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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
(UNIDO)

Feasibility Study
on the Establishment of an
Automobile Tyre and Tube Manufacturing Plant
in Bangladesh

PROJECT NUMBER US/BGD/91/047

FINAL REPORT

Rome, January 1993

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TABLE OF CONTENT

INTRODUCTION

Following its previous activities in support of the implementation of a project concerning the creation of a tyre manufacturing plant in Bangladesh, at the end of 1991 UNIDO decided to conduct a feasibility study on the project; the study has been sub-contracted to AGORA' 2000 on January 1992.

After the briefing session held in Vienna in March 1992 under the coordination of the project backstopping officer Ms. P. Scott, a mission was scheduled to immediately start field work; however, due to the coincidence with a period of religious observance in the Country, such mission was postponed until April 1992.

In co-operation with the UNIDO's Office in Dhaka and with BMDC (Bangladesh Management Development Centre) AGORA' 2000 experts have been able to locally gather available information and to meet the public authorities and private businessmen related to the project; the list of such meetings had been provided with an interim report on June 1992. The field mission was carried out on a positive co-operation climate and no particular problems have arised on collecting data and interviewing relevant key people in the Country.

A Draft Final Report has been prepared on the basis of both the field mission findings and desk research activity. The Draft Final Report has been forwarded to UNIDO in August 1992.

Starting on October 27th, 1992, a UNIDO mission led by Ms. Scott held discussions in Dhaka on the Draft Final Report with representatives of all parties concerned. During such meetings AGORA' 2000 Team Leader responded on questions regarding the report and took note of various observations and remarks. The present Final Report incorporates the results of the meetings.

The project team was composed by A. Bolondi, economist and Team Leader, G. De Lellis, technologist, A. Cinti, market analyst, F. Peruzzo, industrial engineer, and M. Martelli, financial analyst; the team has also benefited by the invaluable backstopping assistance given by AGORA' 2000 office staff.

CHAPTER 1

EXECUTIVE SUMMARY

The setting up and improvement of a communication network has become a central priority for the Government of Bangladesh (GOB), which has particularly emphasized its recent development programmes on the consolidation and strenghtening of the road transport system, since it is the most widespread mode of inland transport in the Country. The entire requirement of tyres and tubes has so far been met through importations. Thus, GOB has provided positive assessment and support when a private promoter presented a project proposal aimed at establishing a tyre factory in the Chittagong Export Processing Zone (EPZ).

Industrial performance in Bangladesh has been consistently poor. Therefore the project environment can hardly be defined conducive. The constraints affecting the performances of already established industries are relevant. On the other hand, the financial possibilities of the promoter seem to be relatively limited. From the technical point of view, his knowledge is also limited and at present he has only general information on the functioning of a tyre plant. Under the circumstances, the chances of a major industry to be set up anew, with scarce financial resources, scanty managerial skills and low productivity of production factors, are rather questionable.

A preliminary market study was achieved in March 1988 giving some positive indications on local market potentiality. At present the world tyre industry is in a stage of international consolidation and vast corporation restructuring. The productive scenario is characterized by a relevant trend to reduce the number of factories and to concentrate production and ownership. From the technological point of view it is important to underline that world production is more and more developing from the traditional cross ply tyres towards radial tyres, even in the Indian Sub-Continent. Radial tyre's comparative advantage consists of minimizing heat generation during tyre running, thereby extending tyre life considerably.

From the marketing point of view, in Bangladesh there are stronger comparative advantages in the Bus and Truck Tyre sub-sector vis-a-vis the Passenger Tyre sub-sector. The main reason is the relatively bigger size of the market since Buses and Trucks represent almost 35% of the mechanized vehicles in Bangladesh, while cars represent only less than 15%. Moreover, Trucks and Buses show a positive growth trend. Therefore, it is deemed appropriate, at least on an initial phase, to limit the production only to the Trucks and Buses Tyres sub-sector.

The estimated annual requirement of such tyres in Bangladesh is 336,000 units. Some relevant factors limiting annual requirement have been identified, such as the general growth trend in world tyre production towards more durable tyres; the technological choices related to the type of tyre to be produced (radial instead of cross ply); the development of road network in terms of asphalted roads and improving maintenance. Total current demand is then estimated at 280,000-300,000 new tyres per year. When the proposed factory could start production in 1997, the estimated demand will reach 560,000 new tyres per year. A newcomer could be able to capture a market share of about 50%. Unlike the conclusions arrived at by the previous market study, the

present study shows that export potential seem to be limited. It is then advisable to postpone the opening up of new markets sometime after the start-up of the factory. Therefore the capacity envisaged for the proposed plant is 400,000 tyres per year, which is the minimum technologically possible size.

Tyres are a very high technology product and experience has shown that it is crucial that they are produced under the guidance and control of experts. A joint venture agreement with an internationally reputed partner, to be selected among the world market leaders, is, therefore an unavoidable prerequisite for the successful implementation of the project.

Natural rubber could be locally available but not before some years from now, provided that both the physical and chemical properties are suitable for the selected technology. It is clear therefore, that the most essential raw materials should be imported. The tyre factory could be located anywhere in Bangladesh as long as enough land could be made available. However, it is mandatory for this factory to be located where electricity and water supplies can be ensured 24 hours a day. This can only be guaranteed in the Chittagong EPZ, where factories also enjoy special benefits in terms of industrial relations, fiscal and customs regulations. However, location at EPZ appears to be impossible for the proposed plant, as its production is tctallly addressed to the domestic market.

The cost for plant and technology is estimated at U.S.$ 104,800,000. The factory would have a total employment opportunities of 357 units, of which 285 is for workers, 61 for foremen and technicians and 11 for supervisors. The latter would have to be recruited abroad and, based on experience of similar projects, their presence would have to be ensured for at least 10 years before sufficient managerial know-how is transferred to local personnel. Factory construction would require 4 years starting from investment decision to production.

The financial analysis of the project and the investment appraisal have been carried out by the use of the COMFAR programme. The initial investment, estimated at a little under $ 106 million to include training and working capital requirements, is assumed covered by equity participation of the local promoter and other local partners (15%), the foreign partner (14.6%) and by a long term loan (70.4%). The analysis showed that the proposed project's profitability is, beyond any reasonable doubt, rather questionable. The investment required is relatively high with respect to the cashflow which the operations are able to generate in the prevailing market conditions, and under the constraint of a complex technology, requiring costly, imported raw materials and human resources. Until more favorable market conditions prevail both domestically and abroad, allowing for a better utilization of the proposed plant capacity, it will be very difficult for the project to find any interested partner for its implementation.

Therefore, it is recommended to reconsider the investment choice, taking into consideration the fact that the cost of the investment required for a modern retreading factory of the assumed production capacity, can be roughly estimated at about 10% of that estimated for the factory to produce new tyres. Furthermore, it would be relatively easy to find a reputed retreading company willing to supply a turn-key factory, as well as technological support and technical assistance to start-up.

CHAPTER 2

PROJECT BACKGROUND AND HISTORY

2.1 DESCRIPTION OF PROJECT IDEA

The increase in population Bangladesh experienced recently brought about some relevant problems in the socio-economic development of the Country. Inability of the productive and service system to meet the increasing demand coming from a low-income population, progressive unemployment, increasing scarcity of financial resources are problems which appear very difficult to solve.

With a population estimated at 116 million in 1991 in an area of only 144 thousand square kilometers, Bangladesh has a population density of over 800 persons per square kilometer, the highest in the world. Bangladesh annual population growth rate can be estimated at 2.6%.

Under this framework, the setting up and improvement of a communication network, pushed by a tremendous growth of the demand for transport (estimated at over 8% per year in the next decade) for both freight and passengers, has become a central priority for the Government of Bangladesh (GOB).

For this reason GOB has particularly emphasized its recent development programmes on the consolidation and strengthening of the transport system. In this context, the road transport has been playing a dominant role and it turned out to be the most widely used mode of inland transport in the Country. Speed, flexibility, increased geographical coverage, ability to offer personal and door-to-door service, reduced terminal handling cost and a combination of arterial and local service operations have made it the preferred as well as the most economical mode of transport in the Country. Public allocations earmarked to road transport development absorbed 2/3 of the limited available resources during the Fourth Five-Year Plan (1985-90). However, according to the GOB infrastructural investment plan, road network development will still continue to be given top priority also in the next decade.

The increasing demand for freight and passengers movement determines a development of the demand for tyres and tubes. The total requirement of tyres and tubes in the Country has so far been met through importations which have drained out Bangladesh's hard earned foreign exchange.

On the basis of these considerations, GOB has given positive assessment and support when a private promoter, Mr. Chowdury, presented a project proposal aimed at establishing a tyre factory to be located in Chittagong, which is first of the three Export Processing Zones (EPZ) GOB has decided to create with the objective to provide areas where potential investors could find a conducive investment climate, free from too many procedural complications. Chittagong EPZ became fully operational in 1984. Chittagong is the main port of the Country, the second town and one of the most important industrial cities. It is situated about 264 Km from the capital city, Dhaka.

Generally, the development objectives of the project are the following:

- To promote industrialization in Bangladesh.
- To generate employment opportunities within the Country.

- To foster import-substitution.
- To develop export potential.
- To earn foreign exchange.
- To assist GOB policies towards self-reliance.

The original project idea, as it was presented to the field mission, regarded production of tyres both for cars (passengers tyres) and for buses & trucks (giant tyres). However, after preliminary discussions with the promoter, the UNIDO Dhaka Office and the Bangladesh Management Development Centre (BMDC), on the basis of the marketing, financial, technical considerations it was decided to limit the product range to the sole production of giant tyres (see chapter 3.3).

On the other hand, it is clear to all concerned parties that project implementation is subject to the "sine-qua-non" condition of the involvement of a major foreign producer as a joint-venture partner to enter into the domestic market and try to penetrate, later on, in selected foreign Countries of the Indian Subcontinent. In fact, the technological choice (radial tyres instead of cross-ply tyres) and organizational and financial requirements can only be mastered through such a kind of association.

2.2 BACKGROUND OF THE PROJECT AND PROFILE OF THE PROMOTER

Mr. S. K. Chowdury began his entrepreneurial activity in 1975 working in the commercial sector. In 1978, he established "EXPOCONCERN Manufacturers & Exporters", a Company located in Chittagong. Mr. S.K. Chowdury is the major owner and the Managing Director of the Company. EXPOCONCERN employs ten workers and deals with import-export and real estate marketing. At present, the main exported goods are jute and dried marine fish, shipped essentially to East Africa, Asia and the Middle East.

The financial possibilities of the promoter seem to be relatively limited. The mission was unable to analyze in depth the Company's statements of assets and liabilities and other documents. Nevertheless, Mr. Chowdury asserts to be certain to obtain sufficient resources to cover around 15% of the total envisaged investment.

From the technical point of view his knowledge is absolutely limited and at present he has only general information on the management of a tyre manufacturing plant.

The promoter has a good entrepreneurial spirit, determination and dynamism, but his managerial capability should be better scrutinized in view of the needs of an articulated productive organization such as a tyre manufacturing plant.

2.3 PROJECT HISTORY

Considering the tyre market conditions in his Country, where demand is totally covered through imports, Mr. S. K. Chowdury began in 1981 to define and formulate his project idea for the establishment of a tyre manufacturing plant in Bangladesh.

Export potential to some neighbouring Countries where there were neither local producers nor special public policies supporting export-oriented firms suggested to locate the project in the Export Processing Zone of Chittagong. Furthermore a number of special conditions existing in the EPZ regarding labour regulations, availability of utilities and services, fiscal incentives, etc., determined the final choice of CEPZ to locate the factory.

The promoter developed contacts with local authorities, international co-operation bodies and foreign firms. He also gathered a considerable amount of information concerning the project from several sources in Bangladesh and abroad. In particular Mr. Chowdury established some positive contacts with the UNIDO Office in Dhaka (Project BGD/80/014) and with two foreign tyre manufacturing firms, AVON (U.K.) and DUNLOP (U.K.) that had shown general interest in his project.

His efforts were supported by UNIDO and the proposal was selected for inclusion in the list of projects submitted at the International Investment Forum held in Dhaka in January 1987 (Project BGD/85/225).

The promoter personally presented his industrial proposal at the Forum and met the foreign firms that had shown interest in the project. Mr. Chowdury then approached the UNIDO Investment Promotion Project experts for the preparation of a pre-feasibility study on the proposal. As a first step, it was proposed to carry out an independent market study. The proposal was endorsed by the Director General of the Department of Industries of GOB. A team of experts was requested to conduct the study in collaboration with the Bangladesh Management Development Center (BMDC) in the framework of a UNIDO Programme of Training Workshops on Feasibility Analysis.

The study, conducted by Mr. J.M.I. Sait, UNIDO Chief Technical Adviser, and A.K.M.N. Chowdury, BMDC Senior Management Counsellor, was completed in March 1988. The study gave some positive indications on local market potential and recommended that a detailed techno-economic feasibilty study be realized.

Meanwhile, following the contacts developed during the Forum, the promoter had submitted his project to several financing agencies such as the Asian Development Bank, the International Finance Corporation of the World Bank, the DEG of Germany, Grindalays Bank Bangladesh, Banque Indosuez Bangladesh, Standard Chartered Bank Bangladesh, Industrial Promotion Development Company Bangladesh. All these financial institutions have shown general interest in the project and await for detailed feasibility study before starting up the decisional process.

Based on the above mentioned reasons, the promoter, prompted by GOB, requested UNIDO's assistance to prepare a Techno-Economic Feasibility Study regarding the proposed project.

2.4 GENERAL DATA AND PUBLIC POLICIES SUPPORTING THE PROJECT

2.4.1 GENERAL BACKGROUND

Bangladesh continues to be primarily an agrarian society with less than 20% of the population living in urban centres. Total GDP generated in the Country in 1989 was $20,240 million. The Country is slowly moving towards

Industrialization. Industrial contribution to GDP has increased at a higher rate compared with other sectors. During the period between 1980 and 1989, the Average Annual Growth Rate of GDP was 3.5%. GNP per capita in 1989 was $180 and Average Annual Inflation Rate between 1980 and 1989 was 10.6%.

The economy is heavily dependent on foreign aid. It has a low and declining rate of National Savings (5.0% of GDP in fiscal 1990) and high Foreign Savings (6.8% of GDP in the same year). Workers' Remittances account for over half of the National Savings, which in turn finance less than half of the total investment in the economy. Export earnings cover only about 40% of Import and Public Revenues finance only about half of Public Expenditures.

Despite these constraints and the repeated disruptions caused by recurring natural disasters, Bangladesh made significant progress in the 1980s. Sustained stabilization policies supported by the IMF and the World Bank helped reduce External and Fiscal Deficits from a level of 10-12% of GDP in the early 1980s to 6-7% of GDP by the late 1980s, while Annual Domestic Inflation was brought down from 16 to 9%.

Policies designed to promote Exports and improve Exchange Rate Management helped to increase non-traditional Exports from $306 million in fiscal 1986 to $353 million in fiscal 1990, while Workers' Remittances increased to $76 million in fiscal 1990, equivalent to about 20% of Imports.

2.4.2 INDUSTRIAL POLICY

In 1971, the new Government embarked upon a Socialist Mode of Development thereby nationalizing industries and financial institutions. This was considered as a necessary step because the previous owners had left the Country along with many of their skilled workers and experienced Managers, as a result of the political changes. The nationalization policy brought about a corresponding fall in managerial and productive efficiency of the industrial sector.

In 1975, a programme of cautious disinvestment of Public-Sector enterprises was launched, while at the same time GOB sought to encourage a more substantial role for the Private Sector in the economy. In 1976, the upper limit on private investment, which had been previously set at $800,000, was raised to $2,700,000. In 1978, all the upper limits on Private Investment were withdrawn. Further incentives were provided through the introduction of a capital market, concessionary import duties and protective tariffs, as well as development financing. In just about a decade, the original Policy was reversed giving the private enterprise a leading role in the whole economy.

A new Industrial Policy formulated in 1982 was revised in 1986 in an attempt to further push the liberalization, calling for a more vigorous expansion of the private sector, as well as for an increased efficiency in public sector enterprises through greater managerial autonomy in their operations. This policy direction and Government Committment towards sustained economic growth as the main means of addressing Bangladesh's development problems has been confirmed by the acceptance of the IMF Structural Adjustment Facility in 1986-87, subsequently extended until 1991-92 under IMF's Enhanced Structural Adjustment Facility.

The present Government wants to carry on liberalization policy and give emphasis to a free market economy: foreign investments and privatizations by means of joint-ventures or buy-back agreements are granted special incentives.

2.4.3 INDUSTRIAL PERFORMANCE

In spite of the efforts made by GOB, Industrial Performance has been consistently poor in the Country, hampered by numerous constraints. These include the following:

a) Demand Constraints: the lack of effective demand for industrial products is one of the major constraints in increasing production levels and achieving higher capacity utilization of the industrial units. Slow growth in agriculture, slow economic activities and the resulting lower income of the people reduced the local demand for industrial products.

b) Cost-Price Squeeze: in many industries, the cost of production has been rising due to the increasing cost of capital goods, rising cost in wages and salaries and utility prices, etc. The rising cost of production under a situation of depressed selling prices has resulted in a cost-price squeeze and hence in under-utilization of the production capacity.

c) Poor Maintenance: due to acute financial constraints, lack of adequate number of skilled and trained manpower and use of obsolete technology, the plant and machineries are being inadequately maintained resulting in low production rates and low capacity utilization of the industrial units.

d) Input Constraints: shortage of materials, machinery and spare parts from domestic sources, difficulties in inland transportation and shipping, shortage of local raw-materials supply due to natural calamities interrupted the efficient and proper operation of the industrial units. This was especially felt in the jute and sugar operations.

e) Energy Shortages are very frequent all over the Country (except at the EPZ).

f) Labour Productivity: it remains low in most of the industries. Overstaffing, dearth of requisite skill and training, labour indiscipline due to unstable industrial relations, etc., are the major reasons for low productivity of industrial labour.

g) Management problems: very little has been done in terms of the development of human resources. Therefore, managerial skills are absolutely insufficient at all levels of the industrial structures.

h) Inadequate Research and Development Activities: they are negligible in both the Public and Private sectors, Industrial enterprises and organizations. There is little access to new process/products and market/trade information.

Therefore the investment environment of the project idea can hardly be defined conducive, so many are the external constraints affecting the performance of already established industries. Further in the report, other aspects will be examined.

CHAPTER 3

MARKET ANALYSIS

3.1 OBJECTIVES, ORGANIZATION AND SCOPE OF THE RESEARCH

The main objectives of this chapter are the following:

- Define the product on which the project must be focused.
- Evaluate the real size of the potential market.
- Identify a suitable marketing strategy.

The results of the analyses discussed in the preceeding chapters, suggest to structure the market analysis into three parts:

A) Analysis of the international market environment and development trends.

B) Market measurement and forecasting: estimate of current demand; conditions affecting tyre demand; import and substitute market; estimation of the future demand; export potential; customer profiles and buying behaviour; channels of distribution.

C) Market strategies: sales projections; market segmentation and positioning; marketing tactics on product, price, channels, promotion decisions; analysis of risks and opportunities.

Following these organization lines, it will be possible to identify key information concerning the market approach. In a broader perspective, the scope is to gather all useful elements relating to the project and group them in a synthetic comprehensive form so that the promoter and his potential partners can exactly evaluate investment opportunities and risks.

3.2 NOTES ON THE GLOBAL CHANGES IN THE INTERNATIONAL TYRE MARKET

Like the world automotive industry which it supplies, the world tyre industry is truly international and dominated by a small number of giant industrial companies of North America, Western Europe and Japan.

Details on world tyre manufacturing factory distribution are given in Tables 3.2.1 and 3.2.2. Over 50% of the factories are owned by the seven world major Firms (Bridgestone/Firestone, Continental, Dunlop BTR, Dunlop Sumitomo, Goodyear, Michelin, Pirelli). In the remaining share, there is a relatively large part (over 30%) of independent producers, although among them the great majority are still strongly dependent upon the technology of one of the "majors", who, in several cases, own minor Equity participations. Even in the case of companies fully owned by the public sector, the control of technology remains in the hands of the seven multinational firms.

Table 3.2.1: Tyre Manufacturing Factories in the World by Ownership (number of units and percentage)					
MULTINATIONAL	No.	%	STATE OWNED	No.	%
Michelin	54	14	China	18	5
Continental	30	8	Cuba	4	1
Goodyear	42	11	Cambodia	1	0
Pirelli	23	6	Russia	17	4
Dunlop Sumitomo	9	2	Sub-total (S.O.)	40	10
Dunlop BTR	10	3	INDEPENDENT	127	32
Bridgestone/Fires.	35	9	OTHERS (East. Eur.)	26	7
Sub-total (Mult.)	203	51	GRAND TOTAL	396	100
Source: World Tyre Report 1992					

Table 3.2.2 gives the territorial distribution of tyre factories in the world (with particular attention to Asia) and their production levels.

Table 3.2.2: Number of Tyre Factories and Tyres Produced per year (1990)		
Distribution	Number of Factories	Number of Tyres
World	396	1,062,000,000
Asia	117	217,000,000
Indian Sub-continent	31	28,500,000
Source: Rubber Journal Statistics 1991		

Table 3.2.3 gives production levels by geographical area in the last two years. Data show a substantial stagnation in world tyre production. Furthermore, it is to be noted a significant recession for western Europe and North America, where most market leaders are located: such trend is bound to influence overall world production in the next few years.

Table 3.2.3: Tyre Produced in the World by Geographical Area Monthly Averages 1990/91 and 1991/92		
Distribution	1990/91	1991/92
North America	25,326,000	24,481,000
Western Europe	22,884,000	20,644,000
Asia/Australia	18,016,000	21,916,000
Eastern Europe	12,108,000	13,598,000
South America	6,517,000	5,525,000
Africa/Middle East	3,735,000	3,392,000
TOTAL	88,586,000	89,556,000
Source: Rubber Journal Statistics 1992		

In order to analyse the competitors situation in Asia, it's deemed important to give some specific data about the number of tyre manufacturing plants in the continent and their production capacity, as shown in Table 3.2.4.

In the Indian Sub-Continent, there is a considerable proliferation of relatively small factories. About 7% of the total number of factories produce 3% of the total number of tyres. Average production capacity in the Indian Sub-Continent is about 900,000 tyres per year compared with 2,000,000 tyres in Asia and 2,400,000 in the world.

Here below, there is a complete list of tyre factories in Asia, where it is shown the origin of the transfer of the technical know-how, the Asian Country of destination and the name of the tyre Company.

ORIGIN OF KNOW-HOW	DESTINATION	NAME OF PLANT
AVON (U.K.)	India	Vikrant
	Pakistan	Delta Tyres
	Malaysia	Silverstone
BRIDGESTONE (Japan)	Taiwan	Kenda
BRIDGESTONE/FIRESTONE	Philippines	Philtread
	China	Ta-chung-ua - Guangzhou 8
BTR DUNLOP	China	Chonqging
		Guangzhou 12
		Liaoning Tyre
	India	Dunlop India
CONTINENTAL/GENERAL	India	Apollo (partnership and technical contacts with Toyo-Japan and Goodyear)
	Pakistan	General

INOVE RUBBER (Japan)	Malaysia	Fung Keong
	Thailand	Inove
	Sri Lanka	Ari
	Indonesia	PT Gadja Tuneggal
MICHELIN	Thailand	Michelin Siam
PIRELLI	India	Kesoram
	Indonesia	project for a joint-venture
	China	Hualin
		Qinqado 2
SAVA (Jugoslavia)	Pakistan	Atlas Tyre
SUMITOMO	Malaysia	DHIB and Sime Tyre Int.
	Taiwan	Yuanlin-Hwa Fong and Tay Feng Tyre
	Japan	Ohtsu
	India	Dunlop India
BARUM (CK)	India	Tyre Corp.
TOYO	Taiwan	Cheng Shin Q.I.
UNIROYAL/GOODRICH	Indonesia	PT Inrub
(Michelin USA)	Korea	Kumbo
	India	MRF
	Philippines	Sime Darby
UNITED	China	Tianjin
YOKOHAMA	Korea	Hankook
	Taiwan	Nankang
	Indonesia	PT Gadjah Tuneggal
	India	CEAT

The world tyre industry is still in a stage of international consolidation and vast Corporation restructuring. The productive scenario is characterized by a relevant trend to reduce the number of factories and to concentrate production and ownership.

The fundamental reason for the present concentration lie on the ever increasing cost of research both in the technological and the chemical fields. Only big producers, that is to say International market leaders, have enough resources to sustain such a level of investment. Small independent producers are not able to compete at this level and technological updating of their factories is rapidly decreasing.

From the technological point of view, it is important to underline that world production is more and more developing from the traditional cross-ply tyres towards radial tyres, even in the Indian Sub-Continent. Over 30% of the Indian factories are already producing radial tyres and 50% more will do the same in the next 3-4 years. Radial tyre technology consists of reinforced materials (cords) positioned as meridians from bead to bead. On the contrary cross ply tyres have reinforced materials (cords) going from bead to bead according to a determined bias resulting in cords crossing each other. Radial tyre's

comparative advantage lies in minimizing heat generation during tyre running, thereby considerably extending tyre life: in fact radial tyre duration is about 90% higher than that of cross-ply.

It is important to note that the proliferation trend in the Indian Sub-Continent (sharp increase of the number of relatively small size tyre factories) is quite different from that which is characterizing the international productive scenario inclined towards concentration. This phenomenon is due to the increasing competitive challenge on a market area where tyres as a product are still in an expansion phase of life cycle. As shown in the above list of Asian producers, for strategical reasons, the major world Companies have set up a considerable number of factories also in geographical segments even with limited developing potential.

Table 3.2.4: Asian Tyre Manufacturing Plants
Number of Factories and Monthly Production

COUNTRY	1990		1991	
	Factories	Production (U/m)	Factories	Production (U/m)
China	21	203,500	18	221,000
Cambodia	1	3,500	1	3,500
India	21	1,523,300	25	2,228,100
Indonesia	4	370,500	4	385,000
Japan	28	10,050,000	28	10,500,000
Malaysia	5	445,500	5	338,000
Nepal	1	7,350	1	7,350
Pakistan	3	132,300	6	112,000
Philippines	4	191,000	4	230,000
South Korea	6	2,415,000	7	3,000,000
Sri Lanka	2	37,000	2	31,000
Taiwan	10	2,500,000	10	2,735,000
Thailand	6	460,000	6	500,000
TOTAL	112	18,338,950	117	20,290,950

Source: AGORA' 2000 Elaboration of World Tyre Report 1992

3.3 MARKET DEFINITION

Tyre market in Bangladesh consists of several segments. There are two broad categories. The first category is catering the need for bicycles and cycle rickshaw and its demand is primarily met through local supply or locally manufactured tyres and tubes. The second category is for mechanized vehicles, the demand of which is entirely fulfilled by import.

Production technology for bicycles and cycle rickshaw tyres is totally different from that for giant tyres and needs a separate production unit. Moreover distribution networks are different and autonomous from each other.

The previous market study (March 1988) focused on all types of tyres for mechanized vehicles. There is a need now to deepen and update the analysis and to concentrate the feasibility study only on the segment of the market with the major potentiality. In fact, it is important to accurately limit the field of research.

On the basis of the above mentioned reasons, excluding the production of tyres for cycles, a choice had to be made among three hypotheses:

- production of tyres for passenger cars;
- production of giant tyres;
- production of giant and passenger tyres.

Under the technical profile it is important to note that the technology for the manufacture of passenger tyres is quite different from that of giant tyres, sine it requires additional special machines and further technology acquisitions. In general, the unification of the two segments of tyre production has very limited benefits in terms of economies of scale.

The investement cost of a passenger tyre plant is considerably higher than that of giant tyres. For this reason, and considering the relative uncertainty in securing adequate financial resources to the project, it appears reasonable to reduce the entity of the cost to be sustained by the investors and to concentrate the project just on the cheapest segment.

From the marketing point of view, in the Bus and Truck tyre sub-sector, there are stronger comparative advantages vis-a-vis the Passenger tyre sub-sector. The main reason is the relative bigger size of the market. The analysis will show (see Table 3.4.2) that buses and trucks represent almost 35% of mechanized vehicles in Bangladesh, while cars represent only less than 15%. Moreover, trucks and buses show a positive evolution trend. Also demographic trends in Bangladesh, together with persisting low income per capita conditions, will lead towards a wider utilization of public services for passengers transport (instead of private cars). Finally, strategic choices of GOB on road network development go in the direction of a considerable increase of goods transport by trucks.

Considering all these reasons, and after having thoroughly discussed them with the main actors of the project (promoter, UNIDO Dhaka Office and BMDC), it is deemed appropriate, at least on an initial phase, to limit the proposed production only to the sub-sector of tyres for Trucks and Buses.

Another important limitation imposed to the study is to concentrate the survey only on the production of tyres, disregarding the production of inner tubes that could be technologically and financially too heavy during the start up phase. Raw materials processing technology on producing inner tubes is completely different from tyre production technology and it requires a specific production unit. Furthermore, though not immediately, international market trends go towards the development of the production of tubeless tyres. Finally the results of the field survey show that the local market is not yet ready for tubeless tyres. In fact road condition and above all type of rims presently fitted on commercial vehicles are not able to guarantee the perfect tyre-rim contact necessary to prevent air leakage. It is reasonable to envisage that manufacturers of vehicles will introduce tubeless tyres rims in Bangladesh as local road condition will make it possible. At that time the proposed tyre factory could gradually switch to the production of tubeless tyres with little or no problem.

3.4 ANALYSIS OF MARKET CHARACTERISTICS

3.4.1 ESTIMATE OF MARKET VOLUME & MARKET POTENTIAL

a. Estimate of Current Demand

i. Number and Types of Mechanized Vehicles on Road

In order to understand the evolutionary trends in the use of Buses and Trucks and consequently their tyres requirements, it is necessary to analyse quantities and qualities of all mechanized vehicles on the road in Bangladesh.

The first step of the analysis will be an evaluation of the total number of mechanized vehicles on the road. Table 3.4.1 presents the quantitative growth of vehicles in the last decade. It is important to note the considerable development rate.

Table 3.4.1: Total Number of Mechanized Vehicles on the Road and % Annual Increase		
Year	Vehicles	% a.i.
1982/83	126,017	n.a.
1983/84	134,670	6.87
1984/85	144,182	7.06
1985/86	154,549	7.19
1986/87	165,520	7.10
1987/88	177,189	7.05
1988/89	202,794	14.45
1989/90	217,277	7.14
Source: AGORA' 2000 Elaboration of BBS Data		

After having considered vehicle quantities, we shall analyse the composition by type out of the total vehicle pool. Table 3.4.2 shows estimated distribution by type of mechanized vehicles during the last decade.

Table 3.4.2: Estimated distribution of mechanized vehicles on the road by type (%)										
Year	Bus	Truck	Jeep	Car	Taxi	Rickshaw	M.cycle	Tractor	Trailer	Other
1982/83	11.85	18.14	3.75	16.56	.90	9.72	36.28	1.15	.57	1.03
1983/84	11.64	17.48	3.69	16.27	.87	. . 10	37.34	1.10	.55	.89
1985	11.42	15.82	3.62	15.95	.84	10.28	38.37	1.17	.53	.96
1986	11.19	16.16	3.54	15.63	.80	10.55	39.37	1.28	.51	.92
1987	10.97	15.54	3.47	15.33	.77	10.83	40.44	1.23	.49	.87
1988	10.75	14.96	3.42	15.13	.77	11.15	41.26	1.20	.47	.83
1989	10.62	14.64	3.41	15.10	.80	11.36	41.53	1.21	.47	.82
1990	10.39	14.08	3.35	14.89	.80	11.68	42.33	1.19	.45	.78
Source: AGORA' 2000 elaboration of BBS Data										

Motorcycles occupy the major share (42.33%) followed by cars (14.89%) and trucks (14.08%). Evolutionary lines seem quite regular. The structure slowly evolves towards a progressive expansion of two wheel vehicles (motorcycles and rickshaw), following the general trend in Asian developing Countries.

According to the objective of our study, it is important now to highlight the sub-sector related to buses and trucks. Absolute number of buses and trucks on the road has increased considerably during last years in Bangladesh even though their percentage share, as regards to total mechanized vehicle pool is costantly but slowly declining. Table 3.4.3 shows the quantitative growth and annual growth rates of buses and trucks on the road in the last decade.

Table 3.4.3: Total Number of Buses and Trucks on the Road and % annual increase

Year	Buses	% a.i.	Trucks	% a.i.
1982/83	14,941	n.a.	22,865	n.a.
1983/84	15,689	5.01	23,551	3.00
1984/85	16,473	5.00	24,258	3.00
1985/86	17,297	5.00	24,986	3.00
1986/87	18,162	5.00	25,736	3.00
1987/88	19,048	4.88	26,517	3.03
1988/89	21,540	13.08	29,707	12.03
1989/90	22,591	4.88	30,609	3.04

Source: AGORA' 2000 Elaboration of BBS Data

The vehicle pool related to buses and trucks is composed of vehicles directly imported or locally assembled using imported components. No local legislation exist concerning speed limit amd maximum permitted load. For both buses and trucks, the type of service and ownership can largely vary. There are several public or private companies owning big fleets but also a number of people own only one or two vehicles.

Finally, it must be noted that there are significant differences on quantitive figures concerning buses and trucks between the data from the previous market study and those collected by the field mission, even if the source was exactly the same (Statistical Yearbook of Bangladesh). For instance, the 1985 data concerning the number of buses and trucks on the road is significantly different - i.e. 8,350 buses instead of 16,473; 15,537 trucks instead of 24,258. However the latest data collected by the mission will be used.

ii. Import of Tyres

Bangladesh is totally depedent on import to meet its demand for bus and truck tyres.

Major exporters are India, Japan and China as shown in Table 3.4.4., while a total of 16 different tyre manufacturers still export tyres to Bangladesh.

Because of the characteristcs of the vehicle pool in Bangladesh, only a few types of tyres for buses and trucks are imported. All of them are of the cross ply kind and are imported as complete set (1 tyre + 1 tube + 1 flap).

The most common sizes, in order of importance, are the following:

Size	%
9.00.R20	about 20%
8.25.R20	about 20%
7.50.R16	about 20%
7.00.R16	about 20%
10.00.R20	
7.50.R20	
6.50.R16	
6.00.R16	

The last four items represent roughly 15-20% of the import.

All sizes are available in different tread design: rib type, lug type and multipurpose type. Illegal imports are very limited and we can estimate that they are less than 1% of the total commercial flow.

iii. Substitutes

The only substitute product is the retreaded tyre. No official statistical sources are available on the issue. However, according to the interviews made, it can be estimated that a market share of about 10-15% of the total demand is covered more than 20 retreading firms, which directly retread the tyres broght in by the customer. They do not use the worlwide adopted system of buying used carcasses on the market, inspecting them systematically and retreading them on an industrial basis.

During the field mission, it was noticed that truck/bus owners have the habit of lengthening as much as possible tyre life, keeping them in operation with any reasonable, and sometimes not reasonable, means, often jeopardizing safety. It is amazing that only few tyres are retreaded and therefore it is evident that users are not confident on the effectiveness of retreaded tyres. On the contrary, it is well known that a tyre retreaded according to an updated tecnhology can guarantee the same performance of a new tyre in terms of safety and durability.

Table 3.4.4: Import Estimation of Tyres for Buses and Trucks by Country of Origin During 1986 to 1990 (value in $ thousand and % share)

COUNTRY	1986	%	1987	%	1988	%	1989	%	1990	%
India	2,453	55.6%	2,268	28.3%	5,370	40.5%	0	0%	8,797	78.6%
Japan	446	10.1%	1,146	14.3%	1,843	13.9%	1,736	47.2%	994	8.9%
China	0	0%	3,623	45.2%	4,544	34.3%	1,386	37.7%	874	7.8%
Indonesia	34	.8%	35	.4%	14	.11%	115	3.1%	274	2.4%
Sri Lanka	0	0%	0	0%	199	1.5%	0	0%	0	0%
Singapore	547	12.4%	101	1.3%	169	1.3%	92	2.5%	105	.9%
Korea R.P.	128	2.9%	168	2.1%	406	3.1%	207	5.6%	69	.5%
Thailand	747	16.9%	558	7.0%	664	5.0%	99	2.7%	61	.5%
Malaysia	58	1.3%	35	.4%	39	.3%	0	0%	0	0%
Germany F.R.	1	.02%	34	.4%	0	0%	0	0%	0	0%
Finland	0	0%	5	.1%	0	0%	22	.6%	0	0%
UK	0	0%	0	0%	8	.05%	19	.5%	22	.2%
Belgium-Lux.	0	0%	21	.3%	0	0%	0	0%	0	0%
Greece	0	0%	10	.12%	0	0%	0	0%	0	0%
USA-Puert.	0	0%	3	.04%	0	0%	0	0%	0	0%
Denmark	0	0%	0	0%	0	0%	1	.03%	0	0%
TOTAL	4,414	100%	8,007	100%	13,254	100%	3,677	100%	11,196	100%

Source: ITC/CCI Geneva based on COMTRADE Data Base

iv. Conditions Affecting the Demand for Tyres

In order to correctly estimate the total demand of buse and truck tyres and its development trends, it is necessary to analyse some elements that can significantly influence such demand.

Road Network

While transport acts as a catalyst in the socio-economic development of a Country, socio-economic development in return generates demand for transport. Therefore, an adequate and efficient transport system is a basic requirement for both initiating and sustaining economic development. Transport facilitates the domestic market expansion by transporting surplus goods and services from production to consumption centres. Similarly, imports and exports are facilitated by efficient transportation.

The transport system of Bangladesh consists of railway, road, inland water as well as two sea ports, international shipping and civil aviation, catering for both domestic and international traffic. While railways and inland water transport continue to bear the main burden of long haul traffic, road transport has been assuming an increasingly important role in the movement of short haul traffic, particularly the manufactured goods and perishables. This trend will be further intensified with the expansion of the road network, both arterial and local, as shown in the following table 3.4.5.

Table 3.4.5: Movement of Goods by Means of Transportation (thousand metric tons)

Year	Railway	Road Transport			Water transport	Air	Grand Total
		Organised	Unorganised	Total			
1981/82	3.280	25.259	43.281	63.440	29.277	2	100.949
1982/83	2.998	25.861	48.297	74.158	30.286	2	107.444
1983/84	2.986	26.721	46.848	73.569	31.049	2	107.606
1984/85	3.057	27.514	47.564	75.078	32.376	2	110.513
1985/86	2.341	28.314	46.266	74.580	33.898	2	110.821
1986/87	1.984	29.022	46.713	75.735	35.127	2	112.848
1987/88	2.518	29.844	45.415	75.259	36.958	2	114.737
1988/89	2.493	33.497	45.862	79.359	39.442	2	120.125
1989/90 (p)	2.410	34.464	46.446	80.910	41.833	2	125.155

Note: (p) = provisional
Source: Bangladesh Railways, BIWTA & BBS

While infrastructural facilities in Road Sector are provided by the Government, operation in this sub-sector is dominated by the Private Sector.

In view of the growing importance of the road transport system, considerable amount of resources have been increasingly allocated during the Third and Fourth Five-Year Plan, as shown in Table 3.4.6.

The above data show that around 2/3 of allocations to the transport sector are earmarked to promote Road Transport. Most of the investments are for construction and maintenance of paved roads and bridges.

Particular importance was given to the Jamuna Multipurpose Bridge Project. To support the economic integration of the potentially productive but relatively isolated North-West region of the Country with the central markets and energy sources located in the Eastern part, and to generate economic activity by substantially reducing transport costs across the Jamuna, the Government has decided to build a multipurpose bridge over the river and has attached a very high priority to this project. The end of construction is scheduled for 1995/96. The Jamuna Bridge will foster transport by road and starting from 1996, transportation of freight and passengers along this route is expected to grow by around 50%.

Table 3.4.6: Public Sector Allocation under Fourth Five-Year Plan (million taka)

Sub-sector	Allocation
Road & Highway Dept. (RHD)	1,730
Jamuna Multipur. Auth. Bridge (JMBA)	2,257
Bangladesh Rd. Transport Corp (BRTC)	10
Planning Commission	9
Sub Total	4,006
Railways	997
Water Transport	878
Air Transport	359
Grand Total	6,240

Source: Bangladesh Fourth Five-Year Plan

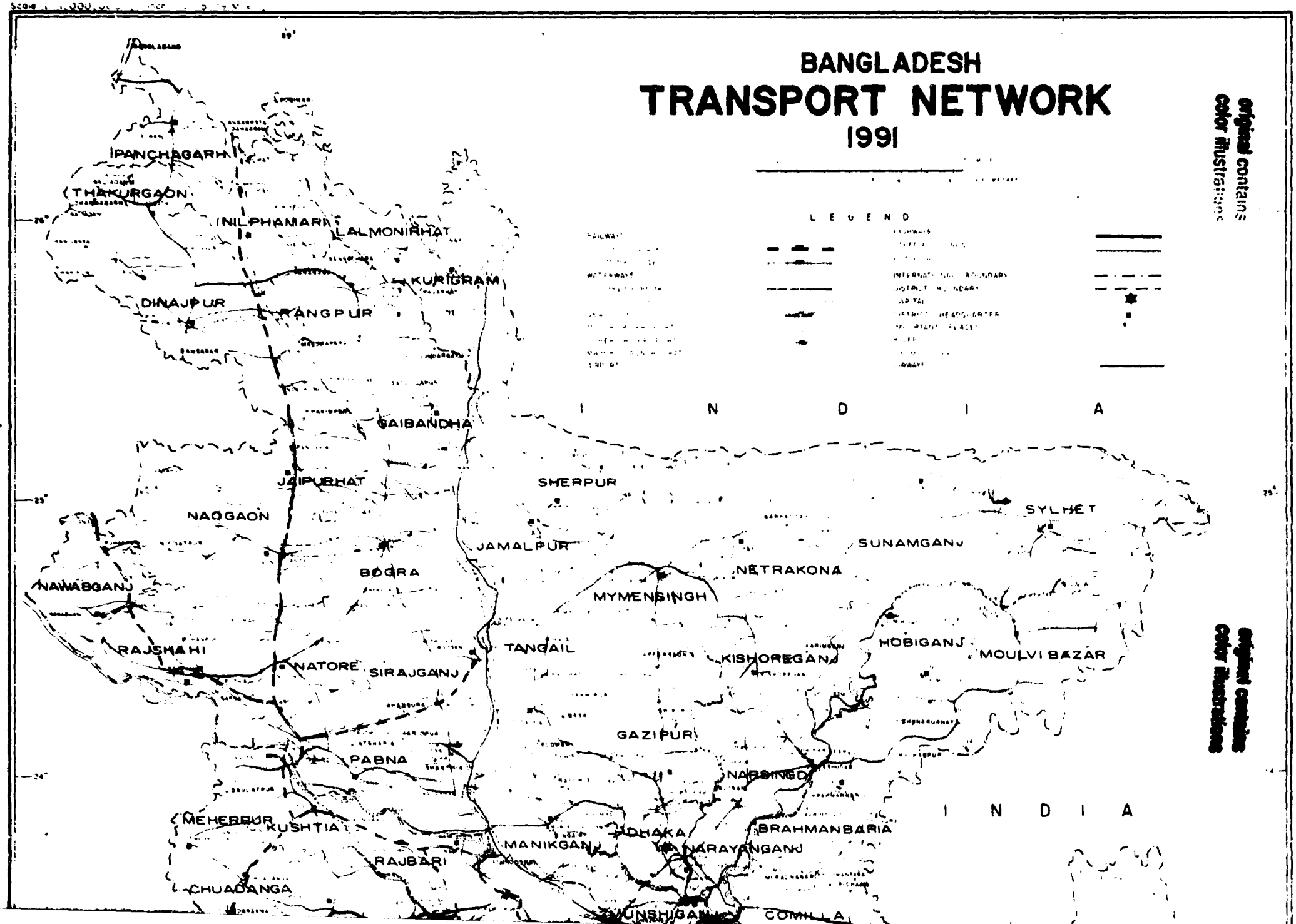
The attached map shows the present road network. Main routes for all types of vehicles are the following:

Dhaka - Chittagong - Cox's Bazar
Dhaka - Sylhet
Dhaka - Rangpur
Dhaka - Rajsani
Dhaka - Jessore

The length of each section is about 250-300 Km.

Table 3.4.7 shows the development of the type of road network over the last few years.

It must be noted that "High Grade" refers to roads having cement, concrete or bituminous concrete surface or bituminous surface. "Low Grade" refers to roads generally made of stone, brick, gravel or dirt with proper alignment and drainage structure. The data refer only to roads constructed and maintained



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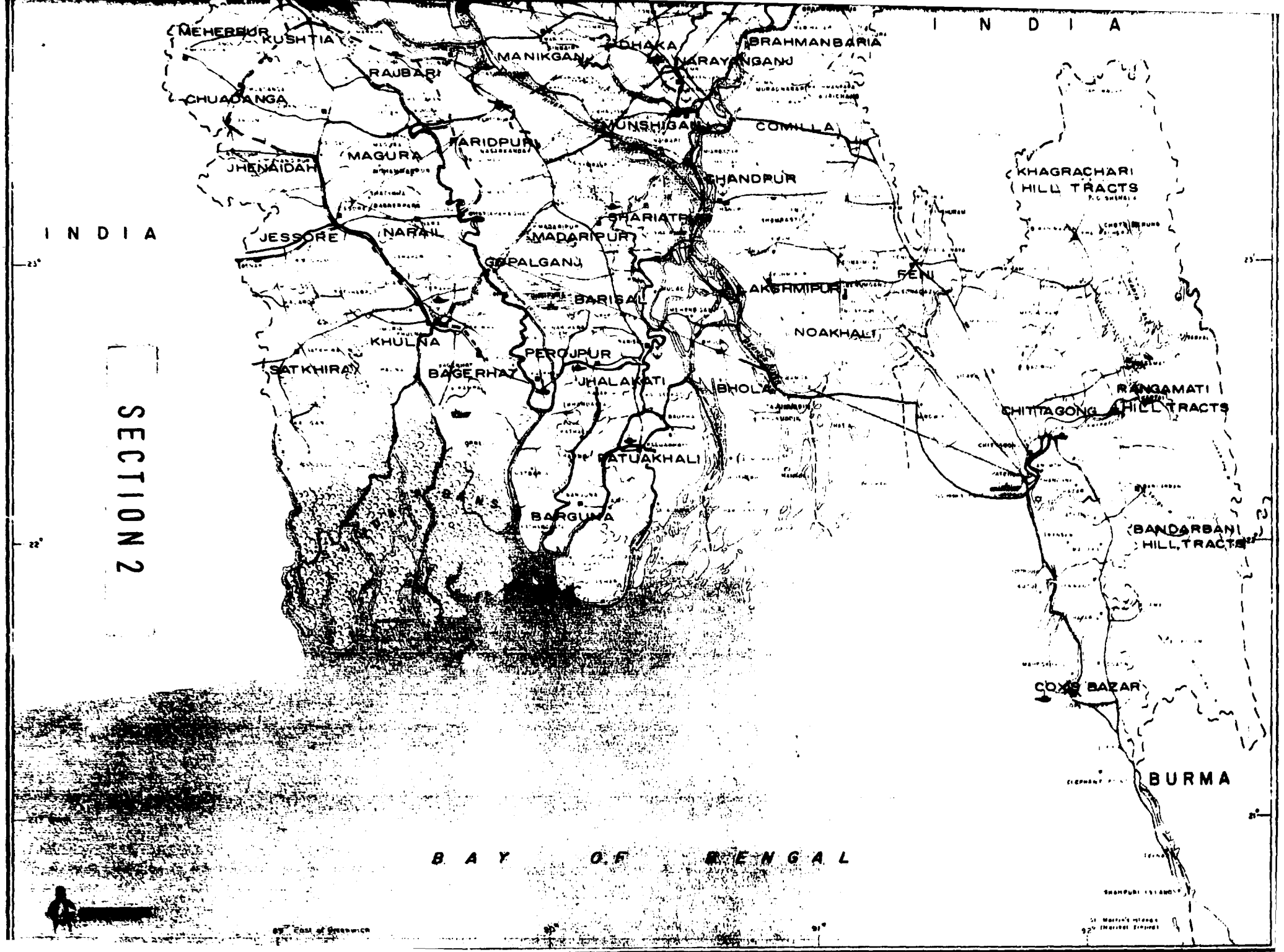

INDIA
MEHERPUR
KUSHTIA
RAJBARI
CHUADANGA
MANIKGANJ
DHAKA
BRAHMANBARIA
NARAYANGANJ
MUNSHIGANJ
COMILLA
FARIDPUR
MAGURA
JHENAIDAH
CHANDPUR
KHAGRACHARI HILL TRACTS
SHARIATPUR
JESSORE
NARAIL
MADARIPUR
GOPALGANJ
FENI
LAKSHMIPUR
BARISAL
NOAKHALI
KHULNA
PEROJPUR
SATKHIRA
BAGERHAT
JHALAKATI
BHOLA
RANGAMATI HILL TRACTS
CHITTAGONG
PATUAKHALI
BARGUNA
BANDARBAN HILL TRACTS
COX'S BAZAR
BURMA
BAY OF BENGAL
SECTION 2
22°
23°
89° East of Greenwich
91°

by the Roads and Highway Department. Roads constructed and maintained by municipalities, district councils and other local bodies have not been included in Table 3.4.7.

Table 3.4.7: Road network by grade (Km)

Year	High Grade	Low Grade	Total
1983	5,131	2,866	7,997
1984	5,359	4,028	9,387
1985	6,215	4,159	10,374
1986	6,503	4,682	11,185
1987	6,782	5,033	11,815
1988	7,217	5,104	12,321
1989	7,559	5,401	12,960

Source: Roads and Highway Department

All main roads are made of asphalt. Underneath, there is a layer normally filled in with small pieces of broken breaks. Roads are quite narrow but could allow two lanes running around big towns. Road maintenance is continuous and efficient. Nevertheless pits with visible rocks are prevalent. It has been reported that maintenance service is not fast enough to repair the effects of floods. Also, non asphalted roads are relatively smooth but small rocks are present.

Tyre Replacement Cycle for Buses and Trucks

Having considered the road conditions in Bangladesh, it is possible now to estimate the annual requirements of tyres per vehicle. The previous study showed that consumption of tyres for buses and trucks ranges from 8 (conservative figure) to 10 (optimistic figure) tyres per vehicle per year. This figure was confirmed during the interviews made by the field mission. Average durability of a set of tyres is around six months for bus and ten months for trucks. This figure could greatly vary according to road maintenance, weather conditions and quality of the product.

v. Conclusions

The total number of buses and trucks in Bangladesh in 1990 was about 53,000. If we consider that around 20% is not effectively on the road at any point in time due to repair or maintenance needs, we obtain a total number of around 42,000 vehicles to be in full efficiency. Multiplying this figure by the number of tyres consumed per vehicle per year, we obtain an estimated annual requirement of (42,000x8) or 336,000 tyres.

It has been decided to make use of the most conservative estimate of 8 tyres per year as the replacement co-efficient. In fact, some relevant factors limiting annual requirement have been identified: the general growth trend in

world tyre production towards more durable tyres; the technological choices related to the type of tyre to be produced (radial instead of cross ply); the development of asphalted road network and improvement in maintenance.

Finally, considering that an estimated 15% of the total demand will be met by substitutes, we obtain a total current demand of 285,000 new tyres per year.

This conclusion is consistent with the data from two different sources, i.e. Bangladesh Statistical Yearbook 1991 and Imports Estimation Tables from I.T.C. Geneva, based on COMTRADE Data Base. These sources estimate that Bangladesh's current import of new tyres for buses and trucks is 280,000 tyres which was obtained by dividing 11,196,000 (total $ value of import in 1990).

Therefore, the current annual demand for for truck and bus tyres is assumed to be about 280,000 to 300,000 pieces.

b. Demand Forecasting

The methodology used to estimate future demand of bus and truck tyres follows these organizational lines:

1) Evaluate the future demand for buses and trucks on the basis of development trends on transportation of freight and passengers by road.

2) Estimate the number of buses and trucks in operation, on the basis of statistical trends.

3) Compare the resulting data and adjust figures according to considerations already expressed in the previous chapters.

4) Calculate, according to both the estimated number of buses and trucks and annual requirements of tyres, the future demand for tyres in the year 1997, considered as production starting year for the plant under study.

1 Evaluation

As already envisaged in the previous study, a fundamental element for the estimation of demand for mechanized vehicles and consequently for tyres is the analysis of freight and passengers transportation by road. On the basis of the Intermodal Transport Study realized in 1985 by the Planning Commission of the GOB, the growth rate of freight and passengers transportation by road has been estimated as shown in Table 3.4.8.

Table 3.4.8: Projection of Freight and Passengers Transportation				
Year	Growth Rate %	Ton/Km (million)	Growth Rate %	Passenger Km
1986	8.6	2,716	8.2	17,352
1987		2,933		18,755
1988		3,168		20,314
1989		3,422		21,980
1990		3,695		23,783
1991	7.9	3,987	7.8	25,638
1992		4,302		27,637
1993		4,642		29,793
1994		5,009		32,117
1995		5,405		34,622
1996	8.80	5,880	8.40	37,530
1997		6,398		40,683
1998		6,961		44,100
1999		7,573		47,805
2000		8,240		51,820
Source: Intermodal Transport Study, Vol. 1 - 1985 Planning Commission, Govt. of Bangladesh				

According to the data from the above mentioned Intermodal Transport Study, already reported in the Market Study of March 1988, the average number of trucks per one million ton/km transported is 6,796 and the average number of buses per one million passengers/km travelled is 0.572. By applying these coefficients we obtain projections of bus and truck requirements for the next decade, shown in Table 3.4.9.

Table 3.4.9: Projection of Bus and Truck Requirements for 1986-2000						
Year	Tons/Km (Miln.)	Truck Coeff. (Miln./Km)	No. of Trucks Required	Pass./Km (Miln.)	Bus Coeff. (Miln./Km)	No. of Buses Required
1986	2,716	6,796	18,457	17,352	.572	9,925
1987	2,933	"	19,932	18,775	"	10,739
1988	3,168	"	21,529	20,314	"	11,619
1989	3,422	"	23,255	21,980	"	12,572
1990	3,695	"	25,111	23,783	"	13,603
1991	3,987	"	27,095	25,638	"	14,665
1992	4,302	"	29,236	27,637	"	15,808
1993	4,642	"	31,547	29,793	"	17,041
1994	5,009	"	34,041	32,117	"	18,371
1995	5,405	"	36,732	34,622	"	19,803
1996	5,880	"	39,960	37,530	"	21,467
1997	6,398	"	43,480	40,683	"	23,270
1998	6,961	"	47,306	44,100	"	25,225
1999	7,573	"	51,466	47,805	"	27,344
2000	8,240	"	55,999	51,820	"	29,461
Source: Intermodal Transport Study, Vol. 1 1985 - Planning Commission, GOB						

2 Estimation

The data on Table 3.4.3 show the quantitative growth of the number of vehicles. In the last 7 years, the average growth rate has been 6.07% for buses and 4.29% for trucks. On the basis of the above mentioned data and considering public policies geared towards the road network development and the increasing demand for freight and transport, it has been estimated an increase in the number of buses and trucks in the next decade as shown in Table 3.4.10 below.

Table 3.4.10: Projection of the Number of Buses and Trucks		
Year	Buses	Trucks
1989/90	22,591	30,609
1990/91	23,262	31,920
1991/92	25,417	33,292
1992/93	26,960	34,720
1993/94	28,596	36,209
1994/95	30,332	37,763
1995/96	32,173	39,383
1996/97	34,126	41,072
1997/98	36,197	42,834
1998/99	38,394	44,672
1999/2000	40,725	46,588
Source: AGORA' 2000 Elaboration of BBS Data		

3 Comparison

When the proposed factory starts production in 1997, the estimated total number of buses and trucks in operation will be about 70,000 vehicles.

This figure seems to be quite realistic as opposite forces will influence directly the sectoral evolution. On the one hand, persisting low levels of per capita income (worsening with demographic increase) represent a heavy constraint to the future development of the Country and also to the growth of transport. On the other hand, the priority given by GOB to Road Network Development is a tangible indication that the number of vehicles in operation is bound to increase.

4 Calculation

Mutiplying 70,000 (estimated total number of buses and trucks in operation in 1997) by 8 (estimated tyre requirement per vehicles per year) we obtain 560,000 which will be the estimated demand of tyres for trucks and buses in Bangladesh in 1997.

c. Export Potentiality

The market study of March 1988 had identified, as potential export areas, the neighbouring Countries of the Indian Sub-Continent and the Countries of Eastern Europe. Moreover, in the framework of a joint-venture agreement, there was a possibility to export on a buy-back basis a certain part of production towards the EEC, particularly in the partner's Country. This last export opportunity could enjoy duty free preferential treatment if directed to a country of the Generalized System of Preference as Bangladesh belongs to group of the Least Developed Countries.

Following locally gathered information, indications for export towards neighbouring Countries, i.e. Bhutan, Burma, Maldives, Nepal and Sri Lanka have been considered. Table 3.4.11 shows data on tyre imports into these Countries as extracted from the Import Estimation Tables of the COMTRADE Data Base (from 1986 to 1990). Import screening tables from the same source were not up to date.

Table 3.4.11: Tyre Imports for Selected Countries (value in thousands of $)

Country	1986	1987	1988	1989	1990
Bhutan	28	23	50	n.a.	16
Burma	1,500	2,072	3,309	3,137	5,889
Maldives	22	58	53	24	38
Nepal	1,199	2,997	2,561	2,292	2,806
Sri Lanka	2,849	2,759	3,066	2,472	4,341

Source: Import Estimation Tables based on COMTRADE Data Base

The data show a negligeable amount of import in Bhutan and Maldives.

Main exporters into Burma, according to 1990 estimated data, are China (58.2%), Japan (20.8%), Singapore (13%), and Korea (4.2%). Market is growing at a considerable rate in the Country and its actual volume is quite interesting. Political and economical relations between Burma and Bangladesh, historically rich with some difficulties, are now improving after the signing of a bilateral agreement on refugees.

Market volume in Nepal seems to stabilize at a stand still, sometimes showing a downward trend. According to the 1990 estimated data, the main imports are from China (36.7%), India (35.6%), Japan (13.8%), Korea (6.5%) and Singapore (5.7%).

The market of Sri Lanka is fairly thick. Import volume remains high although some productive plants have recently been installed in the island. In particular, a factory located in Kalani started production 6 years ago.

According to the 1990 estimated data, the main imports are from Japan (49%), Indonesia (13.5%), India (12%), Singapore (9%), Thailand (5.8%) and Korea (3%).

The assumption to export to the Eastern European Countries appears to have faded away along with the recent economic and political changes in that region.

The last possibility, that is to export part of the production to Western European Countries in the framework of a joint-venture agreement (buy-back), appears strictly tied to the potential partner's requirements and strategies and, therefore, hardly predictable. Nevertheless according to the present sectoral situation in Europe, characterized by overproduction problems, it seems to be almost impossible to materialize.

In conclusion, export potentialities, from what can be assumed on the basis of a desk research, seem to be limited. The markets of Burma and Nepal are major potential outlets where perhaps it might be appropriate to deepen the analysis through field surveys.

On the basis of the above considerations, it is then advisable to postpone the opening of new markets sometime after the factory start-up.

3.4.2 CUSTOMER PROFILES

The final consumers of the manufactured products from the proposed plant are owners of buses and trucks.

At present, the existing transport companies are mainly concentrated in Dhaka and Chittagong, even though there are several transport organizations throughout the Country. Companies are both public and private. Their size is very differentiated. In the private sector, there are several owners with one or two vehicles and some bigger firms with more than 100 vehicles. In the public sector, there is one big organization, the Bangladesh Road Transport Corporation (BRTC), that owns a large fleet of transport vehicles covering more than 500 vehicles for passengers and goods.

Buses and minibuses are used for in city and intercity services. As far as the former is concerned, the main problems that have been registered are overload, frequent sudden stops and accelerations, curbing friction problems and flat spottings. The problems associated with the latter consist of the fact that maximum speed (70 Km/h) is not maintained and off the road service is frequent. In both cases, preventive maintenance is almost ignored, except in some fleets. Nevertheless, it seems that drivers take care of mechanical servicing more than body maintenance. The expected mileage for a new tyre is 35,000 Km. For each bus 10 new tyres are normally bought every year.

Trucks and light trucks are used for any kind of service on any kind of roads. Owners and drivers seem to be more maintenance oriented than their homologues in the bus business. A preventive maintenance programme does not exist normally, but any stoppage of the vehicle is used to carry out maintenance works. According to different services, expected mileage varies between 35,000 and 45,000 Km and the number of new tyres bought per vehicle and per year varies between 6 and 12.

Because of the substantial homogeneity of their charateristics, customers' behaviours are not diversified. Purchasing motivations stem from common cultural and technical attitudes and, therefore, they are mostly similar. Normally the clients do not perceive the peculiarity of the different types of tread design. Customers have no brand preferences and advertising campaigns apparently have never shown good results. Clients are price/performance oriented. New tyres are always fitted on front axle, often jeopardising tyre life because of wrong tread design selection (for example using "lug type" on front axle for highway service).

Examination of tyre status when fitted on vehicles and failure modes when removed are good indicators of the minimal tyre consciousness of drivers and vehicle owners. In particular:

- Tyre pressure is seldom checked (especially for buses) resulting in tyre underinflation and thus great heat generation, particularly dangerous in cross ply tyres.

- Users seem to unaware of the fact that accidental damage can be dangerous for the future tyre life.

- Dual fitting, when required, is done without any criteria aimed at granting optimum tyre life.

In conclusion, the most important factors influencing customer's purchasing decisions are perceived by the Bangladesh consumers as follows:

- Price. The great majority of buyers are particularly price sensitive. All the operators, along with the chain of distribution channels, consider price and quality as the most important factors for their choice. This emerged from the opinion survey realized in the previous Market Study of March 1988 and has been confirmed by the interviews made during the field mission (April-May 1992). However, owners don't usually purchase tyres in large quantity to obtain discounts on price, because they do not want to keep too much stock. In fact, stock availability induces considerable increase in tyre replacement, because of increasing pressure from drivers.

- Quality. Together with price, quality is another factor that is highly valued by the buyers. The importance of the quality factor can be shown by the case of China's Double Coin Factory. This firm, adopting a strategy of low prices, had progressively conquered relevant market shares during the 1980's. However, because of the deterioration of the technological standards of its production due to its obsolete plant, Double Coin has been constantly loosing its position in the Bangladesh market.

- Brand/Advertising. Although overseas manufacturing firms have tried to launch promotional and advertising campaigns supporting their respective brands, the response of Bangladeshi customers is very weak. Brand popularity is strictly tied to the quality perception from the customer's side and constantly verified with actual performance.

- Conditions of Payment. Conditions of payment represent a non-decisive factor in the purchasing decision except sometimes for retailers.

3.4.3 ANALYSIS OF THE COMPETITORS

Bangladesh tyre market is characterized by a high degree of competitiveness. At present, more than 16 brands are on the market. In particular, Indian manufacturers have progressively won a prominent position among other competitors. Indian good performances derive from specific reasons such as the low cost of transport by land (around 2% of tyre price) and special incentives for export, which makes prices of tyres higher in India than in Bangladesh.

The list of the main brands competing on the Bangladesh market, listed by country of origin and distribution channel, is given in Table 3.4.12.

Table 3.4.12: Tyre Brands on the Market by Country of Origin and Distribution Channel

Tyre Brand	Country of Origin	Distribution Channel
Dunlop	India	Rahim Afroze - Dhaka
Goodyear	India	Narasan Ltd. - Dhaka
Bridgestone	Japan	Eastern Motors - Dhaka
M.R.F.	India	India Bangladesh Traders - Dhaka
Toyo	Japan	Nagoya Auto - Dhaka
Vikrant	India	A.H. Enterprise - Chittagong
Apollo	India	E. Ifad Enterprise - Dhaka
Modi	India	Aziz Enterprise - Chittagong
Ceat	India	Mabadan Traders - Dhaka
Modistone	India	Bangla Motors - Chittagong
J.K.	India	G.R. Trading - Chittagong
Kumbo	Korea	Nabarun - Chittagong
Hankook	Korea	Nabarun - Chittagong
Roadstone	Korea	Nabarun - Chittagong
Yakohama	Japan	Nabarun - Chittagong
Double Coin	China	Nabarun - Chittagong

Source: Interviews with Local Businessmen

Bangladesh market can be divided into two big parts: the first one is concentrated in the hands of Dunlop India; the remaining 50% is very fragmented into several little shares (from 1% to 5%); among them the most relevant ones are owned by Indian producers.

Under the technological profile, competition has not yet evolved towards radial tyres productions. Cross ply tyres are the only tyres imported in Bangladesh. However, as already noted in the previous chapters, international trend towards radial type is eventually bound to prevail.

The strategy of market leaders is based on price and quality factors, overlooking advertising and promotional programmes. Newly coming competitors base their strategy mostly on price, but they can resist only if they have sufficient quality standards.

3.4.4 PRICING STRUCTURE

As already highlighted in the previous study, sectoral pricing structure can be summarized as follows:

Importer's Price = CIF price +
Duty on Tariff Value (about 75%) +
Port Charges +
Local transports +
Margin

Wholesaler's Price = Importer's Price +
Transportation +
Inventory Holding Cost +
Margin

Retailer's Price = Wholesaler's Price +
Transportation +
Inventory Holding Cost +
Margin

According to the interviews made with prominent businessmen, current indicative $ prices of the two main types of tyres per set (1 tyre, 1 tube and 1 flap) are as follows:

Price	Type 9.00.20	Type 8.25.20
CIF	45 - 48	40 - 43
Importer's	85 - 90	75 - 80
Wholesaler's	98 - 104	87 - 92
Retailer's	113 - 120	100 - 107

It is important to note that the above mentioned prices are purely indicative as they can vary with time, availability, brand preference, design and country of origin.

3.5 BASIC STRATEGIES AND PROSPECTS

Tyres are products of a very high technology and need to be produced under the guidance and control of experts. A joint venture agreement with an internationally reputed partner, to be selected among world market leaders, is therefore a fundamental prerequisite for the successful implementation of the project. The problem is not only the transfer of know-how but also the continuos support needed in both technical management and organisational aspects.

The promoter's proposal was to set up a joint-venture based on the following hypothetical Equity distribution:

- 70% foreign partner;
- 15% private partner in Bangladesh (to be identified);
- 15% the promoter himself.

In order to realize the above hypothesis, the following strategical considerations will have to be made. These are:

- Technological advantage should be pursued through the choice of radial instead of cross ply products.

- Quality control should play a major role in the company's operation.

- Prices higher than current ones might be envisaged as the market is likely to accept an increase of around 10-15%, if it is justified by a quality advantage.

- A narrow, but well articulated product range should be adopted (8 sizes - 3 types of treads) to simplify production procedures.

- Existing distribution channels should be used.

- Advertisement and promotional activities should be limited and essentially aimed at explaining quality advantages.

Should all of the above considerations materialize, it can thus be concluded that a local producer could reach a market share of 50%, that is between 250,000 and 300,000 tyres per year, in about 2 to 3 years.

CHAPTER 4

RAW MATERIALS AND SUPPLIES

4.1 INTRODUCTION ON THE MANUFACTURING PROCESS

The main conclusions of the market analysis are the following:

- At least initially, local tyre production should be limited to bus, truck and light truck sizes because this is the market segment where sales forecasts are more promising. Production of 400,000 tyres per year is the proposed factory capacity.

- In this segment, 80% of the demand is represented by the following 4 sizes:

  9.00 - 20 | 8.25 - 20 | 7.50 - 16 | 7.00 - 16

  Adding 4 additional sizes like:

  10.00 - 20 | 7.50 - 20 | 6.50 - 16 | 6.00 - 16

  an additional 15% or even more of the tyre demand can be satisfied. It is thus recommended to consider only the above mentioned tyre sizes. All of them can be produced with the same basic manufacturing processes.

- Considering the type of vehicles to be fitted with the above tyres and the different services covered by these vehicles, it is also recommended to make available 3 different tread designs for each tyre size, namely:

  a. Multipurpose design (50%)

  b. Lug type design for rough road service (35%)

  c. Rib type design for highway service (15%)

- In order to successfully penetrate the highly competitive Bangladesh market, where at present 16 tyre brands from 4 different Countries are sold, it is essential that the locally produced tyres are designed and manufactured according to a high quality specification. Therefore it is recommended to consider only steelcord radial tyres.

For a better understanding of all the technical considerations, which will be illustrated in the next chapters, it is advisable to briefly describe the typical manufacturing process necessary to produce steelcord radial tyres.

Raw Materials and Storage

The manufacturing of a tyre starts with the reception and the preparation of the raw materials - including crude and synthetic rubber, textile fabric, steel cord, steel bead wire, oils, carbon black and other chemicals - which have to be compounded with rubber. The major ingredient, rubber, can come from synthetic rubber factories and natural rubber plantations.

The strength of a tyre and its ability to minimize the heat generated by flexing of the cord body while running, depends, to a great extent, on the type and quality of the fabric used.

The tyre body consists of a layer of steel cord fabric and it is belted with strong plies of steel cord. The tread of the tyre is applied over the body ply and belts.

Strong and durable high-tensile wire is used for the beads which serves as an anchor to hold the tyre on the rim.

In order to make the rubber compound tough and resilient, the basic requirements include sulphur for vulcanization, carbon black, oil, pigments and other materials.

Compounding and Milling

The blending and mixing of rubber with chemicals is the first step in the tyre manufacturing process. Different compounds are required for making tyres. These vary according to the purpose for which they are intended to be used. Therefore, different compounds are used for different types and parts of tyres, including treads, sidewalls, steel cord and beads to optimize performance.

Bales of natural rubber obtained from storage are split into small pieces. Then various grades of synthetic rubber, blended to meet specific compound requirements, carbon black and pigments are transported via a conveyor into the Bambury machine. This machine operates like a giant dough mixer, forcing the material meshed together through a pair of irregular rotors with a tearing and mixing motion for the required length of time.

After mixing, this "master batch" drops from the Bambury into the dump extruder with roller die, forming a uniform size and width of a flat sheet to facilitate cooling, handling and processing.

Sulphur and accelerators are added to the stock in a final mixing process. After the final pass through the Bambury mixer, the "final batch" drops onto a mill where it is rolled into a thick continuous sheet, cooled and conveyed to a "wigwag" loader which places it on a skid ready for further processing.

Throughout the compounding, mixing and milling operations, samples are taken to the Mill Room Control Laboratory where several tests are made to ensure the presence of proper amounts of ingredients and that the proper processing temperatures have been kept.

Calendering of Fabric and Innerliner

The steel cord passes from the temperature/humidity controlled creel room onto a calendering machine where rubber stock from an extruder is fed automatically into the calender rolls, and compressed on both sides and between the cords as it passes between the rolls. The calendered steel cord goes over the cooling drums and rolled into cloth liners to prevent sticking.

For calendering operations, weight per square meter and widths are controlled and recorded at a control panel connected with the calender. Many quality checks, including use of an automatic gauging system and statistical quality control charts aid the calender operators. Accurate gauging insures that there is a proper proportion between rubber and fabric.

Innerliner material consisting of three or four rubber laminations and various gum strips are calendered on a 3-roll calender in one or two-pass operation. The calendered material then passes over the cooling drums to a wind-up station and rolled into cloth liners.

Stock Cutting and Fabric Preparation

After calendering, the fabric is transported to the stock cutting operation where the fabric is cut diagonally across the cords for stabilizer belt plies and perpendicularly for body plies. Once they are cut according to specified widths and bias angles, these pieces are spliced into continuous precision strips, ready for tyre assembly.

A special gum injection is also placed in the center of each body ply strip and the edges of both stabilizer plies and body ply are covered with appropriate gum strips.

Bead Building

Quality workmanship and top grade materials are important in the bead building process.

Copper plated, high tensile steel wire, which has been subjected to numerous tests, including strength, twisting and flexing is brought in on a large reel. A strand of wire is brought from the reel and guided through a die in the head of a small extrusion machine. Here, a special rubber insulation stock is squeezed around a strand of wire.

The rubber-covered wire is then run into a bead winding machine, where it is automatically wound into a bead having the proper number of turns and the required profile.

The beads are then wrapped spirally with fabric tape.

Extrusion of Treads, Sidewalls and other Component Parts

The various extrudates consist of one or two different compounds having specific characteristics for any given application. The mixed compound is fed to a pin-type cold feed extruder by feed conveyors having controls for proper feed rates. The material is extruded through dies in a continuous strip which is then processed on a controlled cooling system where additional material such as cushion-gum and/or rubber cement can be added.

The continuous strip is conveyed to a cutter where it is cut into a specified length after which the individual component parts are placed on appropriate storage skids/racks for storage and transport to the pre-assembly operation or tyre building.

Material Pre-Assembly

Certain component parts required for tyre construction, for example stabilizer ply belts, are pre-assembled before the material is brought to the tyre assembly machine in order to maximize the productivity of the tyre assembly machine.

Tyre Assembly

All the component parts of the tyre are brought together in a tyre assembly operation and combined on semi-automatic precision tyre machines.

In the construction of a radial type of tyre, the assembler first places the beads on special holding rings at the sides of the assembly drum. This drum was made to meet the size specifications of the tyre to be built.

The first operation is to place an innerliner material of special compounded rubber on the assembly drum. The steelcord is placed over the innerliner so that its cords are parallel to the drum shaft. Then, other component parts are placed on the assembly drum.

The assembly machine automatically sets the beads in place, turns the plies around the beads and stitches them securely together, followed by shaping up of the tyre carcass and the application of the pre-assembled stabilizer ply belts followed by the application of the pre-cut tread.

After the operation is completed, the assembly drum is made to collapse by the operator so that the green tyre can be removed. The green tyre is checked by an inspector and the inside of the tyre is coated with special material for vulcanization. Thereafter, the green tyre is placed into a storage thereby awaiting curing.

Curing (Vulcanizing)

When the green tyre is placed in a mold of the curing press, it is tacky and pliable. As the mold closes, internal pressure forces a curing bladder into the tyre, shaping it into the mold cavity. Steam causes the mold to heat and soften the rubber forcing it into the non-skid pattern of the tyre mold. Hot water is circulated inside the bladder to maintain the molding pressure and deliver additional heat to the tyre.

The tyre is cured for a prescribed length of time, depending upon its size. In the tightly sealed mold, heat causes a chemical change called "vulcanization", which fuses the many parts of the tyre into an integral unit.

At the end of the curing cycle, the mold opens up and the bladder collapses and retracts from the tyre by means of a hydraulic piston. The tyre is ejected out on a conveyor behind the press line and carried away to the final inspection site.

The complete cycle, from shaping up to the ejection of the cured tyre is performed automatically.

Final Inspection

The tyres arrive from the curing room on a conveyor and are transported to the visual inside/outside inspection by an inspector for possible surface defects.

Tyres are then X-ray inspected and then checked for uniformity and balance.

When the tyre meets the quality standards, it is released to the warehouse for shipment.

Quality Control and Testing

Even after the tyre has met all the production specifications and inspections throughout the manufacturing process, it is necessary to further check the products to assure customers maximum service, performance and safety.

The quality insurance section of a manufacturing plant establishes performance standards for each type of tyre.

This operating group maintains testing facilities to double check the quality to be certain that these rigid standards are met and that the tyre will be satisfactory for customers.

The aforementioned process is quite complicated and delicate. Lots of background, expertise and confidential technology is present at any stage of the process.

Several attempts show that it is very difficult, if not impossible, to start producing tyres only on the basis of the acquisition of the relevant know-how from another tyre Company. On the contrary, it is essential to involve the tyre Company who can supply the know-how in a kind of joint-venture so that this Company can become a "partner" since the beginning of the project implementation.

The involvement of a reputated tyre Company in the project could give an important financial input and will ensure, from the technical standpoint, the support of its expertise not only during the factory start up but continuously for an adequate period of time, in general ten years.

4.2 RAW MATERIALS

It is necessary to point out that, due to the nature of tyre production technology, raw material specification strictly depends upon the selected source of technology, i.e. from the project partner.

To produce steel cord radial truck tyres according to an updated technology, the necessary raw materials are roughly those shown in Table 4.2.1.

Ingredients vary according to the specific technology in terms of type and quantity. The more important ones are Sulphur, Zinc Oxide, Mineral Oils, Accelerators, Antioxidant, etc.

Table 4.2.1: Composition and Percentage in Weight

Composition	%
Natural Rubber	23
Synthetic Rubber	22
Carbon Black	27
Ingredients	18
Steel Cord	8
Wire Cord	2
TOTAL	100

Locally gathered information (BFIDC - Rubber Plantation Project Duncan Brothers Bangladesh Ltd.) confirmed that natural rubber could be locally available but not before some years from now, provided that physical and chemical properties are suitable for the selected technology. A sample of rubber, supplied by BFIDC has been analysed according to ASTM methods and found to contain ingredients in the proportion noted in Table 4.2.2.

Table 4.2.2: Composition of the Natural Rubber Sample Provided by BFIDC

Ingredients	%
Moisture Content	0.42
Ash Content	0.60
Acetone Extract	2.82
Protein Content (N. x 6.23)	3.00
Rubber Hydrocarbon	93.20

According to literature, Ribbed Smoke Sheet (RSS) rubber contains ingredients in the proportion shown in Table 4.2.3.

Table 4.2.3: Composition of Ribbed Smoke Sheet

Ingredients	Range %	Average %
Moisture Content	0.30 to 1.08	0.61
Ash Content	0.20 to 0.85	0.38
Acetone Extract	1.52 to 3.50	2.89
Protein Content (n. x 6.23)	2.18 to 3.50	2.82
Rubber Hydrocarbon		93.30

Physical Tests

The sample of rubber, supplied by the BFIDC, has been compounded using the ingredient mix shown below and vulcanized at 160°C (the only fixed temperature at which the available vulcanizing press could operate).

- Rubber 100
- Zinc oxide 5 phr
- Stearic acid 1 phr
- MBTS (Mercap to benthiazole disulphide) 0.75 phr
- Sulphur 2.50 phr

The optimum tensile strength of BFIDC rubber has been found to be 2,000 pounds per square inch and the time of its optimum cure 4 minutes.

Good quality imported RSSI has been compounded using also the above igredient mix under similar conditions and cured at the same temperature of 160°C. The optimum tensile strength of this rubber (RSSI) has also been found to be 2,000 pounds per square inch and the time of its optimum cure 5 minutes.

Visual Examination

Dry-mold marks are visible on the surface of the given rubber sheets. These marks have not, however, penetrated the sheets. The rubber is dry, strong, sound, evenly smoked and free from blemishes, rust, blisters and any foreign substances. It is also free from pinhead bubbles.

The physical and chemical properties of the rubber, supplied by BFIDC, therefore, closely resemble those of the medium curing Ribbed Smoked Sheet No. 1 (RSSI).

Also carbon black is produced in Bangladesh from rice husk, but quality and available quantity should be further investigated. For the time being, we must assume that carbon black should be imported, taking also into account that, to

avoid pollution, carbon black must be supplied in appropriate containers tailor made for rubber industry. Part of the required mineral oils are locally available, even if some of it is still to be imported.

It is clear that most necessary raw materials should be imported, although no problems are expected neither in terms of local regulations nor in terms of material availability from reliable sources. However, use of foreign currency will be necessary, with most of the raw materials.

4.3 SUPPLIES

To run a tyre factory, the main supplies needed are electricity, water, compressed air, gas and lubricants.

It is mandatory to ensure that electricity and water are continuously available (24 hrs/day) in order to avoid interruptions in the manufacturing process resulting in unaivodable scraps.

From locally available information, it appears that optimum condition can be certainly satisfied only at EPZ. This is the reason why the relevant prices, indicated in Table 4.4.2, are referred to EPZ.

4.4 COSTS OF RAW MATERIALS AND SUPPLIES

For the expected range and quantity of tyres to be produced, the costs of raw materials are shown in Table 4.4.1.

Table 4.4.1: Cost of Raw Materials

Type of Raw Materials	Total Quantity Ton/year	Unit Price $/ton	Cost/year $
Natural rubber	1,897.5	1,000	1,897,500
Synthetic rubber	1,815.0	750	1,361,250
Carbon black	2,227.5	780	1,737,450
Ingredients	1,485.0	1,000	1,485,000
Steel cord	660.0	2,200	1,452,000
Wire cord	165.0	1,000	165,000
TOTAL			8,098,200

The total quantity and cost of the major supplies are indicated in Table 4.4.2 below.

Table 4.4.2: Cost of Supplies

Type of Supplies	Unit	Consumption/year	Unit cost $	Cost/year (1) $
Electricity	Kwh	1,950,000	0.07 (2)	156,000
Water	m^3	13,750	.26	4,000
Gas	m^3	3,250,000	.08	260,000

(1) Rounded to include contingencies
(2) + 1.26 $/Kwh on contracted load/month

CHAPTER 5

LOCATION, SITE AND ENVIRONMENT

5.1 LOCATION REQUIREMENTS

Due to the nature of the manufacturing process and in particular to the linear flow of materials of semi-manufactured goods, a tyre factory does not need special requirements. However, in order to facilitate internal transportation of raw materials and components, it is advisable to design the factory layout basically on the ground floor. No special foundations are required.

In the framework of an expanding market for the product (tyres), it is recommended to have enough land availability for possible factory expansion.

Access to raw material supplies and tyre transportation to the final destination could only affect the area required for raw material and tyre warehouse. From this point of view any location can be selected.

If the manufacturing process is handled according to the satisfaction of an updated technology, the risk of pollution is minimal. Nevertheless, waste and scrap disposal must be looked after according to local legislation. On the other hand, it must be noted that waste and scrap could be largely used in industries like shoe-making, rubber goods, etc.

5.2 COST ESTIMATES

Industrial land is rented out in lots of 2.000 m^2 or its multiple at a price of $ 1.5 per m^2 per year. A typical industrial building costs $ 2 per m^2 per month if rented or $ 120 per m^2 if built anew.

Considering the above data, the tyre factory could be located anywhere in Bangladesh provided that enough land is available. However, it has been already stated that it is mandatory that the factory be located where electricity and water supplies can be ensured 24 hrs/day. According to locally gathered information, this can only be guaranteed in the Chittagong EPZ.

Bangladesh Government can offer in EPZ several benefits to foreign investors and, looking at the necessity of having as a "partner" a reputed foreign Company, this will certainly consider more favourably the EPZ location in comparison to any other one.

As EPZ is designed to accept only industries, no negative environmental impact is expected. On the contrary, EPZ location will guarantee all the required infrastructures.

The mission was made aware of the fact that EPZ Management tends to give preference to those factories which are Export-oriented and able to guarantee the absence of ecological disturbances. However, the mission also learned that special Government authorization could remove the obstacle created by the circumstance that, at least initially, the tyre production will mainly address the home market. Should such authorization fail to materialize, the whole

issue of project location would have to be studied again, as the more suitable and probably the only possible location for the factory seems to be in the Chittagong EPZ.

CHAPTER 6

ENGINEERING AND TECHNOLOGY

6.1 PLANT CAPACITY

On the basis of the Market Analysis, it is recommended to have a factory size designed to produce 400,000 truck/light truck tyres per year with enough land available for possible expansion.

Considering the range of sizes and types of tyres to be produced, the amount of compounds treated is equivalent to 30 tons per day, which is the capacity of a "one Bambury module" factory.

6.2 TECHNOLOGY CHOICE

As it is known worldwide, the worst tyre life enemy is the heat generated during tyre running.

Tremendous success has been achieved in minimizing heat generation when the traditional "cross ply" has been replaced by the "radial" construction and a further step has been achieved, in the heavy duty service tyre field, using steelcord instead of fabric body plies.

Accordingly, tyre design and construction became more and more sophisticated resulting in important differentiation between the various tyre Companies in terms of compounding specifications and machine design. Most of the above peculiarities have been patented by inventor Companies.

In order to successfully penetrate the highly competitive Bangladesh, market it is essential that the tyres produced locally are designed and manufactured using high technology. Therefore, it is recommended to consider only steelcord radial construction.

6.3 TECHNOLOGY ACQUISITION AND TRANSFER

Negotiations with potential partners and final agreement with the selectee should take place immediately after project approval. In fact, as mentioned before, each tyre Company uses its peculiar technology. Different technical details could affect all the next steps of the study, including raw material specifications, equipment and machinery selection, especially in the building department, detailed factory lay-out, organization standards, etc.

Also, the cost of technology acquisition, which could be roughly estimated at about $ 500,000 to 1,500,000 ($ 500,000 if only basic technology is required, $ 1,500,000 if detailed machinery specifications are included), will strongly depend on the partner's involvment, and so is the personnel training cost and start up timing and cost.

6.4 PLANT LAYOUT AND ENGINEERING

Details of the plant lay-out, as mentioned before, should be designed only after a "partner" has been selected so that a specific manufacturing process can be accomodated.

In any case, considering the indicative list of machinery shown in the next chapter, it is recommended to have a "one floor" building of about 25,000 m² (probably 100x250 m.). The various production departments should be located according to the following indicative lay-out:

<table>
<tr><td>Raw materials warehouse (3,000 m²)</td><td rowspan="2">Components preparation (5,500 m²)</td><td>Building (4,000 m²)</td><td colspan="2">Tyre Warehouse</td></tr>
<tr><td>Compounding (2,500 m²)</td><td>Curing (4,000 m²)</td><td>Finishing (1,500 m²)</td><td>Q.A. & Indoor Testing</td></tr>
</table>

The floor space roughly indicated for the individual departments is large enough to locate also molds and drums deposit, maintenance and mold cleaning area and general services like boiler and air compressors.

Land to be made available should be about double (48,000 m²) not only for possible future expansion of the factory but also to erect other small buildings (1,500 m²) for offices, conference room, canteen, changing room and toilets, technical laboratories, etc.

Civil engineering design, including auxiliary structures like piping, electrical cables, etc., especially for the factory building, can be prepared only in cooperation with the "partner" for the above explained reasons.

In addition, EPZ Management indicates rules and regulations to be considered, no one of these being in contrast with the factory operational requirements.

Cost estimate for factory construction is shown in Table 6.4.1 below:

Table 6.4.1: Estimated Cost of Factory Construction ($)

Factory building	3,000,000
Office building	180,000
Site preparation	120,000
TOTAL	3,300,000

6.5 SELECTION OF MACHINERY AND EQUIPMENT

As already mentioned in 4.1, factory size has been proposed to produce 400,000 tyres/year. The sizes and quantity of the different tyres would be as follows:

Size	%	Quantity (tyres/year)
10.00 R20	5	20,000
9.00 R20	20	80,000
8.25 R20	20	80,000
7.50 R20	5	20,000
7.50 R16	20	80,000
7.00 R15	20	80,000
6.50 R16	5	20,000
6.00 R16	5	20,000
T O T A L	100	400,000

In order to satisfy the local market requirements, 3 different tread design for each tyre size should be considered and will affect the number of molds to be available. They can be grouped as multipurpose, lug type and rib type. The percentage share each tread design will have is shown below:

Tread Design	%
Multipurpose	50
Lug Type	35
Rib Type	15
T O T A L	100

According to local standards, 250 working days per year are to be considered.

Table 6.5.1 shows the main machinery and equipment required to realize the above mentioned production.

It must be pointed out that the necessary machinery for tyre manufacturing is never available "on the shelf". About 20% of the work required for each major item is "tailor made". In particular, building machines are always designed for a specific technology.

As a resut estimated cost can vary about 10%, except for building machines where variation can be higher because they are very often totally "tailor made". It could be possible that their cost be included by the "partner" in the basic know-how.

Besides major machinery, other equipment, like boiler/steam-producer, air compressors, creel room, fork lifts, trailer and racks for components storage, conveyors, basic machine-tools for maintenance works, mold cleaning equipment, etc., should be considered. The cost of such equipment is generally considered with the cost of the connecting fixtures plus contingencies, as 30-35% of the total amount of the machinery.

Total investment for machinery and equipment can thus be estimated at $ 100,000,000.

6.6 MAINTENANCE AND REPLACEMENT REQUIREMENTS

Due to the peculiar features of the required machinery and equipment, it is recommended that major maintenance works be carried out by the supplier. Also, spare parts are generally available with the supplier and it is not necessary to keep them in plant inventory.

Consequently, general preventive maintenance works need to be handled by factory Plant Engineering Department following the supplier's Maintenance Catalogue, which is always supplied with the specific machine.

Table 6.5.1: Cost of Machinery and Equipment ($)

Item	Quantity	Unit Cost	Total Cost
Carbon black handling	1	350,000	350,000
Bambury	1	3,500,000	3,500,000
Batch off unit	1	330,000	330,000
4 roll calender	1	8,000,000	8,000,000
Cold feed extruder	2	850,000	1,700,000
3 roll calender	1	4,000,000	4,000,000
Cold feed extruder	2	850,000	1,700,000
0 degree cutter	2	420,000	840,000
H. angle cutter	3	400,000	1,200,000
Cameron slitter	1	200,000	200,000
Wire winder	3	400,000	1,200,000
Spiral wrapping	3	100,000	300,000
Extruder (treads)	1	2,000,000	2,000,000
Extruder (mish)	1	1,700,000	1,700,000
St.ply ass.mch.	6	200,000	1,200,000
Ass.mch.	26	600,000	15,600,000
Drums	30	25,000	750,000
Curing press cavity	44	250,000	11,000,000
Containers	45	35,000	1,575,000
Molds	50	45,000	2,250,000
Insp. mch.	3	100,000	300,000
X-ray unit	2	750,000	1,500,000
R.O. mch.	1	220,000	220,000
Balancer	1	100,000	100,000
4 pos. test. mch.	1	1,000,000	1,000,000
Plunger	1	100,000	100,000
TOTAL			62,615,000

Investment for spare parts is minimal unless we want to consider as "spare parts" the replacement of mold and drum due to technological reasons (e.g. new mold required for tread design change).

The above cost can be estimated as follows:

- General maintenance: $ 5,000,000/year (including possible subcontract works)

- Spare parts: $ 1,150,000/year (including molds, etc.).

6.7 COST ESTIMATE

The total investment cost related to engineering, technology and plant installation can be summarized as shown in Table 6.7.1.

Table 6.7.1: Cost Estimates for Plant and Technology

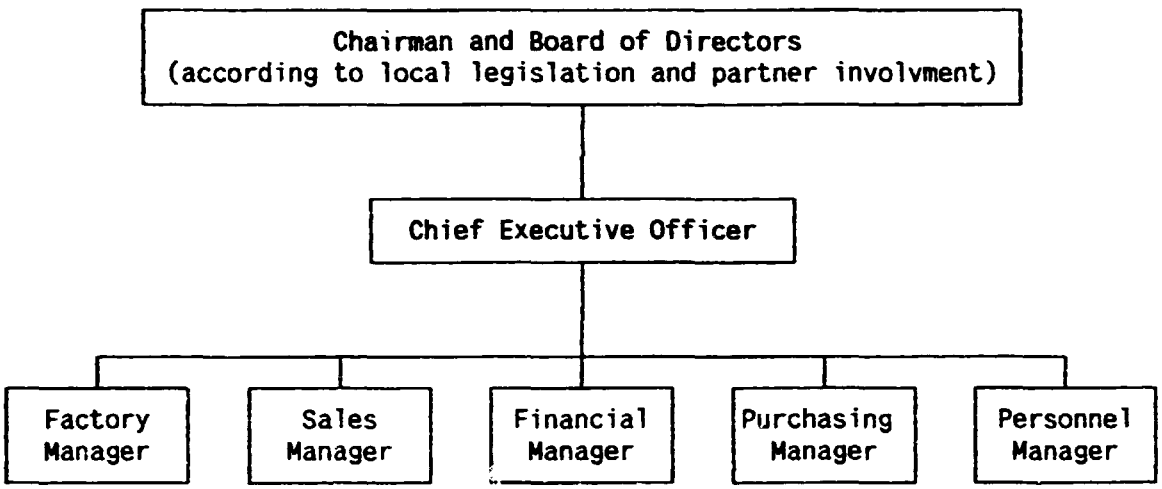
Cost Category	Estimated Cost ($)
Technology transfer	1,500,000
Factory construction	3,300,000
Machinery & equipment	100,000,000
TOTAL	104,800,000

CHAPTER 7

COMPANY ORGANIZATION

7.1 CATEGORIES AND FUNCTIONS

Typical tyre Company organization is as follows:



Main function of incumbents are:

Chief Executive Officer

Job Description:
- Direct, as per Board of Directors guidance, all Company activities.
- Liaise with the partner.

Qualification and Work Experience:
- University degree in technical or administrative field (technical + MBA preferred).
- At least 10 years experience in similar position, not necessarely in the same field.
- Excellent knowledge of local legislation.

Sales Manager

Job Description:
- Control all domestic and export sales.
- Handle distribution channels.

Qualification and Work Experience:
- University degree in administration or equivalent.
- Very good knowledge of vehicle and tyre market.
- At least 5 years experience in similar position.

Financial Manager

Job Description: - Cooperate with the Managing Director in establishing Company objectives and budget.
- Direct financial and administrative activities. According to a possible joint-venture contract the partner could impose to have this function under his jurisdition as "Company Controller".

Qualification and Work Experience: - University degree in administration.
- Very good knowledge of local and international legislation.
- At least 5 years experience in similar position possibly in a multinational company.

Purchasing Manager

Job Description: - Handle major purchasing tasks.
- Direct detail purchasing.

Qualification and Work Experience: - University degree in technical stream or equivalent.
- Good knowledge of tyre production process.
- At least 5 years experience in domestic and international purchasing.

Personnel Manager

Job Description: - Handle personnel policy and administration according to local and international legislation and C.E.O. guidance.

Qualification and Work Experience: - University degree in administration or equivalent.
- Excellent knowledge of local and international legislation.
- At least 5 years experience in similar position possibly in a multinational company.

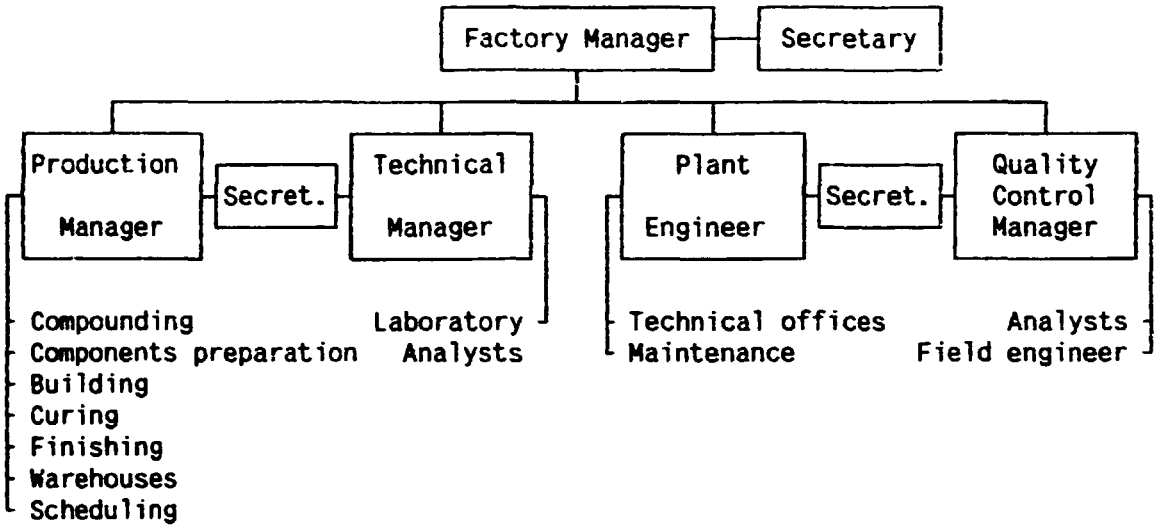
Personnel involved

The type and number of personnel involved in the various offices are shown below:

Chief Executive Officer	:	1 assistant,	1 secretary
Sales office	:	2 employees,	1 "
Financial office	:	2 "	1 "
Purchasing office	:	1 employee,	1 "
Personnel office	:	1 "	1 "
T O T A L		7	5

7.2 ORGANIZATIONAL STRUCTURE

Typical tyre factory Organizational Structure include the following components:



Main functions of incumbents are:

Factory Manager

Job Description:
- Programme and direct all factory activities according to the Company's objectives.
- Co-operate with Personnel Manager in establishing personnel policy.

Qualification and Work Experience:
- University degree in technical streams or equivalent.
- 10 years experience in a high technology quality oriented company.
- Good knowledge of tyre technology.

Production Manager

Job Description:
- Schedule detailed production programmes, balancing different departments' needs, according to the Factory Manager guidance.
- Direct the work of the Supervisors Department.

Qualification and Work Experience:
- University degree in technical streams or equivalent.
- Very good knowledge of tyre technology.
- At least 5 years experience in similar position.

Technical Manager

Job Description:
- Monitor compliance with specifications in all steps of tyre production.
- Supervise laboratory activity.
- Liaise with the partner's technical staff.

Qualification and
Work Experience: - University degree in technical streams or equivalent.
- Very good knowledge of tyre technology.

Plant Engineer

Job Description: - Direct factory maintenance at all levels.
- Co-operate with suppliers and consultants for committed works.
- Control waste and scrap disposal.

Qualification and
Work Experience: - University degree in technical streams or equivalent.
- At least 5 year experience in similar position in a high technology quality oriented company.
- Good knowledge of local regulations for waste and scrap disposal.

Quality Control Manager

Job Description: - Establish detailed quality objectives and monitoring systems at any stage of the tyre production process.
- Stop production if quality level is not adequate and to co-operate with the Factory Manager to introduce corrective actions.
- Direct field engineers' activity also in support to the Sales Manager.

Qualification and
Work Experience: - University degree in technical streams or equivalent.
- At least 5 year experience in similar position or as technical manager in a high technology, quality oriented company.

Table 7.2.1 shows the type number of personnel necessary to run the different departments.

7.3 OVERHEAD COSTS

Additional general services like building cleaning, fire prevention, canteen, laundry, etc. have not been included because they can as well be subcontracted, especially at EPZ. Relevant cost can be estimated at 1% of running cost.

Table 7.2.1: Type and Number of Personnel Requirement for Various Departments

Department	Workers	Foremen Technicians	Supervisors	Total
Production:				
Compounding	23	3	1	27
Components prep.	59	3	1	63
Building	90	3	1	94
Curing	15	3	1	19
Finishing	15	3		18
Warehouses	4	2		6
Scheduling		2		2
Auxiliaries	15			15
Total Production Dept.	221	19	4	244
absenteism 5%	11			11
Technical:				
Laboratory	3	3	1	7
Analysts		15	1	16
Total Technical Dept.	3	18	2	23
Quality Control:				
Analysts		6	1	7
Field engineer		8		8
Machines Operators	4			4
Total Q.C. Dept.	4	14	1	19
Engineering:				
Technical office		4	1	5
Maintenance	25	3	1	29
Total Engineering Dept.	25	7	2	34
General Services:				
Secretaries		3		3
Security	9			9
Switchboard operators	2			2
Drivers	10			10
Computer service			2	2
Total General Services Dept.	21	3	2	26
GRAND TOTAL	285	61	11	357

CHAPTER 8

HUMAN RESOURCES

8.1 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT-AVAILABILITY AND RECRUITMENT

Tyre is a "high technology" product requiring, even at the worker's level, skilled and well trained personnel. At least at the foreman level and above, a minimum knowledge of the English language is required, considering the necessity to communicate with the "partner" who will send technical documentation to be used also at the production level.

From the information gathered locally, it is possible to make the following remarks:

Workers are largely available but their educational level might not be adequate. Recruitment will not be as easy as expected because, even at this level, a minimum educational background is required. Appropriate interviews of the candidates are therefore recommended.

Foremen/Technicians are required to have a High School degree. The local High School system is adequate to the requirements and no additional problems are expected in recruiting this category of personnel.

Managers even though the local University system is adequate, the necessary expertise and experience required to fulfill key positions make it mandatory to consider expatriate personnel at least for the first 10 years, before the plant is handed over to local personnel, formerly hired at employee level. It must be pointed out that the knowledge of tyre technology in general can only be learned by practicing, because this subject is never covered in any of the High Schools or Universities around the world.

Knowledge of local regulations is necessary for recruiting and hiring procedures.

8.2 TRAINING PLAN

For the reasons mentioned above, an important training plan must be considered at various levels. Due to the fact that key personnel will probably be hired by the "partner", such plan is limited to the medium/low level personnel.

As explained in Chapter 9, test production cannot be scheduled before 2 years from project approval. Therefore no local training can take place before this period. At that time, specially trained people will have to be available to initiate factory start up and at the same time be trainer/teachers for the newly hired personnel.

It is recommended to send to the "partner" plant about 20 personnel: 4 of them to be factory Supervisors and 15/16 High School graduated who, initially trained as workers on the different main production machines/operations, will probably become production foremen or technicians. For all of them the

training period should last 3 months. After the training, all of them should be back at the tyre factory; by that time, all the necessary machinery and equipment for test production should be operational.

Mean while, enough personnel to run the factory on a "one shift" basis must be already hired and, at least theoretically, trained. In the following six months the above staff will be trained to his specific functions by foremen/technicians trained abroad.

In order to ensure an adequate training and considering that the factory will start up simultaneously, it is recommended that 8 "partner" Supervisors should assist the programme. These Supervisors should stay at the tyre factory for about 3 weeks each, not necessarily simultaneously.

The cost of the above training can be estimated as follows:

Cost Category	Duration	Unit Cost $	TOTAL COST $
4 supervisors	3 months	260	3,120
16 foremen	3 months	180	8,640
Travel expenses and subsistence for 20 people			220,000
8 "partner" supervisors	21 days	190	32,000
Travel expenses and subsistence			35,000
TOTAL (rounded for contingencies)			300,000

8.3 COST ESTIMATES

Cost of personnel is based on the following estimated unit cost according to locally gathered information (mainly EPZ):

Type of Personnel	Monthly Salary $
Worker (skilled)	80
Foreman/Technician	180
Employee	260

As already explained, Managers at all levels should be considered "expatriate" and their average salary has been estimated at U.S.$ 15,000 per month.

Total cost of personnel is, therefore, estimated at U.S.$ 2,300,000 per year.

CHAPTER 9

IMPLEMENTATION PLANNING AND BUDGETING

9.1 STAGES OF PROJECT IMPLEMENTATION

Project implementation can be divided into the ten stages over a time span of four years or eight semesters, as shown in Table 9.1.1.

Table 9.1.1: Schedule of Implementation Activities

TYPE OF ACTIVITIES	SEMESTERS OF IMPLEMENTATION							
	1st	2nd	3rd	4th	5th	6th	7th	8th
1) Partner Identification	■							
2) Negotiation with the Selected Partner	■							
3) Company Formation	■							
4) Appointment of Implementation Team		■						
5) Final Technical Design		■						
6) Land Acquisition		■						
7) Building Erection			■	■				
8) Machinery-Equipment Orders/Delivery			■	■	■	■	■	
9) Personnel Recruitment-Training			■	■	■	■		
10) Raw Materials/Supplies Acquisition				■				
11) Test Production					■			
12) Reduced Capacity Production						■	■	
13) Full Capacity Production								■

Most of the activities listed above are self-explanatory and relevant cost have either been calculated in the previous chapters or will be included in the investment appraisal. Just few explanatory notes are necessary for the following items:

Company formation includes procedures to obtain Government approvals and the approval for the location at the Chittagong EPZ.

The task of the implementation team which is jointly staffed by the partners is to revise the feasibility study and thereby point out all necessary amendments required by specific technology, namely in the technical and organizational areas. Such exercise will produce detailed financial planning, detailed engineering design, and terms of negotiations with suppliers and subcontractors. It should include those people selected by the foreign "partner" to fulfill the key position in the new tyre Company (Financial Manager, Factory Manager, Purchasing Manager, Plant Engineer, Technical Manager, under the Chief Executive Officer supervision) and should be supported in its task by the various departments of the "partner" organization.

Machinery Order/Delivery. Major machinery and equipment require about one year for manufacturing and installation. At the beginning of semester 5th it would be necessary to start operating with all the required items for at least a few hours every day. This means that relevant orders should be placed at the beginning of semester 3rd for all items required in "one piece" (e.g. bambury, calenders) and for only one of the items required in several pieces (e.g. cutters). Building, curing presses, drums, molds and similar should be ordered in proportional quantity. All the necessary machinery and equipment should be available within semester 8th.

Personnel Recruitment and Hiring should be timely carried out in order to allow sufficient time to undertake the training and have the machinery running as soon as installed.

During the Test Production machinery checks and personnel training take place, resulting in waste and scrap at all stages of the manufacturing process. During this period it should be considered that the standard production cost, should be increased of about 30%.

During the Reduced Capacity Production period, waste and scrap should be at the standard running level. The Reduced Capacity is due to the gradual machinery delivery and the need to gradually introduce newly-hired personnel from training into production.

CHAPTER 10

FINANCIAL ANALYSIS AND INVESTMENT APPRAISAL

10.1 INTRODUCTION

The financial analysis of the project and the investment appraisal have been carried out on the basis of the results arrived at in the previous sections of the study. The relevant data have been analysed by the use of the COMFAR programme. The outcome of the analysis is annexed in the COMFAR schedule at the end of this chapter. The following paragraphs provide comments and interpretation of the analysis.

10.2 BASIC ASSUMPTIONS

The following basic assumptions have been used throughout the whole analysis:

- The initial investment is estimated at a little under $ 106 million, including the expenses for technology, civil works, equipment, training, working capital, etc.

- The source of fund for such an investment, as proposed by the promoter, would be as follows:

	Million $	%
• EQUITY		
Promoter	8.0	7.5
Others in Bangladesh (to be identified)	8.0	7.5
Foreign partner (Supplier of technology)	15.5	14.6
TOTAL EQUITY	31.5	29.6
• LONG TERM LOAN	74.5	70.4
TOTAL SOURCE OF FUND	106.0	100.0

All of the funds would be made available at the beginning of the construction period. The detailed payment schedule is shown in the corresponding COMFAR Table.

- The loan is assumed to have a twenty year repayment period on the basis of constant annuities, with a grace period of 5 years after disbursment and an interest rate of 5%. The source of which is still to be identified, reflecting the need for the direct involvement of an International Development funding agency.

- The additional investment for working capital requirements during production is assumed to be financed through operations, as the size of such an investment is relatively limited.

- Production Costs are calculated on the basis of a standard production capacity of 400,000 tyres per year, adjusted for capacity utilization in the different years of the analysis.

- The size of the Net Working Capital has been calculated on the basis of the prevailing conditions on the internal and international relevant markets.

10.3 SCENARIO No. 1: BASE HYPOTHESIS

ASSUMPTIONS

The following assumptions have been made:

- Production and sales are estimated at 200,000 tyres for the first year (50% capacity utilization); 250,000 tyres for the second year (62.5% capacity utilization) and 300,000 tyres for the years starting from the third year and ending at the fifteenth year (75% capacity utilization). All sales are for the domestic market. The assumption is based on the outcome of the market study (Chapter 3), which envisages a maximum market share of 50% i.e. about 280,000 tyres on the domestic market and considers a penetration on the export market, at least in the first years of operation, quite unlikely.

- The unit price is estimated at 3,000 Taka, or a little over $ 80 per tyre. This corresponds to the average current importer's price of the proposed products, which should enter the market as import-substitutes. Prices are considered stable throughout the period.

RESULTS AND INTERPRETATION

The results of the analysis are by all means gloomy, as all economic and financial indicators fall short of the thresholds needed to positively evaluate an investment of this size.

At the assumed capacity utilization, Production Cost, though decreasing (from $ 81.2 down to $ 73.7 per unit), is rather high with respect to the assumed selling price of about $ 80 per unit. Moreover, a very high percentage (about 87%) of the cost is of foreign origin due to the need to import almost all the raw materials and the most valuable and costly expertise. Therefore, the import substitution objective of the project appears to be quite difficult to attain under these cisrcumstances.

Consequently, Cashflow during production, although positive starting from the first year of operations, at a little over $ 9 million per year is insufficient to counterbalance the relatively high investment cost. Payback period is very long: 16 years (3 for construction and 13 for production). The financial ratios are not appealing: Return On Paid Equity is negative (-5.51%), Return On Net Worth is nonexistent and Internal Rate of Return (3.98%) is below what could be considered acceptable (no less than 10%) for considering a joint-venture agreement in the tyre business. As repeatedly mentioned, the involvement of a foreign partner, and of the technology thereof, is an unavoidable pre-requisite for project implementation.

10.4 SCENARIO No. 2: OPTIMISTIC SCENARIO

ASSUMPTIONS

With respect to the basic scenario, a gradual increase in sales is assumed to be possible due to either an increase in the market share or an expansion of the market size, or some sort of combined effect. The following assumptions on production and sales have been made:

Year of Operation	Tyres Produced	Capacity Utilization %
1	200,000	50.0
2	250,000	62.5
3	300,000	75.0
4	310,000	77.5
5	320,000	80.0
6	330,000	82.5
7	340,000	85.0
8-15	350,000	87.5

RESULTS AND INTERPRETATION

The results of the analysis under this scenario are definitely better than those of the basic scenario.

At the assumed capacity utilization, Production Costs, decrease more (from $ 81.2 down to $ 69.1 per unit), thus allowing for a more evident margin with respect to the assumed selling price (still at about $ 80). However, the percentage of foreign cost is still high, which confirms the structural import dependence of the project.

The increase in working capital due to the assumed expansion of capacity utilization is negligeable and, therefore, it is easily covered by operations surplus.

As about 60% of production costs are variable, the assumed increase in production and sales have a relatively limited effect on Cashflow during production. Payback period is shortened by only 2 years down to 14 years (3 for construction and 11 for production). The financial ratios are better, but not good: return on Paid Equity is virtually non-existent (0.37%), return on Net Worth is positive, but very low (1.16%) and Internal Rate of Return (5.17%) is still below the accepted threshold.

10.5 SCENARIO No. 3: PESSIMISTIC SCENARIO

ASSUMPTIONS

With respect to the basic scenario, a possible difficulty in market penetration has been assumed. Such problem would be likely to exist, unless the Government is willing and able to implement some sort of protection measures, of which the economic consequence, of course, is not analyzed in this study.

The assumed reaction of the company to such problems would be a price reduction aimed at encouraging sales to avoid stock build-up. Therefore, under this scenario, the selling price is estimated at 2,400 Taka, or a little under $ 65 per tyre, which corresponds to a 20% reduction of the price assumed under the basic scenario.

RESULTS AND INTERPRETATION

The results of the analysis are absolutely clear. That is the proposed project cannot survive the assumed decrease in selling price.

Production Costs, stand constantly above selling price. Consequently, Cashflow during production and income are constantly negative resulting in ratios well below the accepted thresholds.

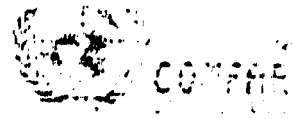
10.6 CONCLUSIONS

The financial analysis showed without any doubt that the proposed project's profitability is rather questionable. The investment required is relatively high with respect to the cashflow which the operations are able to generate in the prevailing market conditions, and under the constraint of a complex technology, requiring costly, imported raw materials and human resources.

All the indicators proved to be below their acceptance thresholds, even in the optimistic scenario of a gradual but steady increase in capacity utilization up to 87.5%.

Under such circumstances it appears inappropriate to try to perform an economic analysis of the project since this would introduce corrective parameters to evaluate national benefits from the project. Even if positive, however, the result of such analysis would hardly be likely to change the attitude of the key investor, which, in the proposed financing plan, would be a transnational tyre corporation.

As a final remark, it is strongly recommended to reconsider the investment choice, taking into consideration what has already been anticipated in Chapter 3 on "new" versus "retreaded" tyres. It is to be pointed out once again that tyres retreaded according to an updated technolgy can guarantee the same performance of new tyres in terms of safety and durability. On the other hand the cost of the investment required for a modern retreading factory of the assumed production capacity, can be roughly estimated at about 10% of that estimated for the factory to produce new tyres. Furthermore, it would be relatively easy to find a reputed retreading company willing to supply a turn-key factory, as well as technological support and technical assistance to start-up.



BANGLADESH - Tyre plant feas bil. study,
November 1992
Final Report - Base Hypothesis

4 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit : 1.0000 units accounting currency
local currency 1 unit : 0.0270 units accounting currency
accounting currency: US$

Total initial investment during construction phase

fixed assets:	105102400.00	98.858 % foreign
current assets:	0.00	0.000 % foreign
total assets:	105102400.00	98.858 % foreign

Source of funds during construction phase

equity & grants:	31511850.00	49.188 % foreign
foreign loans :	74600000.00	
local loans :	0.00	
total funds :	106311900.00	84.896 % foreign

Cashflow from operations

Year:	1	8	15
operating costs:	11883600.00	15229630.00	15229630.00
depreciation :	$165122.00	$165122.00	$165122.00
interest :	0.00	2958738.00	1729563.00
production costs	16248720.00	23353490.00	22124320.00
thereof foreign	87.32 %	88.11 %	87.45 %
total sales :	16212000.00	24318000.00	24318000.00
gross income :	-36726.00	964504.00	2193680.00
net income :	-36726.00	964504.00	2193680.00
cash balance :	4685571.00	3110286.00	3110286.00
net cashflow :	4685571.00	9088364.00	9088364.00

Net Present Value at: 10.00 % : -38377440.00
Internal Rate of Return: 3.98 %
Return on equity1: -5.51 %
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net Income Statement
Working Capital requirements	Source of Finance

Total Initial Investment in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Fixed investment costs								
Land, site preparation, development	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Buildings and civil works	660488.8	660488.8	1320978.0	660488.3	0.0	0.0	0.0	0.0
Auxiliary and service facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incorporated fixed assets	1803000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant machinery and equipment	0.0	0.0	30000000.0	25000000.0	10000000.0	17000000.0	5000000.0	13000000.0
Total fixed investment costs	2460489.0	660488.8	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Pre-production capital expenditures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net working capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total initial investment costs	2460489.0	660488.8	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Of it foreign, in %	73.2	0.0	95.8	97.4	100.0	100.0	100.0	100.0

Total Current Investment in US$

Year	1997	1998	1999
Fixed investment costs			
Land, site preparation, development	0.0	0.0	0.0
Buildings and civil works	0.0	0.0	0.0
Auxiliary and service facilities	0.0	0.0	0.0
Incorporated fixed assets	0.0	0.0	0.0
Plant, machinery and equipment	0.0	0.0	0.0
Total fixed investment costs	0.0	0.0	0.0
Preproduction capitals expenditures	0.0	0.0	0.0
Working capital	522824.8	104138.3	104138.3
Total current investment costs	522824.8	104138.3	104138.3
Of it foreign, %	35.8	42.6	42.6

Total Production Costs in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
% of nom. capacity (single product)	50.0	62.5	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Raw material	4049700.0	5061375.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0
Other raw materials	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utilities	2201.6	2652.0	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3	3102.3
Energy	313551.8	267998.3	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9	317434.9
Labour, direct	1420542.0	1433233.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0	1457925.0
Repair, maintenance	2925000.0	3218750.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0	3812500.0
Spares	805000.0	891250.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0
Factory overheads	400296.3	500370.3	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4
Factory costs	9538722.3	11381630.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0
Administrative overheads	752300.6	761738.4	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2	771176.2
Indirect costs, sales and distribution	810599.9	1013250.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0
Direct costs, sales and distribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0
Financial costs	0.0	3725000.0	3612346.0	3494059.0	3369859.0	3239448.0	3102516.0	2958738.0	2807771.0	2649255.0	2482814.0	2308051.0	2124550.0	1931873.0	1729563.0
Total production costs	16248730.0	22046740.0	24007100.0	23888810.0	23764610.0	23634200.0	23497270.0	23353490.0	23202520.0	23044010.0	22877570.0	22702800.0	22519300.0	22326630.0	22124320.0
Costs per unit (single product)	81.2	88.2	80.0	79.5	79.2	78.8	78.3	77.8	77.3	76.8	76.3	75.7	75.1	74.4	73.7
Of it foreign, %	87.3	89.0	88.4	88.4	88.3	88.3	88.2	88.1	88.0	88.0	87.9	87.8	87.7	87.6	87.5
Of it variable,%	51.0	47.0	51.8	52.1	52.3	52.6	52.9	53.3	53.6	54.0	54.4	54.8	55.2	55.7	56.2
Total labour	2137817.0	2165946.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0

Net Working Capital in US$

Year			1997	1998	1999	2000-11
Coverage	mdc	coto				
Current assets						
Accounts receivable	9	38.3	288650.5	343169.4	397688.2	397688.2
Inventory and materials	15	24.3	168718.6	210898.0	253077.4	253077.4
Energy	1	360.0	607.1	744.4	881.8	881.8
Spares	1	360.0	2236.1	2475.7	2715.3	2715.3
Work in progress	2	180.0	5642.2	6504.2	7366.1	7366.1
Finished products	15	24.3	45152.6	51645.5	58129.4	58129.4
Cash in hand	2	158.5	38253.9	43141.4	48029.0	48029.0
Total current assets			549271.1	658578.6	767888.3	767985.3
Current liabilities and						
Accounts payable	1	360.0	26446.4	31615.8	36784.9	36784.9
Net working capital			522824.7	625963.0	731101.4	731101.4
Increase in working capital			522824.7	104138.3	104138.4	0.0
Net working capital, local			335698.4	395442.8	455186.8	455186.8
Net working capital, foreign			187126.4	231520.5	275914.6	275914.6

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in US$

Year	1993.1
Equity, ordinary ..	31511950.0
Equity, preference.	0.0
Subsidies, grants .	0.0
Loan A, foreign .	74538000.0
Loan B, foreign..	0.0
Loan C, foreign .	0.0
Loan A, local....	0.0
Loan B, local....	0.0
Loan C, local....	0.0
Total loan	74538000.0
Current liabilities	0.0
Bank overdraft	0.0
Total funds	106049800.0

Source of Finance, production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Equity, ordinary ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equity, preference.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subsidies, grants .	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan A, foreign .	0.0	-2253378.0	-2365732.0	-2484019.0	-2608220.0	-2738631.0	-2875562.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0
Loan B, foreign..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan C, foreign .	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan A, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan B, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan C, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total loan	0.0	-2253378.0	-2365732.0	-2484019.0	-2608220.0	-2738631.0	-2875562.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0
Current liabilities	28446.4	5159.2	5159.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank overdraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total funds	28446.4	-2247909.3	-2360563.3	-2484019.0	-2608220.0	-2738631.0	-2875562.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0

Cashflow Tables, construction in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Total cash inflow	166011900.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Financial resources	166011900.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales, net of tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cash outflow	2460489.0	660488.0	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Total assets	2460489.0	660488.0	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Operating costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of finance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corporate tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus (deficit)	163551400.0	-660488.0	-31320980.0	-25660490.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Cumulated cash balance	163551400.0	162890900.0	131569900.0	105909410.0	95909410.0	78909410.0	73909410.0	60909408.0
Inflow, local	16011850.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, local	660488.0	660488.0	1320978.0	660488.0	0.0	0.0	0.0	0.0
Surplus (deficit)	15351360.0	-660488.0	-1320978.0	-660488.0	0.0	0.0	0.0	0.0
Inflow, foreign	90000000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, foreign	1800000.0	0.0	30000000.0	25000000.0	10000000.0	17000000.0	5000000.0	13000000.0
Surplus (deficit)	88200000.0	0.0	-30000000.0	-25000000.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Net cashflow	-2460489.0	-660488.0	-31320980.0	-25660490.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Cumulated net cashflow	-2460489.0	-3120978.0	-34441960.0	-60102460.0	-70102450.0	-87102450.0	-92102450.0	-105102400.0

Cashflow tables, production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total cash inflow	18238440.0	28273170.0	24323170.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0
Financial resources	26446.4	5169.2	5169.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales, net of tax	18212000.0	28268000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0
Total cash outflow	11632870.0	19244000.0	21317020.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0	21207710.0
Total assets	5492771.1	109337.5	109307.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating costs	11083600.0	13156630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0	15229630.0
Cost of finance	0.0	3725000.0	3812346.0	3494059.0	3369859.0	3239448.0	3102516.0	2958738.0	2807771.0	2649255.0	2482814.0	2308051.0	2124553.0	1931873.0	1729563.0
Repayment	0.0	2253870.0	2365732.0	2484019.0	2608220.0	2738631.0	2875562.0	3019340.0	3170307.0	3328823.0	3495264.0	3670027.0	3853529.0	4046205.0	4248515.0
Corporate tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus (deficit)	4605571.0	1029166.0	3006148.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0	3110286.0
Cumulated cash balance	5514979.0	6544145.0	9547293.0	12657580.0	15767870.0	18878150.0	21988440.0	25098720.0	28209010.0	31319300.0	34429580.0	37539870.0	40650160.0	43760450.0	46870740.0
Inflow, local	18214020.0	28265430.0	24318430.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0
Outflow, local	2233022.0	2312917.0	2671157.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0	2610982.0
Surplus (deficit)	15981000.0	17952510.0	21647270.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0	21707010.0
Inflow, foreign	23625.3	4738.1	4738.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, foreign	9399852.0	16931090.0	18645860.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0
Surplus (deficit)	-9376227.0	-16926350.0	-18641120.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0
Net cashflow	4605572.0	7004243.0	8984225.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0	9088364.0
Cumulated net cashflow	-100496900.0	-93492640.0	-84508420.0	-75420050.0	-66331680.0	-57243320.0	-48154960.0	-39066590.0	-29978230.0	-20889860.0	-11801500.0	-2713136.0	6375228.0	15463590.0	24551960.0

Cashflow Discounting:

a) Equity paid versus Net income flow:
Net present value .....-28374480.00 at 10.00 %
Internal Rate of Return (IRR#) .. -5.51 %

b) Net Worth versus Net cash return:
Net present value .....-19355500.00 at 10.00 %
Internal Rate of Return (IRR#) .. not found

c) Internal Rate of Return on total investment:
Net present value .....-38377440.00 at 10.00 %
Internal Rate of Return (IRR) .. 3.98 %

Net Worth = Equity paid plus reserves

Net Income Statement in US$

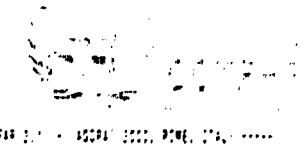
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total sales, incl. sales tax	16212000.0	20265000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0	24318000.0
Less: variable costs, incl. sales tax.	8292062.0	10365060.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0	12438090.0
Variable margin	7919938.0	9899939.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0	11879910.0
As % of total sales	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9
Non-variable costs, incl. depreciation	7956664.0	7956663.0	7956663.0	7956664.0	7956663.0	7956664.0	7956663.0	7956663.0	7956662.0	7956664.0	7956663.0	7956662.0	7956664.0	7956664.0	7956662.0
Operational margin	-36726.0	1943258.0	3923242.0	3923241.0	3923243.0	3923242.0	3923242.0	3923242.0	3923243.0	3923241.0	3923242.0	3923243.0	3923242.0	3923241.0	3923243.0
As % of total sales	-0.2	9.6	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
Cost of finance	0.0	3725000.0	3612346.0	3494059.0	3369859.0	3239448.0	3102516.0	2958738.0	2807771.0	2649255.0	2482814.0	2308051.0	2124550.0	1931873.0	1729563.0
Gross profit	-36726.0	-1781742.0	310896.0	429182.0	553384.0	683794.0	820726.0	964504.0	1115472.0	1273986.0	1440428.0	1615192.0	1798692.0	1991368.0	2193690.0
Allowances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxable profit	-36726.0	-1781742.0	310896.0	429182.0	553384.0	683794.0	820726.0	964504.0	1115472.0	1273986.0	1440428.0	1615192.0	1798692.0	1991368.0	2193690.0
Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net profit	-36726.0	-1781742.0	310896.0	429182.0	553384.0	683794.0	820726.0	964504.0	1115472.0	1273986.0	1440429.0	1615192.0	1798692.0	1991368.0	2193690.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undistributed profit	-36726.0	-1781742.0	310896.0	429182.0	553384.0	683794.0	820726.0	964504.0	1115472.0	1273986.0	1440428.0	1615192.0	1798692.0	1991368.0	2193690.0
Accumulated undistributed profit	-36726.0	-1818468.0	-1507572.0	-1078390.0	-525006.0	158788.0	979514.0	1944018.0	3059490.0	4333476.0	5773904.0	7389096.0	9187788.0	11179160.0	13372840.0
Gross profit, % of total sales	-0.2	-8.8	1.3	1.8	2.3	2.8	3.4	4.0	4.6	5.2	5.9	6.6	7.4	8.2	9.0
Net profit, % of total sales	-0.2	-8.8	1.3	1.8	2.3	2.8	3.4	4.0	4.6	5.2	5.9	6.6	7.4	8.2	9.0
ROE, Net profit, % of equity	-0.1	-5.7	1.0	1.4	1.8	2.2	2.6	3.1	3.5	4.0	4.6	5.1	5.7	6.3	7.0
ROI, Net profit+interest, % of invest.	-0.0	1.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7

Projected Balance Sheets, construction in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Total assets	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0
Fixed assets, net of depreciation	0.0	2460489.0	31209788.0	34441960.0	60102440.0	70102450.0	87102450.0	92102450.0
Construction in progress	2460489.0	660488.8	31320980.0	25660490.0	10030000.0	17000003.0	5000000.0	13000000.0
Current assets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash, Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash surplus, finance available	10355:400.0	102390900.0	71569890.0	45309400.0	35309400.0	18909400.0	13909400.0	909400.0
Less carried forward	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total liabilities	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800	106011800.0	106011800.0
Equity capital	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0
Reserves, retained profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long and medium term debt	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0
Current liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank overdraft, finance required	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total debt	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0
Equity, % of liabilities	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7

Projected Balance Sheets, Production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total assets	106038300.0	103730400.0	101740700.0	99374980.0	96890360.0	94292740.0	91702900.0	89648060.0	87593220.0	85538380.0	83483550.0	81428730.0	79373880.0	77319040.0	75264210.0
Fixed assets, net of depreciation	99937330.0	94772210.0	89607090.0	84441970.0	79276850.0	74111730.0	68946610.0	63781490.0	58616370.0	53451250.0	48286130.0	43121010.0	37955890.0	32790770.0	27625640.0
Construction in progress	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current assets	511017.2	615437.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2
Cash, bank	38253.9	43141.4	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0
Cash surplus, finance available	5514968.0	6541120.0	9547272.0	12657563.0	15767830.0	18878120.0	21988400.0	25098690.0	28208970.0	31319250.0	34429540.0	37539830.0	40650110.0	43760390.0	46870680.0
Loss carried forward	0.0	36726.0	1818468.0	1507572.0	1078330.0	525006.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loss	36726.0	1781742.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total liabilities	106038300.0	103730400.0	101740700.0	99374980.0	96890360.0	94292740.0	91702900.0	89648060.0	87593220.0	85538380.0	83483550.0	81428730.0	79373880.0	77319040.0	75264210.0
Equity capital	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0
Reserves, retained profit	0.0	0.0	0.0	0.0	0.0	0.0	150788.0	973514.0	1944018.0	3059490.0	4333476.0	5773904.0	7389096.0	9187788.0	11179160.0
Profit	0.0	0.0	310896.0	429182.0	553384.0	683734.0	820726.0	964504.0	1115472.0	1273986.0	1440428.0	1615192.0	1798692.0	1991368.0	2193680.0
Long and medium term debt	74503033.0	72246920.0	69881180.0	67397170.0	64786950.0	62050320.0	59174750.0	56155410.0	52985100.0	49656280.0	46161020.0	42490990.0	38637460.0	34591260.0	30342740.0
Current liabilities	28446.4	31615.5	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9	36784.9
Bank overdraft, finance required	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total debt	74526450.0	72278540.0	69917970.0	67433950.0	64825730.0	62087100.0	59211540.0	56192200.0	53021890.0	49693060.0	46197800.0	42527770.0	38674240.0	34628040.0	30379520.0
Equity, % of liabilities	29.7	30.4	31.0	31.7	32.5	33.4	34.4	35.2	36.0	36.8	37.7	38.7	39.7	40.8	41.9



[illegible] - Tyre plant feasibility study
November 1981
Final Report - Optimistic Scenario

4 years of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 0.0370 units accounting currency
accounting currency: US$

Total initial investment during construction phase

fixed assets:	165102400.00	98.358 % foreign
current assets:	0.00	0.000 % foreign
total assets:	165102400.00	98.358 % foreign

Source of funds during construction phase

equity & grants:	31511850.00	49.198 % foreign
foreign loans :	74530005.00	
local loans :	0.00	
total funds :	106041800.00	94.896 % foreign

Cashflow from operations

Year:	1	8	15
operating costs:	11003650.00	17302650.00	17302650.00
depreciation :	5165122.00	5165122.00	5165122.00
interest :	0.00	2958738.00	1720563.00
production costs	16240720.00	25426510.00	24187330.00
thereof foreign	87.32 %	87.87 %	87.35 %
total sales :	16212000.00	28371000.00	28371000.00
gross income :	-28720.00	2944490.00	4173666.00
net income :	-28720.00	2944490.00	4173666.00
cash balance :	4005571.00	5009442.00	5952270.00
net cashflow :	4005571.00	11047520.00	11060350.00

Net Present Value at: 10.00 % : -30645200.00
Internal Rate of Return: 5.17 %
Return on equity1: 5.37 %
Return on equity2: 1.16 %

Index of Schedules produced by [illegible]

Total initial investment	Cashflow tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working capital requirements	Source of finance

Total Initial Investment in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Fixed investment costs								
Land, site preparation, development	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Buildings and civil works	660488.8	660488.8	1320978.0	660488.8	0.0	0.0	0.0	0.0
Auxiliary and service facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incorporated fixed assets	1800000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant machinery and equipment	0.0	0.0	30000000.0	25000000.0	10000000.0	17000000.0	5000000.0	13000000.0
Total fixed investment costs	2460489.0	660488.8	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Pre-production capital expenditures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net working capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total initial investment costs	2460489.0	660488.8	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Of it foreign, in %	73.2	0.0	95.8	97.4	100.0	100.0	100.0	100.0

Total Current Investment in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004
Fixed investment costs								
Land, site preparation, development	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Buildings and civil works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Auxiliary and service facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incorporated fixed assets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant, machinery and equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total fixed investment costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Preproduction capital expenditures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Working capital	522824.3	104138.3	104138.3	20827.7	20827.8	20827.3	20827.8	20827.7
Total current investment costs	522824.3	104138.3	104138.3	20827.7	20827.8	20827.3	20827.8	20827.7
Of it foreign, %	35.8	42.6	42.6	42.6	42.6	42.6	42.6	42.6

Total Production Costs in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
% of nom. capacity (single product)	50.0	62.5	75.0	77.5	90.0	82.5	85.0	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
Raw material 1	4049100.0	5061375.0	6073650.0	6275125.0	6478560.0	6681015.0	6883470.0	7085925.0	7085925.0	7085925.0	7085925.0	7085925.0	7085925.0	7085925.0	7085925.0
Other raw material's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utilities	2201.6	2652.0	3102.3	3192.4	3282.4	3372.5	3462.6	3552.6	3552.6	3552.6	3552.6	3552.6	3552.6	3552.6	3552.6
Energy	219561.8	267999.3	317434.9	327322.2	337209.6	347096.9	356984.2	366871.5	366871.5	366871.5	366871.5	366871.5	366871.5	366871.5	366871.5
Labour, direct	1420542.0	1433233.0	1457925.0	1461563.0	1465401.0	1469140.0	1472878.0	1476616.0	1476616.0	1476616.0	1476616.0	1476616.0	1476616.0	1476616.0	1476616.0
Repair, maintenance	2835000.0	3218750.0	3812500.0	3937250.0	4050000.0	4168750.0	4267500.0	4406250.0	4406250.0	4406250.0	4406250.0	4406250.0	4406250.0	4406250.0	4406250.0
Spares	805000.0	891250.0	977500.0	994750.0	1012000.0	1029250.0	1046500.0	1063750.0	1063750.0	1063750.0	1063750.0	1063750.0	1063750.0	1063750.0	1063750.0
Factory overheads	402296.3	500370.3	600444.4	620459.1	640474.0	660488.8	680503.5	700518.4	700518.4	700518.4	700518.4	700518.4	700518.4	700518.4	700518.4
Factory costs	9520702.0	11385530.0	13242563.0	13614740.0	13985930.0	14359110.0	14731100.0	15103480.0	15103480.0	15103480.0	15103480.0	15103480.0	15103480.0	15103480.0	15103480.0
Administrative overheads	752300.6	761738.4	771176.2	773063.3	774951.1	776838.9	778725.4	780614.0	780614.0	780614.0	780614.0	780614.0	780614.0	780614.0	780614.0
Distr. costs, sales and distribution	819539.3	1013250.0	1215900.0	1255430.3	1296960.0	1337490.3	1378020.0	1418550.0	1418550.0	1418550.0	1418550.0	1418550.0	1418550.0	1418550.0	1418550.0
Direct costs, sales and distribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0	5165122.0
Financial costs	0.0	3725000.0	3612346.9	3494059.0	3369859.0	3239448.0	3102516.0	2958738.0	2807771.0	2649255.0	2482814.0	2308051.0	2124550.0	1931873.0	1729563.0
Total production costs	16248730.0	22046740.0	24007100.0	24303420.0	24593820.0	24878010.0	25155680.0	25426510.0	25275540.0	25117030.0	24950580.0	24775820.0	24592320.0	24399640.0	24197330.0
Costs per unit - single product	81.2	88.2	80.0	78.4	76.9	75.4	74.0	72.8	72.2	71.8	71.3	70.8	70.3	69.7	69.1
Of it foreign, %	87.3	89.0	88.4	88.3	88.1	88.0	87.8	87.7	87.6	87.5	87.4	87.3	87.3	87.2	87.0
Of it variable,%	51.0	47.0	51.8	52.3	53.3	55.0	56.0	57.1	57.4	57.8	58.2	58.5	59.0	59.5	60.0
Total labour	2137817.0	2165346.0	2194075.0	2199701.0	2205327.0	2210953.0	2216578.0	2222204.0	2222204.0	2222204.0	2222204.0	2222204.0	2222204.0	2222204.0	2222204.0

Net Working Capital in US$

Year			1997	1998	1999	2000	2001	2002	2003	2004	2005-11
Coverage	mdc	cot									
Current assets											
Accounts receivable	9	38.3	288650.5	343169.4	397688.2	402532.1	419495.3	430399.4	441303.3	452207.1	452207.1
Inventory and materials	15	24.3	166718.5	210898.3	253077.4	261513.2	269949.1	278385.0	286820.9	295256.9	295256.8
Energy	1	360.0	607.1	744.4	881.8	909.2	936.7	964.2	991.6	1019.1	1019.1
Spares	1	360.0	2236.1	2475.7	2715.3	2765.2	2811.1	2859.0	2906.9	2954.9	2954.9
Work in progress	2	180.0	5642.2	6504.2	7366.1	7538.5	7710.9	7883.3	8055.7	8228.1	8228.1
Finished products	15	24.3	45162.5	51645.5	58128.4	59425.0	60721.6	62018.2	63314.8	64611.4	64611.4
Cash in hand	2	159.9	38253.9	43141.4	48029.0	49006.6	49984.1	50961.6	51939.1	52916.6	52916.6
Total current assets			549271.1	658578.5	767886.3	783747.9	811609.4	833470.7	855332.3	877193.9	877193.9
Current liabilities and											
Accounts payable	1	360.0	26446.4	31615.6	36784.9	37818.7	38852.5	39886.4	40920.3	41954.1	41954.1
Net working capital			522824.7	626963.0	731101.4	751929.1	772756.9	793584.3	814412.0	835239.8	835239.8
Increase in working capital			522824.7	104138.3	104138.4	20827.8	20827.8	20827.4	20827.8	20827.8	0.0
Net working capital, local			98.4	395442.5	455186.8	467135.7	479084.6	491033.2	502982.2	514931.0	514931.0
Net working capital, foreign			26.4	231520.5	275914.6	284793.4	293672.3	302551.0	311429.8	320308.7	320308.7

Note: mdc = minimum days of coverage ; coefficient of turnover .

Source of Finance, construction in US$

Year	1993.1
Equity, ordinary ..	31511850.0
Equity, preference.	0.0
Subsidies, grants .	0.0
Loan A, foreign .	74500000.0
Loan B, foreign..	0.0
Loan C, foreign .	0.0
Loan A, local....	0.0
Loan B, local....	0.0
Loan C, local....	0.0
Total loan	74500000.0
Current liabilities	0.0
Bank overdraft	0.0
Total funds	106011850.0

Source of Finance, production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Equity, ordinary ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equity, preference.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subsidies, grants .	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan A, foreign .	0.0	-2253078.0	-2365732.0	-2484019.0	-2608220.0	-2738631.0	-2875562.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0
Loan B, foreign..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan C, foreign .	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan A, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan B, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan C, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total loan	0.0	-2253078.0	-2365732.0	-2484019.0	-2608220.0	-2738631.0	-2875562.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0
Current liabilities	26446.4	5169.2	5169.2	1033.8	1033.8	1033.8	1033.8	1033.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank overdraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total funds	26446.4	-2247909.0	-2360563.0	-2482985.0	-2607186.0	2737597.0	-2874529.0	-3018307.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0

Cashflow Tables, construction in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Total cash inflow	106011893.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Financial resources	106011893.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales, net of tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cash outflow	2460489.0	660488.8	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Total assets	2460489.0	660488.8	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Operating costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of finance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corporate tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus (deficit)	103551403.0	-660488.8	-31320980.0	-25660490.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Cumulated cash balance	103551480.0	102890900.0	71569900.0	45909410.0	35909410.0	18909410.0	13909410.0	909408.0
Inflow, local	16011850.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, local	660488.8	660488.8	1320978.0	660488.8	0.0	0.0	0.0	0.0
Surplus (deficit)	15351360.0	-660488.8	-1320978.0	-660488.8	0.0	0.0	0.0	0.0
Inflow, foreign	90000000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, foreign	1800000.0	0.0	30000000.0	25000000.0	10000000.0	17000000.0	5000000.0	13000000.0
Surplus (deficit)	88200000.0	0.0	-30000000.0	-25000000.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Net cashflow	-2460489.0	-660488.8	-31320980.0	-25660490.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Cumulated net cashflow	-2460489.0	-3120978.0	-34441960.0	-60102440.0	-70102450.0	-87102456.0	-92102450.0	-105102400.0

Cashflow tables, production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total cash inflow	16238440.0	20270170.0	24323170.0	25129630.0	25940230.0	26750830.0	27561430.0	28372030.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0
Financial resources	26446.4	5169.2	5169.2	1033.8	1033.8	1033.9	1033.8	1033.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales, net of tax	16212000.0	20265000.0	24318000.0	25128600.0	25939200.0	26749800.0	27560400.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0
Total cash outflow	11632870.0	19244000.0	21517020.0	21644180.0	22058780.0	22473380.0	22887980.0	23302590.0	23280730.0	23280730.0	23280730.0	23280730.0	23280730.0	23280720.0	23280720.0
Total assets	5492271.1	109307.5	109307.5	21861.6	21861.6	21861.7	21861.6	21861.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating costs	11003600.0	13155620.0	15229630.0	15644240.0	16058840.0	16473440.0	16888040.0	17302650.0	17302650.0	17302650.0	17302650.0	17302650.0	17302650.0	17302650.0	17302650.0
Cost of finance	0.0	3725000.0	3612345.0	3494059.0	3369459.0	3239448.0	3102516.0	2958738.0	2807771.0	2649255.0	2482814.0	2308051.0	2124550.0	1931873.0	1729583.0
Repayment	0.0	2253078.0	2365732.0	2484019.0	2608220.0	2738631.0	2875562.0	3019340.0	3170307.0	3328823.0	3495264.0	3670027.0	3853529.0	4046205.0	4248515.0
Corporate tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus (deficit)	4605571.0	1026166.0	3026148.0	3485454.0	3881454.0	4277452.0	4673446.0	5069442.0	5090270.0	5090270.0	5090270.0	5090270.0	5090270.0	5090272.0	5090272.0
Cumulated cash balance	5514979.0	6541145.0	9567293.0	13052750.0	16934200.0	21191650.0	25865100.0	30934540.0	36024810.0	41115080.0	46205350.0	51295620.0	56385900.0	61476170.0	66566440.0
Inflow, local	16214020.0	20265430.0	24318430.0	25128680.0	25939280.0	26749880.0	27560480.0	28371080.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0
Outflow, local	2233022.0	2312917.0	2671157.0	2694667.0	2766311.0	2837959.0	2909609.0	2981259.0	2969224.0	2969224.0	2969224.0	2969224.0	2968224.0	2968224.0	2968224.0
Surplus (deficit)	13981000.0	17952510.0	21647270.0	22434020.0	23172970.0	23911920.0	24650870.0	25389820.0	25401770.0	25401770.0	25401770.0	25401770.0	25401770.0	25401770.0	25401770.0
Inflow, foreign	23825.3	4738.3	4738.3	947.7	947.7	947.7	947.7	947.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, foreign	9399852.0	16931090.0	18845860.0	18949510.0	19292460.0	19635420.0	19978370.0	20321330.0	20311500.0	20311500.0	20311500.0	20311500.0	20311500.0	20311500.0	20311500.0
Surplus (deficit)	-9376227.3	-16926350.0	-18841120.0	-18948560.0	-19291520.0	-19634470.0	-19977430.0	-20320380.0	-20311500.0	-20311500.0	-20311500.0	-20311500.0	-20311500.0	-20311500.0	-20311500.0
Net cashflow	4605572.0	7004243.0	8984225.0	9463532.0	9859532.0	10255530.0	10651520.0	11047520.0	11068350.0	11068350.0	11068350.0	11068350.0	11068350.0	11068350.0	11068350.0
Cumulated net cashflow	-100496900.0	-93492640.0	-84508420.0	-75044880.0	-65185350.0	-54929820.0	-44278300.0	-33230780.0	-22162430.0	-11094080.0	-25732.0	11042620.0	22110960.0	33179310.0	44247660.0

Cashflow Discounting:

a) Equity paid versus Net income flow:
Net present value .....-22614760.00 at 10.00 %
Internal Rate of Return (IRRE1) .. 0.17 %

b) Net Worth versus Net cash return:
Net present value .....-13623330.00 at 10.00 %
Internal Rate of Return (IRRE2) .. 1.16 %

c) Internal Rate of Return on total investment:
Net present value .....-30645250.00 at 10.00 %
Internal Rate of Return (IRR) .. 5.17 %

Net Worth = Equity paid plus reserves

Net Income Statement in US$

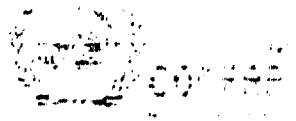
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total sales, incl. sales tax	16212000.0	20255000.0	24318000.0	25129600.0	25939200.0	26749800.0	27560400.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0	28371000.0
Less: variable costs, incl. sales tax.	8293051.0	10365080.0	12438090.0	12852990.0	13267300.0	13681900.0	14096500.0	14511110.0	14511110.0	14511110.0	14511110.0	14511110.0	14511110.0	14511110.0	14511110.0
Variable margin	7919938.0	9899921.0	11879910.0	12275900.0	12671900.0	13067900.0	13463890.0	13859890.0	13859890.0	13859890.0	13859890.0	13859890.0	13859890.0	13859890.0	13859890.0
As % of total sales	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9
Non-variable costs, incl. depreciation	7956554.0	7956663.0	7956663.0	7956663.0	7956663.0	7956664.0	7956663.0	7956661.0	7956660.0	7956662.0	7956661.0	7956660.0	7956662.0	7956660.0	7956660.0
Operational margin	-36726.0	1943258.0	3923242.0	4319239.0	4715237.0	5111232.0	5507230.0	5903228.0	5903229.0	5903227.0	5903228.0	5903225.0	5903228.0	5903229.0	5903229.0
As % of total sales	-0.2	9.6	16.1	17.2	18.2	19.1	20.0	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
Cost of finance	0.0	3725000.0	3612346.0	3494059.0	3369859.0	3239448.0	3102516.0	2958738.0	2807771.0	2649255.0	2482814.0	2308051.0	2124550.0	1931873.0	1729563.0
Gross profit	-36726.0	-1781742.0	310896.0	825180.0	1345378.0	1871784.0	2404714.0	2944490.0	3095458.0	3253972.0	3420414.0	3595178.0	3778678.0	3971356.0	4173666.0
Allowances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxable profit	-36726.0	-1781742.0	310896.0	825180.0	1345378.0	1871784.0	2404714.0	2944490.0	3095458.0	3253972.0	3420414.0	3595178.0	3778678.0	3971356.0	4173666.0
Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net profit	-36726.0	-1781742.0	310896.0	825180.0	1345378.0	1871784.0	2404714.0	2944490.0	3095458.0	3253972.0	3420414.0	3595178.0	3778678.0	3971356.0	4173666.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undistributed profit	-36726.0	-1781742.0	310896.0	825180.0	1345378.0	1871784.0	2404714.0	2944490.0	3095458.0	3253972.0	3420414.0	3595178.0	3778678.0	3971356.0	4173666.0
Accumulated undistributed profit	-36726.0	-1818468.0	-1507572.0	-682392.0	662986.0	2534770.0	4939484.0	7883974.0	10979430.0	14233400.0	17653820.0	21249000.0	25027670.0	28959030.0	33172700.0
Gross profit, % of total sales	-0.2	-8.8	1.3	3.3	5.2	7.0	8.7	10.4	10.9	11.5	12.1	12.7	13.3	14.0	14.7
Net profit, % of total sales	-0.2	-8.8	1.3	3.3	5.2	7.0	8.7	10.4	10.9	11.5	12.1	12.7	13.3	14.0	14.7
ROE, Net profit, % of equity	-0.1	-5.2	1.0	2.6	4.3	5.9	7.6	9.3	9.8	10.3	10.9	11.4	12.0	12.6	13.2
ROI, Net profit+interest, % of invest.	-0.0	1.9	3.7	4.1	4.5	4.3	5.2	5.6	5.6	5.6	5.5	5.5	5.6	5.6	5.6

Projected Balance Sheets, construction in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Total assets	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0
Fixed assets, net of depreciation	0.0	2460488.0	3120978.0	34441960.0	69102448.0	78102450.0	87102450.0	92102450.0
Construction in progress	2460488.0	660488.0	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Current assets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash, Bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash surplus, finance available	103551400.0	102890900.0	71569890.0	45909400.0	35903400.0	18903400.0	13909400.0	909400.0
Loss carried forward	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total liabilities	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0
Equity capital	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0
Reserves, retained profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long and medium term debt	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0
Current liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank overdraft, finance required	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total debt	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0
Equity, % of liabilities	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7

Projected Balance Sheets, Production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total assets	106038300.0	103730400.0	101740700.0	99772010.0	97685030.0	96136820.0	95667000.0	95593130.0	95518340.0	95443490.0	95368630.0	95293780.0	95218930.0	95144080.0	95069230.0
Fixed assets, net of depreciation	99937350.0	94772210.0	89607090.0	84441970.0	79276850.0	74111730.0	68946610.0	63781490.0	58616370.0	53451250.0	48286130.0	43121010.0	37955890.0	32790770.0	27625640.0
Construction in progress	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current assets	5101017.3	5154437.2	7198857.2	7407741.3	7616625.3	7825509.1	8033393.2	8242277.3	8242277.3	8242277.3	8242277.3	8242277.3	8242277.3	8242277.3	8242277.3
Cash, bank	33253.9	43141.4	48029.0	49008.6	49984.1	50961.5	51939.1	52916.6	52916.6	52916.6	52916.6	52916.6	52916.6	52916.6	52916.6
Cash surplus, finance available	5514968.0	8541120.0	9547272.0	13032710.0	16914190.0	21191620.0	25865080.0	30934530.0	36024780.0	41115050.0	46205310.0	51295580.0	56385850.0	61476120.0	66566390.0
Loss carried forward	0.0	36726.0	1818468.0	1507572.0	683392.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loss	36726.0	1781742.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total liabilities	106038300.0	103750400.0	101740700.0	99772010.0	97685030.0	96136820.0	95667000.0	95593130.0	95518340.0	95443490.0	95368630.0	95293780.0	95218930.0	95144080.0	95069230.0
Equity capital	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0
Reserves, retained profit	0.0	0.0	0.0	0.0	0.0	662985.3	2534770.0	4933434.0	7883974.0	10979430.0	14233400.0	17653820.0	21249060.0	25027670.0	28999030.0
Profit	0.0	0.0	310896.0	825180.0	1345379.0	1871784.0	2404714.0	2944430.0	3095458.0	3253972.0	3420414.0	3595178.0	3778678.0	3971356.0	4173666.0
Long and medium term debt	74500000.0	72246920.0	69881180.0	67397170.0	64788950.0	62050320.0	59174750.0	56155410.0	52985100.0	49656280.0	46161020.0	42490990.0	38637460.0	34591260.0	30342740.0
Current liabilities	26446.4	31815.6	36784.9	37818.7	38852.6	39885.4	40920.3	41954.1	41954.1	41954.1	41954.1	41954.1	41954.1	41954.1	41954.1
Bank overdraft, finance required	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total debt	74526450.0	72278540.0	69917970.0	67434980.0	64827800.0	62090200.0	59215670.0	56197370.0	53027080.0	49698240.0	46202970.0	42532940.0	38679420.0	34633210.0	30384490.0
Equity, % of liabilities	29.7	30.4	31.0	31.6	32.3	32.8	32.9	33.0	33.0	33.0	33.0	33.1	33.1	33.1	33.1



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BANGLADESH - Tyre plant feasibility study
November 1991
Final Report - Pessimistic Scenario

4 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 0.0270 units accounting currency
accounting currency: US$

Total initial investment during construction phase

fixed assets	105'022400.00	98.958 % foreign
current assets:	0.00	0.000 % foreign
total assets:	105'022400.00	98.958 % foreign

Source of funds during construction phase

equity & grants:	31511950.00	49.180 % foreign
foreign loans :	74530000.00	
local loans :	0.00	
total funds :	105511800.00	84.996 % foreign

Cashflow from operations

Year:	1	8	15
operating costs:	11083600.00	15229630.00	15229630.00
depreciation :	5165122.00	5165122.00	5165122.00
interest :	0.00	2958738.00	1729553.00
production costs	16248720.00	23353490.00	22124320.00
thereof foreign	87.32 %	88.11 %	87.45 %
total sales :	12969600.00	19454400.00	19454400.00
gross income :	-3279120.00	-3899094.00	-2669918.00
net income :	-3279120.00	-3899094.00	-2669918.00
cash balance :	1363171.00	-1753314.00	-1753312.00
net cashflow :	1363171.00	4224764.00	4224764.00

Net Present Value at: 10.00 % = -62563150.00
Internal Rate of Return: -1.49 %
Return on equity: not found
Return on equity: not found

Index of Schedules produced by COMFAR

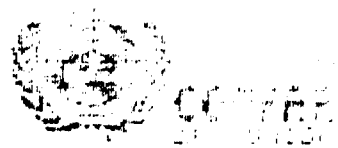
"old" initial investment	Cashflow tables
"old" investment during production	Projected balance
"old" production cost	Net income statement
working capital requirements	Source of finance

Total Initial Investment in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1995.1	1996.2
Fixed investment costs								
Land, site preparation, development	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Buildings and civil works	660488.0	660488.0	1320976.0	660488.0	0.0	0.0	0.0	0.0
Auxiliary and service facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incorporated fixed assets	1803000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant machinery and equipment	0.0	0.0	30000000.0	25000000.0	10000000.0	17000000.0	5000000.0	13000000.0
Total fixed investment costs	2463488.0	660488.0	31320976.0	25660488.0	10000000.0	17000000.0	5000000.0	13000000.0
Pre-production capital expenditures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net working capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total initial investment costs	2463488.0	660488.0	31320976.0	25660488.0	10000000.0	17000000.0	5000000.0	13000000.0
Of it foreign, in %	73.2	0.0	95.8	97.4	100.0	100.0	100.0	100.0

Total Current Investment in US$

Year	1997	1998	1999
Fixed investment costs			
Land, site preparation, development	0.0	0.0	0.0
Buildings and civil works	0.0	0.0	0.0
Auxiliary and service facilities	0.0	0.0	0.0
Incorporated fixed assets	0.0	0.0	0.0
Plant, machinery and equipment	0.0	0.0	0.0
Total fixed investment costs	0.0	0.0	0.0
Preproduction capitals expenditures	0.0	0.0	0.0
Working capital	522824.8	104138.3	104138.3
Total current investment costs	522824.8	104138.3	104138.3
Of it foreign, %	35.0	42.5	42.5



Total Production Costs

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
% of nom. capacity, single product	50.0	60.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Raw material	4049*25.0	5251*75.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0	6073650.0
Other raw materials	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utilities	2277.6	2662.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0	3102.0
Energy	2*8557.2	257338.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0	317434.0
Labour direct	1457340.0	1457340.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0	1457325.0
Repair, maintenance	3825000.0	3219750.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0	3825000.0
Spares	825000.0	991650.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0	977500.0
Factory overheads	600286.1	600873.0	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4	600444.4
Factory costs	13*1*25.3	1*38*630.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0	13242560.0
Administrative overheads	7*1220.6	7*738.4	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2	771*76.2
Distrib. costs, sales and promotion	1*2555.2	1*12850.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0	1215900.0
Direct costs, sales and promotion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0	5165*22.0
Financial costs	0.0	3726033.0	3812345.0	3434039.0	3052859.0	2671448.0	2289716.0	1907738.0	1525777.0	1143955.0	762814.0	382080.0	2124650.0	1911675.0	1729561.0
Total production costs	15249*30.0	22246*40.0	24037*30.0	23888*10.0	23734*70.0	23584*00.0	23497*70.0	23353*60.0	23202*30.0	23044*10.0	22877*70.0	22*02*0.0	22519*00.0	22326*30.0	22124*20.0
Costs per unit, single product	81.2	88.2	80.2	79.6	79.2	78.6	78.3	77.8	77.3	76.8	76.3	75.7	75.1	74.4	73.7
Unit foreign, %	87.3	88.3	88.4	88.4	88.5	88.6	88.7	88.8	88.9	89.0	89.1	89.2	89.3	89.4	89.5
Unit variable,%	51.2	47.2	51.2	52.7	52.6	52.6	52.9	53.3	53.5	54.0	54.4	54.8	55.2	55.7	56.2
Total sales	2197*17.0	2755946.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0	2194075.0

Net Working Capital in US$

Year			1997	1998	1999	2000-11
Coverage	mdc	coto				
Current assets						
Accounts receivable	9	30.3	289550.5	340193.4	397589.2	397589.2
Inventory and materials	15	24.3	162718.5	210252.3	253077.4	253077.4
Energy	1	360.3	607.1	744.4	881.8	881.8
Spares	1	360.3	2236.1	2475.7	2715.3	2715.3
Work in progress	2	120.3	5642.2	6504.2	7366.1	7366.1
Finished products	15	24.3	45152.8	51648.5	58128.4	58128.4
Cash in hand	2	180.3	38253.3	43141.4	48029.3	48029.3
Total current assets			543271.1	655578.5	767885.3	767885.3
Current liabilities and						
Accounts payable	1	360.3	36445.4	39515.6	36784.3	36784.3
Net working capital			522824.7	526953.3	731101.4	731101.4
Increase in working capital			522824.7	104128.3	104138.4	0.3
Net working capital, local			335698.4	395442.6	455136.8	455136.8
Net working capital, foreign			187126.4	231520.5	275914.5	275914.5

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in US$

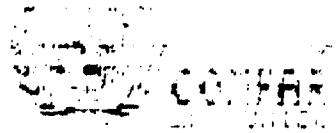
Year	1993.1
Equity, ordinary ..	31511850.0
Equity, preference.	0.0
Subsidies, grants .	0.0
Loan A, foreign .	74588000.0
Loan B, foreign..	0.0
Loan C, foreign .	0.0
Loan A, local....	0.0
Loan B, local....	0.0
Loan C, local....	0.0
Total loan	74588000.0
Current liabilities	0.0
Bank overdraft	0.0
Total funds	106099850.0

Source of Finance, production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Equity, ordinary ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equity, preference.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subsidies, grants .	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan A, foreign .	0.0	-2353079.0	-2385732.0	-2484019.0	-2528220.0	-2738831.0	-2875582.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0
Loan B, foreign..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan C, foreign .	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan A, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan B, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan C, local....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total loan	0.0	-2353079.0	-2385732.0	-2484019.0	-2528220.0	-2738831.0	-2875582.0	-3019340.0	-3170307.0	-3328823.0	-3495264.0	-3670027.0	-3853529.0	-4046205.0	-4248515.0
Current liabilities	25446.4	5753.2	5183.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank overdraft	0.0	754288.0	1957448.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0	1753312.0
Total flows	25446.4	-1593529.0	-503194.8	-730708.8	-774907.5	-985319.5	-1122246.0	-1266028.0	-1416995.0	-1575507.0	-1741950.0	-1916715.0	-2100216.0	-2292893.0	-2495199.0

Cashflow Tables, construction in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Total cash inflow	168311800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Financial resources	168311800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales, net of tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cash outflow	2460489.0	660489.0	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Total assets	2460489.0	660489.0	31320980.0	25660490.0	10000000.0	17000000.0	5000000.0	13000000.0
Operating costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of finance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corporate tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus (deficit)	165851400.0	-660489.0	-31320980.0	-25660490.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Cumulated cash balance	165851400.0	165190900.0	133869900.0	108209410.0	98209410.0	81209410.0	76209410.0	63209408.0
Inflow, local	16811850.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, local	660489.0	660489.0	1320978.0	660489.0	0.0	0.0	0.0	0.0
Surplus (deficit)	15351360.0	-660489.0	-1320978.0	-660489.0	0.0	0.0	0.0	0.0
Inflow, foreign	98000000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, foreign	1800000.0	0.0	30000000.0	25000000.0	10000000.0	17000000.0	5000000.0	13000000.0
Surplus (deficit)	88200000.0	0.0	-30000000.0	-25000000.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Net cashflow	-2460489.0	-660489.0	-31320980.0	-25660490.0	-10000000.0	-17000000.0	-5000000.0	-13000000.0
Cumulated net cashflow	-2460489.0	-3120978.0	-34441963.0	-60102460.0	-70102450.0	-87102450.0	-92102450.0	-105102400.0



Cashflow tables, production in USS

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total cash inflow	12388240.0	16217770.0	19454870.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0
Financial resources	25440.0	5750.0	5183.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales, net of tax	12362800.0	16211920.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0
Total cash outflow	11003973.0	16244000.0	21307205.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0	21307713.0
Total assets	5427.0	15337.0	15337.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating costs	11238650.0	15198650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0	18238650.0
Cost of finance	0.0	1728000.0	3017348.0	3468793.0	3068063.0	2638449.0	2178314.0	1687738.0	1387771.0	2446255.0	2402814.0	2070051.0	2124550.0	1951873.0	1729563.0
Repayment	0.0	2300000.0	1000000.0	3400000.0	3800000.0	4200000.0	4660000.0	5160000.0	5460000.0	3338823.0	3495284.0	3857007.0	3858329.0	4044335.0	4248815.0
Corporate tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus before	1384271.0	-3026230.0	-1852835.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0	-1853314.0
Cumulated cash balance	1379973.0	-1646256.0	-3499108.0	-5352422.0	-7205736.0	-9059050.0	-10912364.0	-12765678.0	-14618992.0	-16472307.0	-18325621.0	-20178935.0	-22032249.0	-23885563.0	-25738877.0
Inflow, local	12372423.0	16212420.0	19454933.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0
Outflow, local	2933222.0	3313917.0	2971193.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0	2610984.0
Surplus before	10739423.0	13898503.0	16482940.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0	16843416.0
Inflow, foreign	15817.0	4730.0	4730.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow, foreign	8069869.0	12931030.0	12944953.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0	18596730.0
Surplus before	-8053052.0	-12926300.0	-12940223.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0	-18596730.0
Net cashflow	1383171.0	2951242.0	4120625.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0	4224764.0
Cumulated net cashflow	-123739380.0	-120788000.0	-116667420.0	-112442560.0	-108217700.0	-103992920.0	-99768150.0	-95543380.0	-91318620.0	-87093850.0	-82869090.0	-78644320.0	-74419760.0	-70195000.0	-65970230.0

Cashflow Discounting:

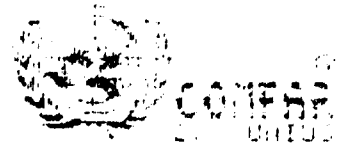
a) Equity paid versus Net income flow:
Net present value .....-5455[illegible]30.30 at 10.00 %
Internal Rate of Return (IRR%) .. not found

b) Net worth versus Net cash return:
Net present value .....-4553[illegible]30.30 at 10.00 %
Internal Rate of Return (IRR%) .. not found

c) Internal Rate of Return on total investment:
Net present value .....-5355[illegible]30.30 at 10.00 %
Internal Rate of Return (IRR) .. -1.43 %
Net worth = Equity paid plus reserves

Net Income Statement (M$)

Year	'97	'98	'99	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total sales, incl. sales tax	12889600.0	16011000.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0	19454400.0
Less: variable costs, incl. sales tax	8392257.0	10355280.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0	12438030.0
Variable margin	4497343.0	5655721.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0	7016307.0
As % of total sales	34.9	35.3	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1
Non-variable costs, incl. depreciation	7956664.0	7956663.0	7956663.0	7956664.0	7956663.0	7956664.0	7956663.0	7956663.0	7956663.0	7956664.0	7956663.0	7956663.0	7956664.0	7956664.0	7956663.0
Operational margin	-3459321.0	-2300942.0	-940356.0	-940357.0	-940356.0	-940356.0	-940356.0	-940356.0	-940356.0	-940357.0	-940356.0	-940356.0	-940357.0	-940357.0	-940356.0
As % of total sales	-26.8	-14.4	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8
Cost of finance	0.0	1735000.0	2673840.0	2494259.0	2313858.0	2133448.0	1953038.0	1772628.0	1592218.0	1411808.0	1231398.0	1050988.0	870579.0	690169.0	509759.0
Gross profit	-3459321.0	-4036942.0	-4613702.0	-4434616.0	-4253214.0	-4073804.0	-4043873.0	-3893394.0	-3748126.0	-3588612.0	-3423170.0	-3248406.0	-3064906.0	-2872230.0	-2669916.0
Allowances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxable profit	-3459321.0	-4036942.0	-4613702.0	-4434616.0	-4253214.0	-4073804.0	-4043873.0	-3893394.0	-3748126.0	-3588612.0	-3423170.0	-3248406.0	-3064906.0	-2872230.0	-2669916.0
Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net profit	-3459321.0	-4036942.0	-4613702.0	-4434616.0	-4253214.0	-4073804.0	-4043873.0	-3893394.0	-3748126.0	-3588612.0	-3423170.0	-3248406.0	-3064906.0	-2872230.0	-2669916.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undistributed profit	-3459321.0	-4036942.0	-4613702.0	-4434616.0	-4253214.0	-4073804.0	-4043873.0	-3893394.0	-3748126.0	-3588612.0	-3423170.0	-3248406.0	-3064906.0	-2872230.0	-2669916.0
Accumulated undistributed profit	-3459321.0	-7496263.0	-12109965.0	-16544582.0	-20797796.0	-24871600.0	-28915473.0	-32808867.0	-36557993.0	-40146605.0	-43569775.0	-46818181.0	-49883087.0	-52755317.0	-55425233.0
Gross profit, % of total sales	-26.8	-25.2	-23.7	-22.8	-22.2	-21.5	-20.8	-20.0	-19.3	-18.5	-17.6	-16.7	-15.8	-14.8	-13.7
Net profit, % of total sales	-26.8	-25.2	-23.7	-22.8	-22.2	-21.5	-20.8	-20.0	-19.3	-18.5	-17.6	-16.7	-15.8	-14.8	-13.7
ROE, Net profit, % of equity	-13.4	-18.5	-14.4	-14.1	-13.7	-13.3	-12.9	-12.4	-11.9	-11.4	-10.9	-10.3	-9.7	-9.1	-8.5
ROI, Net profit+interest, % of invest.	-3.1	-3.0	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3



Projected Balance Sheets, construction in US$

Year	1993.1	1993.2	1994.1	1994.2	1995.1	1995.2	1996.1	1996.2
Total assets	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0
Fixed assets, net of depreciation	0.0	2465489.0	31209[illegible]2.0	34441360.0	50[illegible]2460.0	70[illegible]2460.0	87[illegible]2460.0	92[illegible]2460.0
Construction in progress	2465489.0	663488.0	31320380.0	25663460.0	10000000.0	17000000.0	5000000.0	13000000.0
Current assets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash, bank	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash surplus, finance available	103551400.0	102932311.0	71569830.0	45539400.0	35939400.0	19539400.0	13939400.0	989400.0
Less carried forward	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Less	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total liabilities	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0	106011800.0
Equity capital	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0
Reserves, retained profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long and medium term debt	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0
Current liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank overdraft, finance required	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total debt	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0	74500000.0
Equity, % of liabilities	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7

Projected Balance Sheets, Production in US$

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total assets	105033320.0	104544720.0	104241500.0	103310300.0	102455900.0	101472600.0	100348400.0	99082340.0	97665340.0	96089840.0	94347890.0	92431180.0	90330970.0	88038070.0	85542880.0
Fixed assets, net of depreciation	99937330.0	94772210.0	89607090.0	84441970.0	79276850.0	74111730.0	68946610.0	63781490.0	58616370.0	53451250.0	48286130.0	43121010.0	37955890.0	32790770.0	27625650.0
Construction in progress	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current assets	511217.3	615437.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2	719857.2
Cash, bank	38353.3	43141.4	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0	48029.0
Cash surplus, finance available	2272598.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loss carried forward	0.0	3273125.0	9113858.0	13655570.0	18100350.0	22417300.0	26591000.0	30633280.0	34532970.0	38281100.0	41870710.0	45293880.0	48542290.0	51607150.0	54479420.0
Loss	3273125.0	5834742.0	4552723.0	4434475.0	4312214.0	4173904.0	4042972.0	3893294.0	3748126.0	3589612.0	3423170.0	3248405.0	3064906.0	2872230.0	2659718.0
Total liabilities	105033320.0	104544720.0	104241500.0	103310300.0	102455900.0	101472600.0	100348400.0	99082340.0	97665340.0	96089840.0	94347890.0	92431180.0	90330970.0	88038070.0	85542880.0
Equity capital	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0	31511850.0
Reserves, retained profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long and medium term debt	74520000.0	72248320.0	69991130.0	67337170.0	64738850.0	62350330.0	59174750.0	56155410.0	52985100.0	49656280.0	46161020.0	42490930.0	38537460.0	34591360.0	30542740.0
Current liabilities	28445.4	31515.5	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3	36784.3
Bank overdraft, finance required.	0.0	754280.0	2511735.0	4365040.0	6118353.0	7371880.0	9624952.0	11378300.0	13131610.0	14884930.0	16638240.0	18391550.0	20144870.0	21898180.0	23651510.0
Total debt	74526450.0	73033920.0	72539700.0	71738990.0	70944080.0	69953780.0	68835530.0	67570500.0	66153500.0	64577390.0	62836040.0	60919330.0	58819120.0	56526320.0	54031030.0
Equity, % of liabilities	29.7	30.1	30.3	30.5	30.8	31.1	31.4	31.8	32.3	32.8	33.4	34.1	34.9	35.8	36.8