead or lead components.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

Though all of the present supply comes from imports, offi-

cial statistics on imports of automotive batteries are not readily available. Demand is influenced by the number of cars on the road, vehicle imports, vehicle retirement, service life span of the battery, size of the population and economic conditions. However, as statistical data are meager, only rough estimates of demand can be made. The number of vehicles is estimated at 600,000, and the average life of the battery is between 24 and 30 months. Accordingly, the replacement demand is estimated at 240,000 units to 300,000 units annually. It should be noted that demand will continue to grow with the improvement in economic conditions and in population growth. Export to neighboring markets might be explored.

2.2 Plant Capacity

The plant capacity is assumed at 250,000 units per year of different sizes. The plant will operate in one shift of 8 hours a day and 300 days per year. Success in penetrating the market depends on quality and price. As this capacity is about equal to the assumed replacement demand, it is not likely that the plant will operate at full capacity. For this reason, the size of the market should be re-examined and accurately ascertained in order to determine a realistic plant capacity.

3 SALES REVENUE

The wholesale price per battery is assumed to be US$ 40. Therefore, gross sales revenue equals:

250,000 x 40 = US$ 10,000,000.

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

- About 65 percent of the battery's weight is lead or lead components.
- Lead metal is imported and made into lead grids; Lead can also be recuperated from old worn out batteries.
- Lead oxide is produced in the plant from lead metal.
- Sulfuric acid is produced in the UAE.
- Battery body, battery cover and bushes are made in the plant from polypropylene resin by injection casting.
- Packaging materials, mainly carton boxes are available locally.

One battery requires:

- Lead	8.5 kg
- Sulfuric acid (diluted 1.265)	0.125 gallons
- Polypropylene resin	3.5 kg

The cost of the above materials per unit is 15 US$.

4.2 Utilities

Electricity: 15.5 KWH per unit at US$ 0.02/KWH

Water: 0.75 gallons per unit at US$ 0.0041/gallon.

5 LOCATION AND SITE

It is proposed to locate the plant in the Dubai region. The required site area is 20,000 square meters. The cost of buildings and site preparation is estimated at US$ 3.6 mn.

6 PROJECT ENGINEERING

6.1 Process and Technology

The lead peroxide is manufactured by blowing hot air on the surface of melted lead. The oxidized lead is carried by air blowing and collected in a receiver, then mixed with water and diluted sulfuric acid to form a paste which is fed to the funnel of the spraying machine.

The lead grids are produced by a continuous casting machine which is fed by melting metal from the furnace.

After coding, the lead grids are fed by a conveyor to the paste spraying machine, where they are sprayed with paste. Then they are dried in a drying furnace. Half of the grids which will be the positive Plates (PbO_2) transferred to the grid assembly shop, the other half, which will be the negative plates (Pb), are passed through a treatment operation and sprayed with special chemicals for the formation of sponge lead (Pb) on their surface, then they are transferred to the grid assembly shop. The separators, caps and cap covers are manufactured from polypropylene resin in the injection molding machine and are passed to the grid assembly shop. After the grids are assembled in 3 cells for 6 volts batteries, and 6 cell- for 12 volts batteries, they are transferred to the battery assembly, where the battery body, cap and cap covers arrive from the injection molding machine. The battery is filled with diluted sulfuric acid through the holes in the battery cap which is pressed on the body. The bushes are screwed into the cap holes and the battery is tested for capacity in volts and amperes. The batteries are then packed in carton boxes and transferred to the warehouse (see flow chart).

6.2 Main Machines and Equipment

a) Lead peroxide paste line:

- Crucible furnace
- Hot air blower 80°C
- Receiver
- Paste mixer
- Diluted Sulfuric acid mixture

b) Grid manufacture line:

- Crucible furnace
- Continuous casting machine
- Paste spraying machine
- Drying furnace 80°C
- Sponge lead surfacing machine

c) Battery body manufacture line:

- Injection molding machine

d) Grid assembly:

- Automatic welding machine

e) Battery assembly:

- Hydraulic presses

f) Packing:

- Automatic cartoon box folding machine

6.3 Auxiliary Machines

- Maintenance workshop containing lathe, drill, small shaping machine, tools kits and benches.

- Belt or chain conveyor.
- Transport and handling equipment.
- Emergency electric generator 1200 k.v.a

The cost of machines and equipment is estimated at US$ 6 mn.

7 MANPOWER

As shown in the table below, the total number of workers is estimated at 145. The wages and salaries given represent averages for the various categories of manpower. As the process of manufactering requires special skills, it is recommended that some of the workers be trained abroad at the factory of the supplier of know-how and others be trained locally by foreign expertise.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	8	16,400	131,200
Skilled workers:	116	8,200	951,200
Unskilled workers:	21	5,900	123,900
Total:	145		1,206,300

8 PROJECT IMPLEMENTATION

The project implementation period is assumed to be 2.5 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 11,793,000. The breakdown by major items is given in the following table.

Cost items	Value in US$
Land:	Nominal value
Building and civil works:	3,600,000
Machinery and equipment:	6,000,000
Technology acquisition and training:	1,000,000
Working capital:	1,193,000
Total:	11,793,000

9.2 Production Costs

The total production costs per year at full capacity amount to US$ 7,184,700. The major categories of production costs are shown in the table below:

Production Costs

Costs	Value in US $	
1 Raw materials:	3,750,000	
2 + Manpower:	1,206,300	
3 + Utilities:	74,400	
4 + Maintenance:	216,000	
5 + Other factory overhead:	562,000	
6 = Factory costs:		5,808,700
7 + Insurance:	96,000	
8 + Marketing, sales & distribution:	200,000	
9 + Other administrative overhead:	300,000	
10 = Operation costs:		596,000
11 + Depreciation:		780,000
12 = Total production costs:		7,184,700

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue	= US$	10,000,000
Minus Total Production Costs	=	7,184,700
Equals Net profit	=	2,815,300

$$\text{Therefore, RR} = \frac{2{,}815{,}300}{11{,}793{,}000} \times 100 = 23.9 \text{ percent}$$

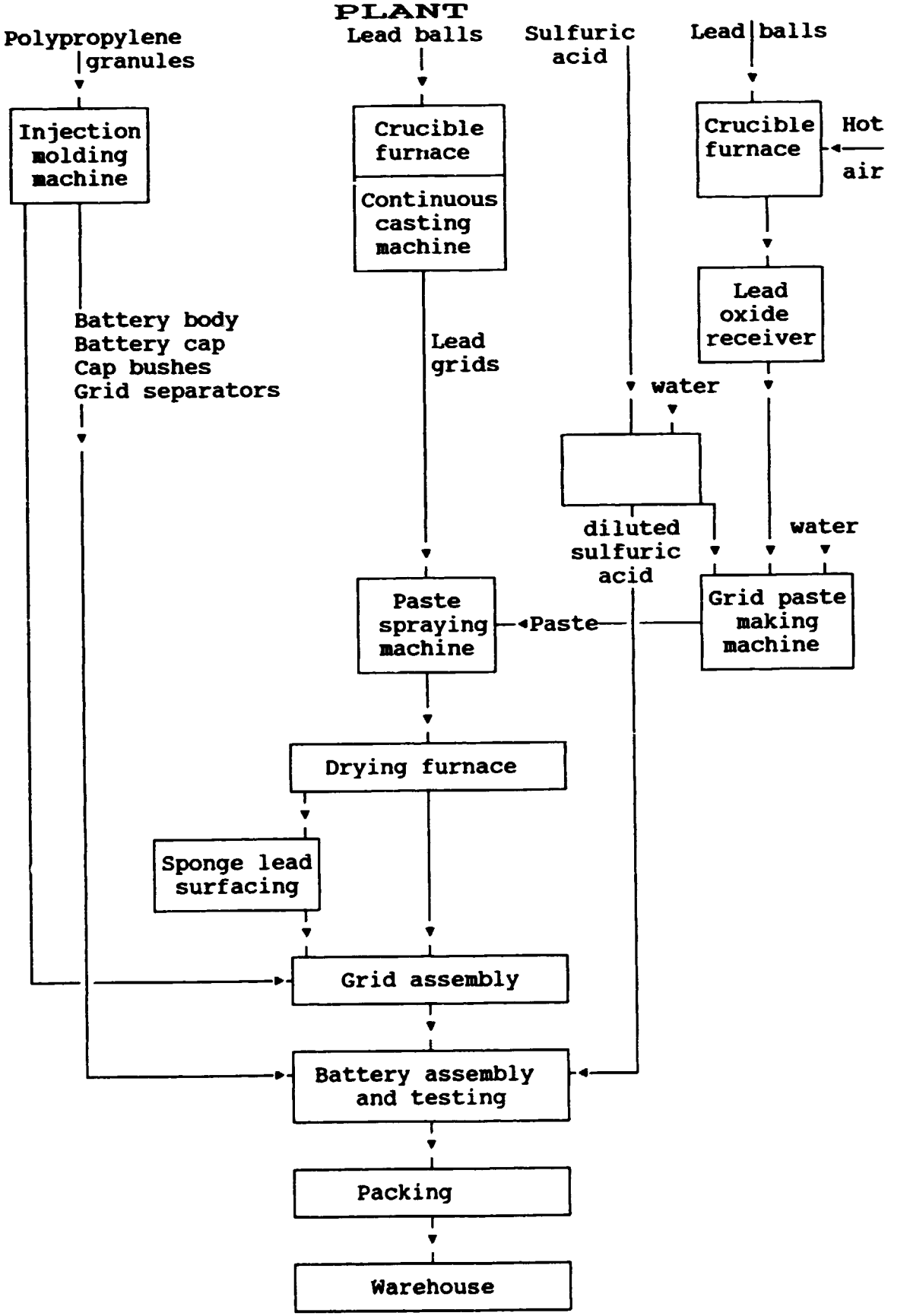
9.3.2 Pay Back Period after operation (PB)

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{11,793,000}{2,875,300 + 780,000} = 3.3 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

The financial evaluation shows acceptable results with the RR at 23.9 percent, and the PB in 3.3 years. However, as indicated earlier the current assumed domestic demand does not justify the proposed plant capacity. This points to the importance of undertaking a thorough market study before embarking on a full scale feasibility study. On the other hand, as consumers associate quality with established brand names, it is advised to explore possibilities of joint venture with the manufacturer of a brand popular in the country.

FLOW CHART
LEAD-ACID AUTOMOTIVE BATTERIES PLANT



VIII. DATE PROCESSING AND PACKAGING PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

Dates are a delicious fruit appreciated by many consumers. It is available in the markets generally in fresh natural form but also in processed packaged form. In this study four kinds of date products are proposed, namely:

(a) preserved fresh dates for ready eating;

(b) date paste for use as jam or to be cast in bars enveloped with biscuits;

(c) date syrup for the manufacture of candies and glucose;

(d) date pit powder for animal fodder.

1.2 Justification for Selecting the Product

The Government of the UAE has in the past two decades given special attention to increase the cultivated area devoted to date palms, which are known to survive the rigorous climate of sub-tropical deserts. For this reason, it is to be noted that the date crop has been increasing in recent years. With an abundance of local dates as a source of raw material, it makes good sense to exploit it through modern industrial processing. The setting up of a processing plant may diminish certain imports of dates from neighboring countries such as Saudi Arabia, Iraq and Oman and may also result in some exports of its products.

1.3 Product Specifications

Date products are expected to be of uniform quality, free from insects and foreign matter, and packed in suitable containers of desirable sizes. Different size packaging is proposed for each of the four products. Thus fresh dates will be in packages of 1/2 kilograms, 1 kilogram and 5 kilograms; date paste in packages of 1 kilogram, 5 kilograms and 20 kilograms; date syrup in containers of 20 kilograms; date pits powder in bags of 20 kilograms.

DEMAND AND PLANT CAPACITY

2.1 Demand

Official statistics regarding demand for any of the above mentioned products are not readily available. On the other hand, the production estimates of the different varieties of date crops grown locally are also not available. The available statistics show that the date crop during the decade of the eighties ranged between 50.000 tons and 60.000 tons annually, with the higher figures attributed to the recent years. Allowing for over estimation of crop figures, for dates not suitable for packing industry, for dates consumed locally in natural form and for exports, there will still be sufficient supply of dates as raw material for the needs of a processing and packing plant. It is important that the project depend entirely on local dates as raw material and be able to compete with imported date products from abroad including neighboring countries. Under these circumstances the proposed capacity for the plant would out of necessity be modest at this initial stage.

2.2. Plant Capacity

Under conditions of uncertainty described above, the proposed capacity for the plant would, out of necessity, be modest at the initial stage. Accordingly, the proposed annual capacity is as follows:

- Processed dates :2000 tons
- Date paste : 500 tons
- Date syrup : 100 tons
- Animal fodder : 200 tons

  Total production :2800 tons.

The plant will operate in one shift of eight hours per day.

3 SALES REVENUE

The wholesale price for each of the four products is as follows:

- Processed dates :US $ 3,680 per ton
- Date paste :US $ 1,050 per ton
- Date syrup :US $ 1,450 per ton
- Animal fodder :US $ 200 per ton

Gross Sales Revenue are calculated here below:

- Processed dates :2000 tons x US $ 3,680 = US $ 7,360,000
- Date paste : 500 tons x US $ 1,050 = US $ 525,000
- Date syrup : 100 tons x US $ 1,450 = US $ 145,000
- Animal fodder : 200 tons x US $ 200 = US $ 40,000

  Total = US $ 8,070,000

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The principal raw materials required are given below:

- One ton of processed dates requires 1.033 tons of good quality fresh dates, that is a total of 2066 tons at US$ 1800 per ton.
- One ton of date paste requires 1.18 tons of inferior quality fresh dates, that is a total of 590 tons at US$ 600 per ton.
- One ton of date syrup requires 4 tons of inferior quality fresh dates, that is a total of 400 tons at US$ 600 per ton.
- Additives:

Vanilla and Sesame seeds for date paste at the rate of 20 kg per ton.

Fumigating gas at the rate of 0.3 kg per ton.

Vitamins at the rate of 1 kg per ton.

- Packing material

All the required additives are to be imported.

4.2. Utilities

Electricity: 4 KWH per kg at US $ 0.02 per KWH.

Water: 2 gallons per kg at US $ 0.0041 per gallon.

5 LOCATION AND SITE

The selected location is the Emirate of Ras Al Khaimah which is known to have adequate crops of dates, as well as the neces-

sary infrastructure. The total required site area is 6000 square meters. The cost of buildings and site preparation is US $ 1.2 mn.

6 PROJECT ENGINEERING

6.1. Process and Technology

- Primary cleaning line: the dates go through a process of initial cleaning where those unsuitable for processing are removed, together with the debris. Dates are then cleaned by water sprays and dried in hot air at about 60°C. Then the dates are fumigated to kill any insects infesting them. This process is carried out by spraying methyl bromide gas either under pressure or in vacuum. Dates then pass through another washing, cleaning and drying process and finally conditioned with paraffin oil spray to improve their appearance.

From the above operation dates are either packed in their natural state or are pitted and pressed into rectangular blocks and packed in container boxes of different weights.

- Date paste: is made from dates of inferior quality. After these dates are cleaned, fumigated and destoned, they are crushed and minced into a paste which can be used as jams or cast in bars.

- Date syrup: inferior quality dates are cleaned, fumigated, destoned, crushed, minced and mixed with hot water and extruded into syrup.

- Animal fodder: The pits are ground and mixed with the waste of the above products, to which vitamins are added. The powder is filled in bags of appropriate weights. A flow chart is attached at the end of the study.

6.2 Main Machines and Equipment

- Primary cleaning line
- Fumigation chambers: 2 separate chambers
- Washing / Conditioning line
- Distribution conveyor belt
- Bulk pack line
- Paste line: Pitting machine, hydraulic press, packing machine
- Date syrup line: Extrusion unit, dozing machine
- Animal fodderline: Grinding machine.

6.3 Auxiliary Equipment

3 belt conveyors, compressed air installation, testing laboratory, transport and handling equipment, water treatment plant, 2 cold storage rooms, maintenance workshop.

The total cost of machines and equipment is estimated at US $ 4 mn.

7 MANPOWER

The Manpower requirement is shown in the table below. The wages and salaries represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the suppliers of the equipment.

Category	Number	Annual cost per person	Total cost in US$
Management staff	4	16,400	65,600
Skilled workers	15	8,200	123,000
Unskilled workers	6	5,900	35,400
Total	25		224,000

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2.5 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

The total investment cost is estimated at US $ 7,236,000. The breakdown by major items is given in the table below.

Cost items	Value in US $
Land	Nominal Value
Building and civil works	1,200,000
Machinery and equipment	4,000,000
Technology acquisition and training	807,000
Working capital	1,229,000
Total	7,236,000

9.2 Production Costs

The total production costs amount to US $ 6,385,800. The major categories of production costs are shown in the table below:

Production Costs

Costs	Value in US $	
1 Raw materials:	4,312,800	
2 + Manpower:	224,000	
3 + Utilities:	247,000	
4 + Maintenance:	132,000	
5 + Other Factory Overhead:	510,000	
6 = Factory costs:		5,425,800
7 + Insurance:	52,000	
8 + Marketing, sales & distribution:	120,000	
9 + Other Administrative Overhead:	260,000	
10 = Operation costs:		432,000
11 + Depreciation:		528,000
12 = Total production costs:		6,385,800

9.3 Commercial Profitability

9.3.1. Rate of Return (RR)

Gross sales revenue US $ 8,070,000

Minus total production costs US $ 6,385,800

Equals Net Profit US $ 1,684,200

$$\text{Therefore, RR} = \frac{1{,}684{,}200}{7{,}236{,}000} \times 100 = 23.3 \text{ percent.}$$

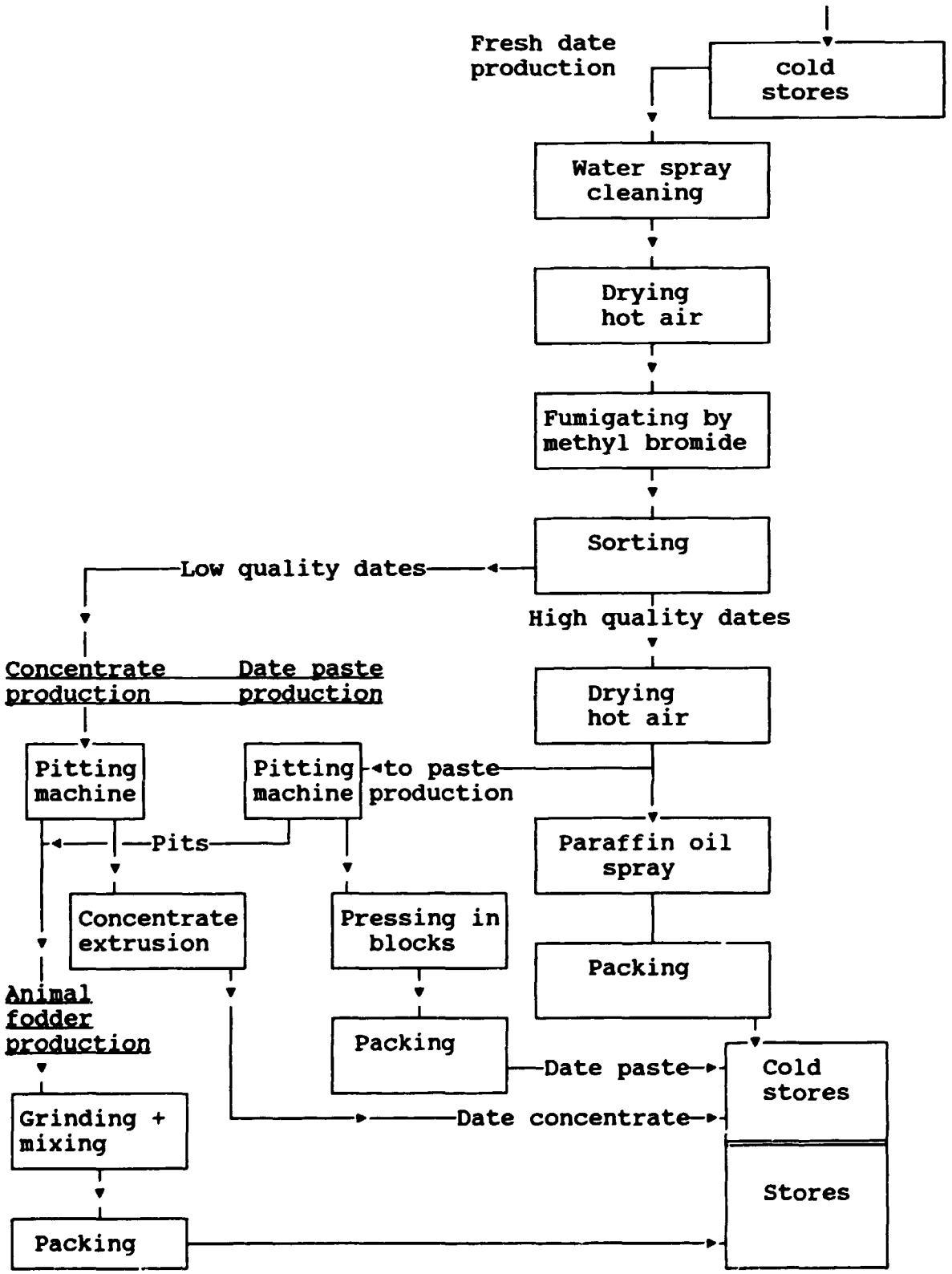
9.3.2. Payback Period after operation

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{7{,}236{,}000}{1{,}684{,}200 + 528{,}000} = 3.27 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

The financial evaluation shows a very good rate of return of 23.3 percent, and a relatively short pay back period of 3 years and three months. The project being based on locally available raw materials is essential for the overall development of the date palm agricultural programme in the country. Farmers may be encouraged to become part owners in the new enterprise. A detailed feasibility study is recommended for its implementation.

FLOW CHART
DATE PROCESSING AND PACKAGING PLANT



IX. WELDED STEEL PIPES PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

Steel pipes have several applications. They can be used to transmit water for use in buildings and for agricultural irrigation projects and to transmit liquids in industrial plants. Plastic pipes compete with steel pipes in the small diameter range, that is less than 4 inch in diameter (10.16 mm).

1.2 Justification for Selecting the Product

There is at present no local production in the country. Steel pipes are needed for industrial plants including petroleum and petro-chemical industries, for municipal water supply and in buildings. Exports to the GCC market could be developed if the quality and price of the steel pipes are competitive.

1.3 Product Specification

Steel pipes are made in various diameters, thicknesses and lengths. Each usage has its own specifications. The proposed plant will produce black pipes as well as lined and coated pipes. The proportion of each will be determined by the market study.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

Official statistics show that the quantity of imported iron and steel pipes of all dimensions between 1981 and 1985 were as follows.

Year	1981	1982	1983	1984	1985
Tons(000)	388	418	449	372	238

There are no up to date figures beyond 1985. Moreover there is no breakdown of these figures into the different pipe dimensions and end user. It is essential to determine the demand for each pipe dimension in order to select the proper technological process for the manufacture of that range of product. Under these circumstances it is presumed that the most popular pipes in demand are within the range of 6 inch (15.24 mm) to 12 inch (30.48 mm) in diameter, 3.18 to 6.35 mm in thickness of steel and about 10 meters in length. These pipes can be used in the construction and petro-chemical industries as well as in the conduit of water for various purposes. Though the size of the market for this dimension range has not been accurately defined in the present study, it is believed to be about 100,000 tons per year. However, a market study should be undertaken to determine the specifications of the pipes most widely in demand domestically, including the size of demand for black pipes and coated pipes.

2.2 Plant Capacity

The available technology dictate an economic plant capacity of about 82,000 tons per year, operating in two shifts, of 8

hours each shift. It is therefore proposed to set up a plant with an annual production capacity of 82,000 tons of pipes, with a diameter range from 6 inch to 12 inch. If a smaller dimension range, say from 0.5 inch to 4 inch is also desired and justified by a market study, then a second production line with the appropriate capacity may be added to the above plant. It is worth mentioning that operating the plant in two shifts, will minimize the capital costs of machinery and equipment.

3 SALES REVENUE

The average wholesale price per ton of pipe of the above dimension range is estimated at US$ 500. On this basis the gross sales revenue equals:

82,000 x 500 = US$ 41,000,000

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The main raw material for production of welded steel pipes is coiled steel sheet which should be imported as no local production facility exists at present. The selection of the grade or quality of steel sheets for use in the plant depends on the specifications of the pipes to be produced. The quantity required is 82,000 tons of carbon steel, if no wastage in production occurs. Otherwise allowance for wastage should be made. Other materials needed are:

- An emulsion consisting of water and a solvable oil used as a lubricant and coolant for the sheet steel. The yearly

consumption of oil is 170 cubic meters.

Hydraulic oil: 1500 kg per year, available locally.

Lube oil: 1000 kg per year, available locally.

Lube grease: 410 kg per year, available locally.

The cost of the carbon steel raw material per ton is US$ 360.

4.2 Utilities

Electricity requirement per ton of pipes is 200 KWH at US$ 0.02 per KWH.

Water requirement is 210 gallons per ton of pipes at US$ 0.004 per gallon.

5 APPROXIMATE LOCATION AND SITE

The ideal location and site for such a plant should have the following characteristics: proximity to a sea port, access roads, utilities and availability of manpower. On this basis the proposed site would be Abu Dhabi. The land area required is 55,000 square meters. The cost of buildings and site development is US$ 4 mn.

6 PROJECT ENGINEERING

6.1 Process and Technology

As pointed out earlier, a pipe making machine turns out pipes within a certain diameter range. The selected process for this project can produce pipes within the range of 6 inch to 12 inch in diameter. Moreover, as it was assumed that there is a

demand for pipes lined and coated for water application, the plant includes the required equipment for internal cement lining and for external bitumen coating and wrapping.

The pipe manufacturing process is summarized as follows:

The slitting line: the steel sheets come in coils which are cut in strips corresponding to the circumference of the tube to be welded.

Tube production line: the strip goes through the preparation and forming mill, where the incoming strip is converted into an open seam tube. Inside and outside arc welding is done automatically. Then the welded seam is tested by ultrasonic method after which the pipe is cut to the required length. There are two finishing lines. Black tubes go through the pipe end facing machine; other tubes are lined from inside and coated from outside.

6.2 Main Machines and Equipment

- Tube forming machine
- Flux sweeping device
- Pipe rotating device
- Pipe facing and levelling machine
- Portable ultrasonic tester
- Blasting machine
- Primer coating machine
- Inside lining machine
- Outside coating and wrapping machine

6.3 Auxiliary Equipment

- Workshop
- Cranes and transportation equipment
- Compressed air system
- Electrical system
- Heating facilaty
- Laboratory equipment

The total cost for machinery and equipment is estimated at US$ 12 mn.

7 MANPOWER

It was stated earlier that the plant will operate in two shifts. As shown in the table below the cost of manpower requirement in two shifts is US$ 2,151,400 annually. The wages and salaries represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the supplier of the know-how and equipment.

Category	Number per shift 1st	2nd	Annual Cost per person	Total cost in US$ for 2 shifts
Management staff :	16	-	16,400	262,400
Skilled workers :	100	80	8,700	1,476,000
Unskilled workers:	40	30	5,900	413,000
Total :	156	110		2,151,400

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2.5 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 23 mn. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	4,000,000
Machinery and equipment:	12,000,000
Technology acquisition and training:	1,000,000
Working capital:	6,000,000
Total:	23,000,000

9.2 Production Costs

The total production costs amount to US$ 35,781,000. The major categories of production costs are shown in the table below:

Production Costs

Costs	Value in US $	
1 Raw materials:	29,520,000	
2 + Manpower:	2,151,000	
3 + Utilities:	396,000	
4 + Maintenance:	400,000	
5 + Other Factory Overhead:	700,000	
6 = Factory costs:		33,167,000
7 + Insurance:	176,000	
8 + Marketing, sales & distribution	300,000	
9 + Other Adminstrative Overhead:	138,000	
10 = Operation costs:		614,000
11 + Depreciation:		2,000,000
12 = Total production costs:		35,781,000

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue	= US$	41,000,000
Minus total Production costs	=	35,781,000
Equals Net Profit	=	5,219,000

$$\text{Therefore, RR} = \frac{5{,}219{,}000}{23{,}000{,}000} \times 100 = 22.7 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{23{,}000{,}000}{5{,}219{,}000 + 2{,}000{,}000} = 3.2 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATIONS

On the basis of the above assumptions, the project is profitable. Thus, the RR is 22.7 percent, and the PB is 3.2 years. However, as indicated earlier, a market study is needed to determine:

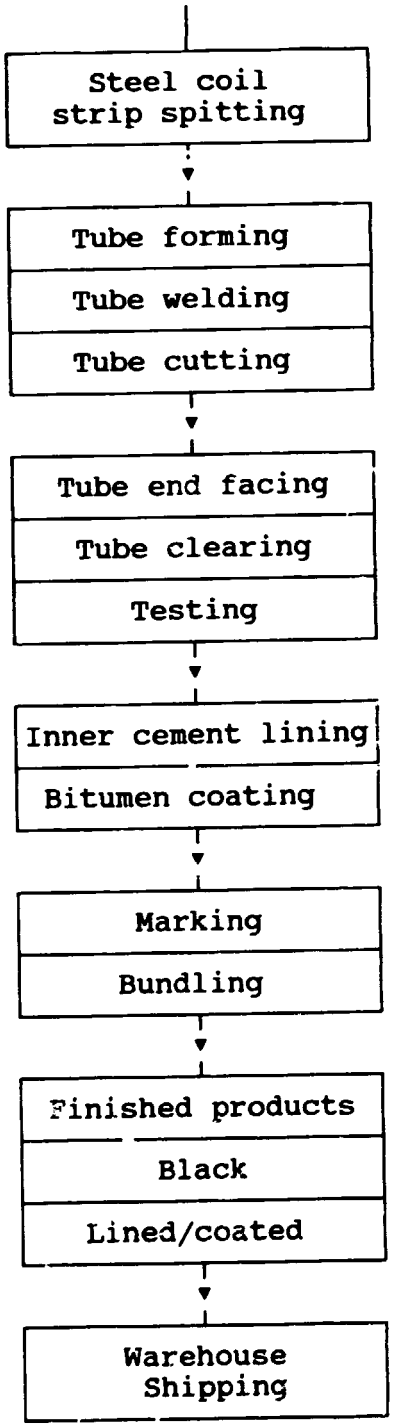
a) the size of the demand and specifications for the most widely used steel pipes and whether these are within the given range of 6 inch to 12 inch in diameter,

b) whether a two shift operation is justified,

c) the proportion of black pipes versus lined and coated pipes and

d) the size of demand for the smaller diameter pipes of 0.5 to 4 inch in order to dertermine whether a production line for galvanized pipes is waranted within the context of the project.

FLOW CHART
WELDED STEEL PIPES PLANT



X. GLASS BOTTLES MAKING PLANT

1. GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

Carbonated beverages companies in the UAE use at least three different types of containers for their soft drinks. The first type is the returnable bottles, second the non-returnable bottles, and third the metal cans. Plastic bottles (PET) are not in use yet.

1.2. Justification for Selecting the Product

For this project, it is proposed to produce non-returnable bottles, which seem to enjoy an expanding market. The primary justification is that in hot countries consumption of soft drinks is relatively high. The second justification is that silica sand and limestone, which are the basic raw materials, may be found in the country. However, their suitability should be investigated. Thirdly the UAE imports all its requirements of containers for the beverage industry.

1.3 Product Specifications

Non-returnable bottles are made mostly of flint glass and weigh about 195 grams each, equivalent to 28.08 Kgs per gross of 144 bottles. Bottling companies require different shapes and colour of bottles. The manufacturer of bottles must meet the specifications of the particular user, who usually supplies the mold. Although bottling companies use also returnable bottles, the weight of which is 440 grams per bottle, this study is con-

cerned with non-returnable bottles only as the market for returnable bottles is dwindling.

2 DEMAND AND CAPACITY

2.1 Demand

In 1985 a market study was carried out by the Gulf Organization for Industrial Consulting (GOIC) which covered three states, the UAE, Qatar and Bahrain. The results of this study, as they relate to the UAE, are:

a) Non-returnable bottles (NRBS) represented 48 percent of total sales of bottling companies.

b) The market for returnable bottles is on the decline.

c) The demand for NRBS was estimated at 148.4 mn bottles of which 133.3 mn were made of flint glass and the balance of green glass.

This is equivalent to about 23,900 tons of flint glass and 2,700 tons of green glass.

Apart from glass, there are other types of containers such as metal cans and possibly PET bottles. However, it was assumed that glass bottles would constitute about half of the total demand, most of which will be NRBS.

2.2. Plant Capacity

The capacity considered for this project is small, namely 2,500 tons of flint glass, equivalent to 12.8 mn bottles a year. At this capacity, the entire production can be easily sold. Moreover it means that the production programme would concentrate on a few types of bottles whose demand is the highest.

SALES REVENUE

The wholesale price per gross of NRBS is assumed to be US $ 21.6 and the quantity sold is 89,031 gross of bottles. Therefore, gross sales revenue equals: 89,031 x 21.6 = US $ 1,923,070

4 RAW MATERIALS AND OTHER INPUTS

The following raw materials are used for the manufacture of container glass:

- Silica sand
- Limestone and/or dolomite
- Feldspar or some other mineral containing aluminum oxide
- Coloring and decoloring agents

Geological surveys were carried out in the Fujairah Emirate where silica sand, limestone and pegmatite are available. However, initial laboratory testing show high content of iron oxide which would require that these raw materials be treated to make them suitable for flint glass manufacture. There has no study been done on the process of beneficiation needed and on the corresponding cost. On the other hand, importing the raw materials from abroad might render the project unprofitable.

For one gross (144 units) of NRBS the raw material requirement by weight in Kilograms is:

- Silica sand 19.6
- Limestone 2.6
- Pegmatite 2.5

- Soda ash 4.0
- Others 1.5
- Glass cullet 2.0

Total in kg 32.2

The actual requirement will depend on the proportions of the raw materials used. The cost of the above material per gross is estimated at US $ 5.5.

4.2 Utilities

Electricity, fuel oil or LPG gas and water constitute the major utilities required. For the production of one gross of bottles the cost of utilities is:

- Electricity: 6.21 KWH at US $ 0.02 per KWH.
- Fuel oil: 1.2 kg at US $ 0.22 per kg.
- Water: 63 gallons at US $ 0.0041 per gallon.

5 APPROXIMATE LOCATION AND SITE

The recommended location is Fujairah which has deposits of limestone. The site of the plant may be at the industrial area. The land area required is about 5000 square meters. The estimated cost of buildings and site preparation is US $ 750.000.

6 PROJECT ENGINEERING

6.1 Process and Technology

For a very small capacity, sophisticated technology and equipment cannot be used. The first stage in the process is the batch plant which should be automatic. In this plant the batch is composed. The quantities of the different raw materials used in

a batch depend on their chemical and physical qualities. These have to be tested in advance in the laboratory. The raw materials to be used in the batch are weighed accurately. The weighed materials are then mixed very carefully in special mixing machines in order to obtain a homogeneous batch, which is then transported on conveyor belts to a silo at the furnace.

The batch is fed into the furnace at a rate equal to the withdrawal of the glass from the furnace. In order to get high quality glass containers there must be a continuous operation of melting the glass in a tank furnace and blowing the bottles in automatic machines.

After having been melted, refined and homogenized, the glass leaves the furnace and enters temperature controlled channels known as forehearths. At the end of the forehearth there is a feeding device that prepares the gobs of glass which drop into the molds of the forming machines. The most common forming machines are known as IS (individual Section) machines.

When the bottle leaves the forming machine it has a temperature of about 500 °C. To achieve controlled cooling the bottles pass into an annealing lehr, which is a tunnel shaped oven. At the end of the annealing lehr, the cold end, the bottles are inspected and controlled. The inspection machine will automatically reject glass containers that are not up to the required standard. The accepted high quality glass containers are packed. A flow chart is attached. The cost of machinery and equipment is estimated at US $ 2 mn.

6.2 Main Machines and Equipment

- Batch Plant
- Furnace
- Molds
- Glass forming equipment
- Annealing lehrs
- Inspection equipment
- Packing Equipment

6.3 Auxiliary Equipment

- Compressor
- Workshop
- Laboratory
- Transport equipment

7 MANPOWER

The manpower requirement is shown in the table below. The wages and salaries represent averages for the various categories of manpower. It is recommended that certain key technical workers be trained by the suppliers of the know-how and equipment.

Category	Number	Annual cost per person	Total cost in US $
Management staff	5	16,400	82,000
Skilled workers	14	8,200	114,800
Unskilled workers	6	5,900	35,400
Total	25		232,200

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2.5 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US $ 3,358,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land	Nominal value
Building and civil works	750,000
Machinery and equipment	2,250,000
Technology acquisition and training	192,000
Working capital	166,000
Total	3,358,000

9.2 Production Costs

The total production costs per year amount to US $ 1,292,000. The major categories of production costs are shown in the table below.

Production costs

Costs	Value in US $	
1 Raw materials:	489,600	
2 + Manpower:	232,200	
3 + Utilities:	57,700	
4 + Maintenance:	70 000	
5 + Other Factory Overhead:	80,000	
6 = Factory costs:		929,500
7 + Insurance:	30,000	
8 + Marketing, sales & distribution:	20,000	
9 + Other Administrative Overhead:	50,000	
10 = Operation costs:		100,000
11 + Depreciation:		262,500
12 = Total production costs:		1,292,000

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue = US $ 1,923,070

Minus total Production Costs = US $ 1,292,000

Equals Net profit = US $ 631,070

$$\text{Therefore, RR} = \frac{631,070}{3,358,000} \times 100 = 18.8 \text{ percent}$$

9.3.2 Payback Period after Operation (PB)

$$\frac{\text{Total investment}}{\text{Net profit + Depreciation}} = \frac{3,358,000}{631,070 + 262,500} = 3.7 \text{ years}$$

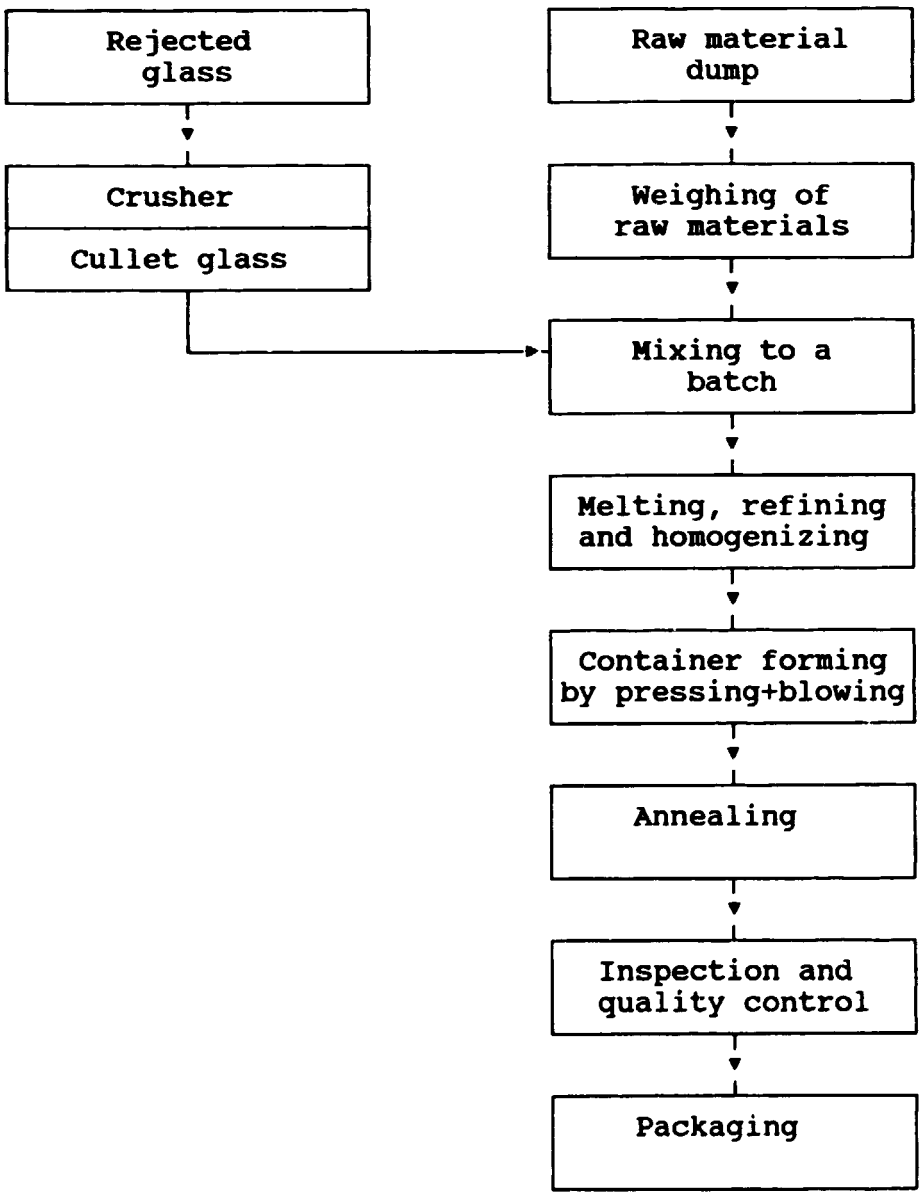
10 CONCLUSIONS AND RECOMMENDATION

The financial evaluation shows acceptable results. The simple rate of return is 18.8 percent, and the payback period is 3.7 years. However, the profitability of the glass container industry depends largely on the availability of cheap local raw materials and inputs. While the cost of utilities is very low, dependance on imported silica sand could jeopardize the viability of the project. It is, therefore, imperative to determine the suitability of the local raw materials before a feasibility study is undertaken. On the other hand, it is necessary to ascertain whether a small scale production, as proposed in this study, will not compromise the quality required by the bottling concessionaire. In early 1988, UNIDO undertook a pre-feasibility study on a glass container plant in Fujairah at the request of the authorities. The study proposed a much larger plant capacity and a more sophisticated technology and process than in the above proposal. It also took into account the need to have plastic

sleeves covering the body of the non-returnable bottles as required by the municipalities of the UAE. This will raise the production cost of the bottles by some 17 percent. The Internal Rate of Return in the study was about 11 percent. In conclusion, the authorities were advised to ascertain the suitability of the local silica sand and other locally available raw materials before attempting a feasibility study.

FLOW CHART
GLASS BOTTLES MAKING PLANT

(Raw materials arrive at the plant ready to be used in the manufacturing process)



XI. SANITARY PAPER MAKING PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

Sanitary paper has a number of uses for hygienic applications in the home situation and the place of work. The main kinds are toilet paper, sanitary napkins, towels, paper tissues and baby napkins.

1.2 Justification for Selecting the Product

It is proposed to produce sanitary paper tissue in bulk for sale to local manufacturers of retail size rolls. In the UAE there are five factories producing various kinds of sanitary paper in the following Emirates: one in Abu Dhabi, two in Dubai, one in Sharjah and one in Ajman. The total production capacity of these factories is about 3,000 tons per year. They operate on the basis of imported jumbo rolls. The cost of transportation of jumbo rolls from abroad is high and so is the retail price of the end product. It would seem beneficial to produce the required sanitary paper tissues locally based on imported wood pulp and locally available waste paper.

1.3 Product Specification

The plant will produce standard mass grades based on the specification provided by the user. Each roll will be of Jumbo size.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

It has not been possible to obtain official import figures on the products in question. The demand for the sanitary paper tissue should in principle correspond to that of the existing plants. In so far as this project is concerned, the demand has been assumed to be 3,000 tons per year, which corresponds to the requirements of the existing manufacturing enterprises.

2.2 Plant Capacity

Paper manufacture is influenced by scale and other cost economies. Moreover, higher quality tissue is obtain with additional investment in auxiliary process equipment. For this product, this implies a scale of 6 to 8 tons of finished product per day as an economic size. Therefore, a production capacity of 3,000 tons annually will fulfill this requirement and will meet the assumed demand.

3 SALES REVENUE

The average wholesale price per ton of paper tissue of the required specification is assumed to be US$ 580. Therefore, gross sales revenue equals:

3000 tons x 580 = US$ 1,740,000.

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The main raw materials required are wood pulp, waste paper and some chemical and additives for making pulp from waste paper,

and for bleaching, binding and filling. All the materials are to be imported except for the waste paper and the starch. The requirements per ton of finished product are:

- Wood pulp	700 kg
- Waste paper	350 kg
- Digesting chemicals	3 kg
- Pigment and starch	1 kg
- Bleaching chemicals	3 kg
- Clay	42 kg
- Ream and roll wrapping, markers	As required.

The cost of the above material is US$ 70 per ton of finished product.

4.2 Utilities

Electricity requirement per ton is 800 KWH at US$ 0.02 per KWH.

Water requirement per ton is 25,000 gallons at US$ 0.0041 per gallon.

5 APPROXIMATE LOCATION AND SITE

It is proposed that the plant will be located in Dubai. The required land area is 8,000 square meters. The estimated cost of the buildings and site preparation is US$ 980,000.

An important consideration in the selection of the site is the provision of sufficient process water, and the treatment and disposal of effluents.

6 PROJECT ENGINEERING

6.1 Process and Technology

For small scale production, the batch system is more economical. There are a number of alternative technologies, the selection of one will depend on the volume of production and the related costs. A brief process description follows.

The first step is to produce pulp from waste paper. The sorted waste paper is fed into a global digester into which hot steam is blown as it rotates. The material is then charged into the blow pocher where chemicals are added. The digested chemicals are thoroughly washed in the washing drum and the material is transferred into the dump chest. After waste paper pulp has been screened and cleaned, the accepted pulp is mixed with the imported wood pulp and then bleached. The bleach liquor is washed away and the pulp is cooked with water to form a paste or stock which is transferred to the loading section, where a filler (clay) is added to smooth the surface and brighten the color. The paste is coated with an inorganic substance like a pigment and starch is added as a binding material. A coloring substance is added if required. Sheets are formed by calendering. After the drying process, sheets are wound into rolls in the required length. See attached Flow Chart.

6.2 Main Machines and Equipment

- 1 Global digester for waste paper
- Various machines, chests, tanks, dumps and pumps for the preparation of waste paper into pulp.

- Paper making equipment to cover various operations, including bleaching, washing, cooking, smoothing, coating, calendering, drying and rolling.

6.3 Auxiliary Equipment

- Boiler
- Screens
- Different types of pumps
- Screw conveyor
- Maintenance workshop
- Handling and transport equipment

The total cost of machinery and equipment is estimated at US$ 2 mn.

7 MANPOWER

As the table below shows, a total of 15 staff and workers are required at an annual cost of US$ 127,900. It is recommended that the technical workers receive training at some plants abroad arranged by the supplier of equipment and know-how.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	2	16,400	32,800
Skilled workers:	8	8,200	65,600
Unskilled workers:	5	5,900	29,500
Total:	15		127,900

8 PROJECT SCHEDULING

The project implementation period is assumed to be 2.5 years of which six months are for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 3,223,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	980,000
Machinery and equipment:	2,000,000
Technology acquisition and training:	169,000
Working capital:	74,000
Total:	3,223,000

9.2 Production costs

The total production costs per year amount to US$ 1,151,800. The major categories of production costs are shown in the table on the next page.

Production Costs

Costs	Value in US $	
1 Raw materials:	210,000	
2 + Manpower:	127,900	
3 + Utilities:	355,500	
4 + Maintenance:	70,000	
5 + Other Factory Overhead:	30,000	
6 = Factory costs:		813,400
7 + Insurance:	30,000	
8 + Marketing, sales & distribution:	17,400	
9 + Other Administrative Overhead:	41,000	
10 = Operation costs:		88,400
11 + Depreciation:		250,000
12 = Total production costs:		1,151,800

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

2	Gross Sales Revenue	= US$	1,740,000
	Minus total Production Costs	=	1,151,800
	Equals Net profit	=	588,200

$$\text{Therefore, RR} = \frac{588,200}{3,223,000} \times 100 = 18.2 \text{ percent}$$

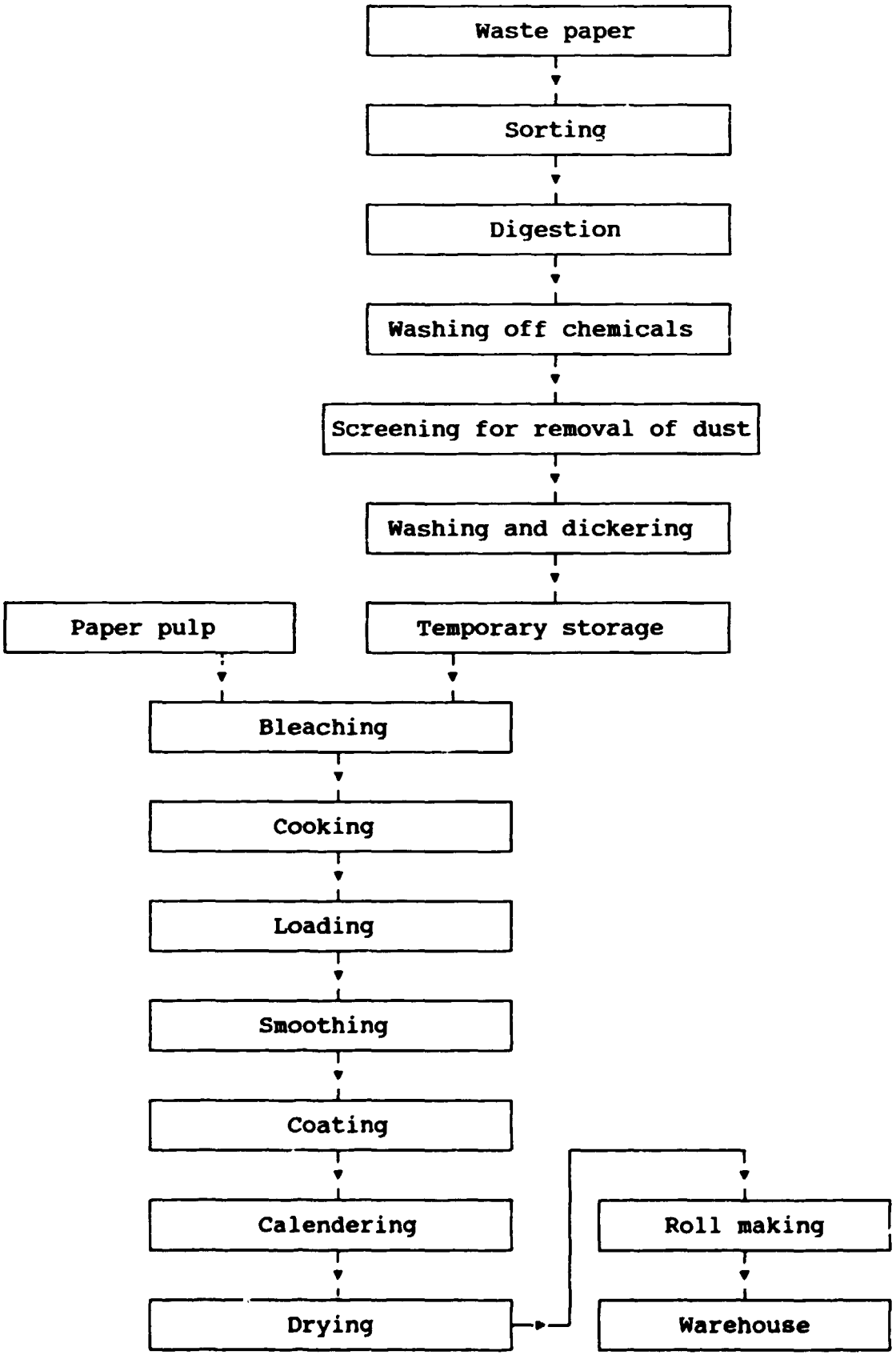
9.3.2 Pay Back Period after Operation (PB)

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{3,223,000}{588,700 + 250,000} = 3.8 \text{ years}$$

10. CONCLUSIONS AND RECOMMENDATIONS

The financial evaluation shows that the project has reasonable prospects for success. The RR is 18.2 percent which is still above the lending rate, and the PB is 3.8 years which is acceptable in a stable environment. However, to enhance the success of the venture, the following conditions must be met. The first is to get the current manufacturers of sanitary paper tissue to sponsor the proje_t in order to ensure the marketability of the end product. Secondly, to examine ways and means of ensuring the supply of waste paper requirements for the proposed plant. When these conditions are fulfilled a feasibility study may be attempted.

FLOW CHART
SANITARY PAPER MAKING PLANT



XII. FISH MEAL MAKING PLANT

1 GENERAL ECONOMIC DATA

1.1 Product Characteristics and Use

Fish meal is the residue of fish products not fit for human consumption which is ground into powder for animal consumption. Fish meal has substantial nutritional value because of the high protein content and to a lesser extent of mineral salts. It is used as fodder for animals in composite form, mainly for poultry and cattle. It is, therefore a component of a mixture of animal feed. A by-product of the fish meal plant may be fish oil, which can be produced if the fatty content in the fish is at least 5 percent.

1.2 Justification for Selecting the Product

The UAE being a maritime country has substantial fisheries resources which at present are under exploited. There is good potential for developing a fish meal industry both for the local market and for export, as there are plentiful resources of low value fish species and fish residue or fish waste resulting from the processing of high value species. Being a dried powder, fish meal is very convenient for transport. There is no fear of deterioration in transport as in the case of raw fish. Furthermore, as the moisture content is small, it can be transported to distant places by sea at low freight costs. Hence, fish meal has export potential if the price is competitive.

1.3 Product Specification

Fish meal is a homogeneous powder with a pronounced taste and odor. Its color is usually brownish which varies with the type of raw material (fish waste) being processed and with the cooking time.

2 DEMAND AND PLANT CAPACITY

2.1 Demand

The official statistics on the animal wealth in the country are not readily available. Similarly statistics on the type, quantity and value of imported animal feed per year are not readily available. Therefore, even a rough estimate of the demand for fish meal could not be worked out. However, in a country where the contribution of the agricultural sector to GDP is very small, the animal population is likely to be small indeed. The same applies to the fodder requirements.

The following observations are worth bearing in mind for any future analysis of demand and market trends for fish meal.

First, fish meal being a feed supplement has to be mixed with other animal feed in the proportion of up to 8 percent for poultry and 4 percent for cattle, goats, sheep and camels.

Second, as a small proportion of the fish meal goes into the animal feed mix, the consumption in the country is not likely to be large. Hence, a part of the production may have to be targeted towards the export market.

Third, the processing technology of fish meal makes it possible to set up small scale plants.

2.2 Plant Capacity

In view of the above comments on the market, it is proposed that a plant with small scale capacity should be considered. A typical small scale plant is one with production capacity of 475 tons of fish meal per year in one shift of 8 hours daily. To produce this quantity of fish meal 1500 tons of raw material are required. As a by-product fish oil may be produced provided the fish raw material has a fatty content of at least 5 percent. Assuming that this is the case, then the quantity of fish oil by-product would be 5 percent of the raw material, that is 75 tons.

3 SALES REVENUE

The wholesale price of fish meal is assumed to be US $ 500 per ton and that of fish oil is US$ 350 per ton. Therefore gross sales revenue equals:

475 x 500 = US$ 237,500

75 x 350 = US$ 26,250

Total = US$ 263,750

4 RAW MATERIALS AND OTHER INPUTS

4.1 Raw Materials

The basic raw material is low quality fresh fish and fish offal and waste which are available all the year round. The enterprise should establish an arrangement with suppliers of low value fresh fish and fish offal in order to ensure regular supply of the raw material. Moreover, it is necessary to determine the rate of fatty substance in the fish to see whether it is worth-

while to extract it in the form of oil.

To produce 475 tons of fish meal per year, 1500 tons of fresh fish and fish offal is required, that is an extraction rate of 31.67 percent. In addition 75 tons of oil could be extracted as a by-product. The cost of the raw material is US $ 17 per ton delivered to the factory.

4.2 Utilities

Electricity requirement per ton of raw material is 40 KWH at US$ 0.02 per KWH.

Water requirement per ton of raw material is 88 gallons at US$ 0.0041 per gallon.

5 APPROXIMATE LOCATION AND SITE

The plant location and site should be near to the source of raw material and should have ample supply of water and electricity. Moreover, the plant should be away from residential areas because of the odor. An area of 1500 square meters would be adequate. Cost of buildings and site preparation is US$ 175,000.

6 PROJECT ENGINEERING

6.1 Process and Technology

6.1.1 Fish Meal Line

The raw material consisting of waste fish and fish offal is weighed and fed to the fish hasher which incorporates a built in screw conveyor which feeds the material to the fish hopper of the

cooker in the fish meal reduction line. Steam from the boiler is introduced into the cooker. The cooking is completed while the material is moving in the cooker on a conveyor. The cooked material is discharged from the other end into a compressor, which with its screw press separates the oil and water turning out pressed cake containing about 50 percent moisture. Then the cake is disintegrated and dried in a rotary drier. Following that the material is cooled and crushed into a suitable size. The fish meal is packed in plastic bags of 20 and 50 kgs. The plant should also be equipped with deodorizing equipment to treat the steam and vapor coming out of the drier.

6.1.2 Fish oil line

The oil and water coming out of the screw press is pumped into a fish oil separator which separates the oil from the water and any solid material found therein. The oil is fed into the dozing machine to be filled in plastic containers of 5 gallons each. The water is recycled to the steam generator. See attached Flow Chart.

6.2 Main Machines and Equipment

6.2.1 Fish Meal line

- Raw Material Hasher
- Steam cooker
- Screw press
- Screw conveyor
- Disintegrator
- Bucket elevator

- Rotary drum drier
- Air heater
- Cooking conveyor
- Crusher for finished product
- Magnet separator
- Boiler

6.2.2 Fish Oil line

- Fish oil separator
- Fish oil tanks
- Dozing machines

6.3 Auxiliary Equipment

- Cold storage
- Steam generator
- Compressed air installation
- Transport and handling equipment
- Maintenance workshop

7 MANPOWER

The manpower requirement shown in the table below is 6 at a total cost of US$ 50,500 annually. The wages and salaries represent averages for the various categories of manpower. It is recommended that the key technical workers be trained by the supplier of the know-how and equipment.

Category	Number	Annual Cost per person	Total cost in US$
Management staff:	1	16,400	16,400
Skilled workers:	2	8,200	16,400
Unskilled workers:	3	5,900	17,700
Total:	6		50,500

8 PROJECT SCHEDULING

The project implementation period is assumed to be 15 months of which three months are required for study, planning and design.

9 FINANCIAL ANALYSIS

9.1 Investment Costs

Total investment costs is estimated at US$ 610,000. The breakdown by major items is given in the following table.

Cost items	Value in US $
Land:	Nominal value
Building and civil works:	175,000
Machinery and equipment:	400,000
Technology acquisition and training:	20,000
Working capital:	15,000
Total:	610,000

9.2 Production Costs

The total annual production costs amount to US$ 161,400. The major categories of production costs are shown in the table on the next page.

Production Costs

Costs	Value in US $	
1 Raw materials:	25,500	
2 + Manpower:	50,500	
3 + Utilities:	1,700	
4 + Maintenance:	13,000	
5 + Other factory overhead:	9,000	
6 = Factory costs:		99,700
7 + Insurance:	5,700	
8 + Marketing, sales & distribution:	2,000	
9 + Other administrative overhead:	6,000	
10 = Operation costs:		13,700
11 + Depreciation:		48,000
12 = Total production costs:		161,400

9.3 Commercial Profitability

9.3.1 Rate of Return (RR)

Gross Sales Revenue = US$ 263,750

Minus total production costs = US$ 161,400

Equals Net profit = US$ 102,350

$$\text{Therefore, RR} = \frac{102{,}350}{610{,}000} \times 100 = 16{,}8 \text{ percent}$$

9.3.2 Pay Back Period after operation (PB)

$$\frac{\text{Total Investment}}{\text{Net Profit + Depreciation}} = \frac{610{,}000}{102{,}350 + 48{,}000} = 4 \text{ years}$$

10 CONCLUSIONS AND RECOMMENDATION

The financial evaluation shows an acceptable project idea which is worthwhile pursuing. The RR is 16.8 percent and the PB is 4 years. Accordingly, a feasibility study is recommend, where the market analysis should cover both the domestic market and that of neighbouring Gulf States. It is important to bear in

mind that the profitability of this project may be enhanced by:

(a) Operating the plant continuously in two or three shifts. This is because the daily start-up of the plant consumes much energy. More shifts mean a higher output. If the market cannot absorb the higher output, then the solution is to reduce the number of working days per week accordingly.

(b) Attaching the fish meal plant to an existing fish processing plant. The fish meal plant will use as raw material the by-product offal generated by the fish processing plant.

FLOW CHART
FISH MEAL MAKING PLANT