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MASTER DEGREE THESIS

PROFITABILITY IMPROVEMENT IN THE OIL REFINERY - A Case Study of Bongaigaon Refinery and Petrochemicals

Ljubljana, September 2004 **Bishnu Ram Boro**

Author's STATEMENT

I Bishnu Ram Boro hereby certify to be the author of this Master's thesis that was written under the mentorship of Prof. Rudi Rozman and in compliance with the Act of Authors' and Related Rights – Para. 1, Article 21. I herewith agree this thesis to be published on the website pages of the Faculty of Economics.

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A business cannot continue without running on self-sustainability basis. To achieve sustainability, it is important to look within and outside business environment and understand the way of analysing the situation and take all possible measures in order to bring improvement in the profitability of enterprises on sustainable basis. This is the main issue in the present scenario of running enterprises. Having working experience in different departments of Bongaigaon Refinery & Petrochemicals Limited (BRPL) such as Technical Services, Corporate and Strategic Planning, Project and Refinery Operation during last sixteen years, I got the opportunity to study about the business process and corporate strategies in these departments. The issues related to improvement of profitability were in my mind since the company was facing uncertainty in its existence after the abolition of Administered Pricing Mechanism (APM) and hence it was my spontaneous eagerness to choose this topic for my thesis. Keeping the developments in view, an attempt has been made in this thesis to explore and select factors that could provide the means to the refinery for improvement in the profitability.

I am very glad to have been given the opportunity to study International MBA for which I am grateful to the management of Bongaigaon Refinery & Petrochemicals Limited (BRPL). Without the sponsorship of BRPL, it would not have been possible for me to study International MBA.

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ABBREVIATIONS USED

AGM	Annual General Meeting
APM	Administered Pricing Mechanism
ATF	Aviation Turbine Fuel
bbl	Billion Barrel
BCM	Billion Cubic Meters
BPCL	Bharat Petroleum Corporation Limited
BRPL	Bongaigaon Refinery & Petrochemicals Limited
CAGR	Consumption Average Growth Rate
CCU	Coke Calcination Unit
CDU	Crude Distillation Unit
CFO	Coker Fuel Oil
CK	Coker Kero
CMP	Centralised Maintenance Planning
CN	Coker Naphtha
CPC	Calcined Petroleum Coke
CR	Coker Residue
CRL	Cochin Refinery Limited
DCU	Delayed Coker Unit
DMT	Dimethyl Terephthalate
EAT	Earning Before Tax
EOQ	Economic Order Quantity
ERP	Enterprise Resource Planning
HBCPL	Haldia-Barauni Crude Pipeline
HGO	Heavy Gas Oil
HPCL	Hindustan Petroleum Corporation Limited
HSD	High Speed Diesel
IOC	Indian Oil Corporation (Indian Oil)
KgOE	Kilogram of Oil Equivalent
KTU	Kerosene Treating Unit
LDO	Light Diesel Oil
LGO	Light Gas Oil
LPG	Liquefied Petroleum Gas
LSHS	Low Sulphur Heavy Stock

ABBREVIATIONS USED

mbtu	Million British Thermal Unit
MCM	Maintenance Condition Monitoring
MEG	Mono ethyl Glycol
MMTPA	Million Metric tonne Per Annum
MOU	Memorandum of Understanding
MS	Motor Spirit
MTPA	Metric tonne Per Annum
MRL	Madras Refinery Limited
MRN	Mixed Run Naphtha
MRPL	Mangalore Refinery Private Limited
NRL	Numaligarh Refinery Limited
MT	Metric Tonne
OM&S	Oil Movement and Storage
ONGC	Oil & Natural Gas Corporation
PPD	Pour Point Depression
POL	Petroleum Oil & Lubricant
POY	Partially Oriented Yarn
PSF	Polyester Staple Fibre
PTA	Para Toluic Acid
PSU	Public Sector Units
RIL	Reliance Industries Limited
ROR	Rate of return
RPC	Raw petroleum coke
Rs.	Rupees
SKO	Superior Kerosene Oil
SRFT	Standard Refinery Fuel per Tonne
SRN	Straight Run Naphtha
SWOT	Strength Weakness Opportunity Threat
USD	US Dollar
VRS	Voluntary Retirement Scheme

CHAPTER 1

INTRODUCTION

India is currently the world's 8th largest consumer of oil. It is expected to rise to 5th place in the next 20 years. The downstream oil industries i.e. refining and marketing promise to be one of the most attractive growth markets in the world. It is emphasized that investment of Rs. 2500 billion in the refining, Rs. 210 billion for pipelines and Rs. 1350 billion in the marketing infrastructure would be required by 2025. The Hydrocarbon vision 2025 formulated by the Ministry of Petroleum & Natural Gas in 1999 emphasized 90% self-sufficiency in middle distillate (Diesel/kerosene group) in the sector with an appropriate mix of national oil companies, foreign players and private Indian players so as to develop a globally competitive industry. According to this report, the country would require 277 MMTPA petroleum products and 358 MMT refining capacity is to be build up in order to achieve 90 % self-sufficiency. Corresponding increase in pipeline and marketing infrastructure would also be required. The consumption of petroleum products has grown 33 times from 2.7 million tones during 1947-48 (year of independence) to about 98 million tones in 2001-02. Vast network of over 30,000 dealerships and distributorships has been developed backed by over 400 storage points countrywide including remote and far-flung areas. 18 refineries support these with the processing capacity of 112 MMTPA, crude and product pipelines network of over 7000 kilometres, storage terminals and bottling plants and fleet of ocean going tankers on time charter and road tankers.

Indian Refineries were running earlier under Administered Pricing Mechanism (APM) system, which gave assured profit margin to them and there was basically no competition among the oil refineries. With the influence of global free economy, high imported crude oil price, Government of India eventually led to complete deregulation of Administered Pricing Mechanism and free market on 1st April 2002. This has brought sea change in the oil refining business environment in India. In the present competitive environment, **Indian oil refineries have no other option but to compete among themselves and with the private sector for their survival and growth**. Entrance of private sector in the oil refining business further enhanced the competitiveness. Today, Indian PSU refineries are to compete with the private giant like Reliance Industries Limited (RIL).

Bongaigaon Refinery & Petrochemicals Limited (BRPL) was incorporated as Government of India Undertaking under the administrative control of the Ministry of Petroleum and Natural Gas on 20th February 1974. With an investment of about Rs. 8,000 million in the refineries and petrochemicals plants, BRPL has the unique distinction of being the first indigenous grass root refinery in the country integrated with a petrochemical complex at one location. Since its inception, BRPL stands as a most prominent industry in the region. As a public undertaking to the government of India, the company has continuously endeavouring the responsibility to fulfil the need and aspiration of the people of the region by contributing in socio-economic development. In the process of phase-wise abolition of Administered Pricing Mechanism (APM), the government of India has allowed both private and public sector players to

compete in the petroleum refining business. This has led to crisis in operating small stand-alone public sector oil industries in the country. BRPL, being a small stand-alone refinery cum petrochemicals industry has strived for its survival in the stiff competitive environment. In the process the government of India disinvested BRPL's share and the company became a subsidiary of Indian Oil (IOC), another public enterprises on 29th of March 2001.

BRPL is a refinery with 2.35 million tones per annum of crude oil processing capacity. The employees' strength is at present 1800. The company has many strategic disadvantages in the competitive market due to its size. Number of employees compared to the size of the refinery is very high. The company also has locational disadvantage due to its existence in the far most North Eastern part of the country, where transportation of raw materials and products etc. are problematic. Cost of crude oil movement through pipeline is also high due to its distance from the port and Krishna Godavari basin, which are directly affecting the processing cost. After deregulation of APM by the government of India, the company is facing with many challenges for its survival and growth. There were rises and falls in the overall performance of the company during last few years due to uncertain business environment. **The refinery has been running at under capacity due to short supply of crude oil and other reasons such as products containment problem. These and emergency shutdown of the plants on account of technical failure are the main factors contributing to poor performance of the company.** However, iinfrastructure facilities have been developed to supply crude oil from Krishna Godavari Basin of Southern India and for importing crude oil, therefore shortage of crude oil may not be a hindrance in full capacity utilization as long as the company can effort to buy crude oil from all these sources. Enhancement of refining capacity involves huge capital investment and it does not seem to be a good proposition at this juncture. Existing crude oil supply pipelines are partly owned by Indian Oil and partly by Oil India Limited and they are used on shared basis with other Indian Oil refineries. Similarly IOC owns products pipeline and the same is used as shared basis. Therefore supply of crude oil as well as dispatch of products by pipelines stand as another bottlenecks in capacity enhancement of BRPL.

Viability of the refinery is a question at the present highly competitive environment. Another problem of the company is lower market price of petrochemical products, which leads to forced shutdown of petrochemicals units since last two years. In fact **the company incurred losses during the financial year 2000-01 and 2001-02.** However, during the financial year 2002-03 the company has made profit and also present financial trend indicates even better profit margin during the financial year 2003-04. At present, refinery is not in the crisis. It was very close in the last years. This is a kind of warning of taking care for improvements. **However, in such an uncertain changing market scenario, maintaining profitability on sustainable basis is a big question.** Closure of the company cannot be a solution because the company has already invested a huge amount in infrastructure development. Moreover, as a Public Enterprise to the government of India, BRPL has socio-economical obligation to the region. The company can only take short-term or long-term improvement measures inside the company to meet the above challenges. Implementation of long-term decisions often involves high capital investment, which may not be possible at this juncture. The option available at

this juncture is to continue petroleum-refining business by taking internal improvement measures by best utilizing existing strength of the company and removing weaknesses to the extent possible. Opportunities and threats to the company are also to be analyzed carefully and seriously considered in decision-making process in order to improve profitability. The purpose of this thesis is to systematically analyze different critical areas with a goal to find out main areas of improvements in the refinery sectors and to help in making better decisions within selected areas, which will lead to improvement of profitability of BRPL. For this reason it is necessary to study and establish a rational and systematic approach to reach the profit improvement. Only in such a case improvement will be achieved constantly and not by random.

Method, which is proposed to adopt for analyzing the business, establishing the problems developing measures and achieving goal of profit improvement are as below:

- Analysis of profitability, business and organization
- Detailed analysis of critical areas
- Analysis of environment
- SWOT analysis
- Development and evaluation of possible solutions to problems within critical areas from managerial point of view.

Following different literature on improvement programmes, decision-making, management and neighbouring areas propose a process of profit improvement programme, which latter follow in the practical part of the thesis. This approach will be based also on the collection of literatures on strategic management concepts, business analysis, improvement performance, crisis management, cost concepts, technology management, competitive advantage, productivity, profitability and also collection field information etc.

The thesis has been divided into eight chapters. This **introductory chapter**, which is the current chapter, deals with the description of the problem, the purpose of the thesis, goal, methodology and the schemes of the main chapters.

The **second chapter** deals with **presentation of BRPL**. It consists of how the company has developed, what are the investment and its uniqueness. It also contains brief description on various processing units, their processes, capacities, utility functions, different products (sector-wise) along with their end uses and also highlight of BRPL's past achievement. Vision and mission are contained in this chapter, too.

The **third chapter** deals with the **profit improvement programme and process**. It includes theoretical approach in decision-making process and involvement of planning and controlling in the process. To understand the subject, purpose and method of analysis a brief on cognitive method is given and subsequently analysis of business functions and profitability is made. Definition of organisation, analysis of its structure and culture are discussed to understand

their influences in an organisation. The chapter deals with environment (PEST and industry analysis). It is the analysis of external factors that are influencing the business environment and helps in determining opportunities and threats to the company. To understand the same, Porter's five competitive forces model has been discussed. Discussion on SWOT analysis has been made to understand the strength, weaknesses, opportunities and threats to the company and how it can be used in decision-making. Finally, discussion on setting goals, propose measures and implementation of profit improvement programme has been made.

The **fourth chapter** deals with **business and organisational analysis of BRPL** in line with the theoretical approach made in chapter-3. Business function analysis includes analysis of purchase, production, sales, financing and personals. Analysis of profitability, profit and assets analysis are made in order to have an idea about the position of the company. In the analysis of organisation, organisational structure, culture and processes have been discussed.

The **fifth chapter** deals with oil **industry scenario in the world, in India**. It includes discussion on oil and gas reserves in the world, energy consumption pattern in different regions and future potential based on the facts and figures. Scenario of oil industry in India includes trend of production, demand, supply, export and import of crude and petroleum products as well as future projection.

The **sixth chapter** deals with SWOT analysis of BRPL. In this chapter, a brief on SWOT analysis and development of SWOT matrix of BRPL is discussed and finally conclusion has been drawn based on the analysis.

The **Seventh chapter** deals with various **profits improvement measures in BRPL**. Discussion has been made on various critical areas and issues based on practical approach to find out solution for improvement of profitability in BRPL. It includes maximisation of capacity utilisation, energy optimisation, process optimisation, product mix optimisation, and improvement in maintenance function, system automation and improvement in human resources management practices. Finally a model organisation of profit improvement programme has been drawn.

The **eighth chapter** is the concluding chapter, which summarize the major findings in each of the previous chapters in a consolidated manner.

CHAPTER 2

PRESENTATION OF BRPL

2.1 DEVELOPMENT OF THE COMPANY

Bongaigaon Refinery & Petrochemicals Limited (BRPL) was incorporated as Government of India Undertaking under the administrative control of the Ministry of Petroleum and Natural Gas on 20th February 1974 with its corporate office at Dhaligaon, Assam. The company became a subsidiary of Indian Oil on 29th of March 2001 after disinvestments of share by Govt of India.

With an investment of about Rs.8,000 million in the Refineries and Petrochemicals plants, BRPL has the unique distinction of being the first indigenous grass root Refinery in the country integrated with a Petrochemical complex at one location. The primary unit of the Refinery, Crude Distillation Unit (CDU-I), with an annual capacity to process 1.0 million tons of crude per annum (21,900 BPSD) was commissioned in February 1979. In 1981, Kerosene Treating Unit (KTU), the Delayed Coking Unit (DCU-I) and the Coke Calcinations Unit (CCU) were commissioned. In 1986, the capacity of the Crude Distillation Unit (CDU-I) was enhanced to 1.35 MMTPA (29,600 BPSD) through de-bottlenecking. Capacity of the Refinery was further augmented in 1995 to 2.35 MMTPA (51,400 BPSD) through expansion of the Refinery comprising of one Crude Distillation Unit (CDU-II) and one Delayed Coking Unit (DCU-II). Petrochemical sector comprising of Xylenes and Dimethyl Terephthalate (DMT) plants was commissioned in 1985. Polyester Staple Fibre (PSF) plant was commissioned in 1988. A LPG bottling plant of capacity 22000 MTPA was added to the complex and commissioned on March 2003.

At present, the refinery is processing crude oil from the oil fields of ONGC and OIL located in the North-East India and Ravva crude oil from the Krishna-Godavari basin off the coast of Andhra Pradesh. The Northeast crude is received through a 750-km pipeline of Oil India Limited (OIL) originating at Duliajan. Ravva crude oil is shipped to Haldia port where from it is pumped to Barauni through Haldia-Barauni Crude Pipeline (HBCPL) of IOCL. From Barauni, it is pumped to Bongaigaon through OIL's crude pipeline.

The company is holding ISO-9002 and ISO-14001 certificates for its excellence in maintaining products and environment quality. The Company in the past achieved "Excellent" rating for several years from Government of India under the Memorandum of Understanding (MOU) system of performance evaluation. The company is proud winner of many national and regional awards.

2.2 PRODUCTS OF BRPL

BRPL products are basically divided into three parts. These are:

- Refinery products

- Petrochemical Products
- PSF Products

Refinery products of BRPL and their major end uses are shown in table 2.1 below:

Table 2.1: Refinery products of BRPL and their major uses

Sl.No.	Product	Major End Use
1.	Liquefied Petroleum Gas (LPG)	Domestic Fuel
2.	Unleaded Motor Spirit (MS)	Automobile Fuel
3.	Straight Run Naphtha (SRN)	Fertilizer/Petrochemical feed
4.	Mixed Run Naphtha (MRN)	Industrial Fuel
5.	Reformer Feed Naphtha (RFN)	Petrochemical Feed
6.	Superior Kerosene Oil (SKO)	Domestic Fuel
7.	Aviation Turbine Fuel (ATF)	Aviation Fuel
8.	High Speed Diesel (HSD)	Automobile Fuel
9.	Light Diesel Oil (LDO)	Agriculture / Industrial Fuel
10.	Low Sulphur Heavy Stock (LSHS)	Industrial Fuel
11.	Raw Petroleum Coke (RPC)	Manufacture of Calcined Petroleum Coke
12.	Calcined Petroleum Coke (CPC)	Manufacture of carbon electrodes for Aluminium Industry, Graphite electrodes in Electric-Arc Furnaces, as a Carbon addition in Steel manufacturing, etc.

Sources: http://www.brplindia.com

Refinery products such as LPG, MS, ATF, SKO, HSD, LDO and LSHS are used as fuel for domestic cooking, illumination, automobiles, aeroplane, agriculture and industrial sectors. Naphtha products are used in petrochemicals and fertilizer industries. CPC is produced from RPC it is used in aluminium industry. Refinery products are marketed through IOC.

Petrochemicals products are used in the paints, pesticides, thinner, varnish and PSF products etc. Petrochemicals products of BRPL and their major end uses are shown in table 2.2 below:

Table 2.2 Petrochemical products of BRPL and their major uses

S.No.	Product	Major End Use
1.	Ortho-xylene	Manufacturing of Phthalic Anhydride, Paints, Ink etc.
2.	Mixed-xylene	Manufacturing of Paints, Pesticides etc.
3.	Ceenine	Manufacturing of Paints, Pesticides etc.
4.	DMT	Manufacturing of Polyester Fibre/Polyester Filament Yarn/ Polyester Film/Polyester Chips, Resin
5.	Petrosol	Manufacturing of Thinner, Varnish, Paints, Pesticides etc.
6.	Bonmex	Manufacturing of Pesticides etc.

Sources: http://www.brplindia.com

BRPL marketed the above products through its own marketing network through out the country.

PSF products of BRPL and their end uses are shown in table 2.3 below:

Table 2.3 PSF products of BRPL and their major uses

S.No.	**Product**	**Major End Use**
1.	Annealed & Non-Annealed Fiber	Polyester Blended Yarn, Sewing Thread, Sarees, Shirting, Suiting & Dress Material, Hosiery yarn & knitted Fabric.
2.	Trilobal Fibre	Fancy Dress Materials
3.	Tow & Tops	Worsted Fabric, Suiting & Winter Dress Material
4.	Fibre Fill	Filling Material & Upholstery

Sources: http://www.brplindia.com

PSF products are used for production of dress materials. These products are marketed through own marketing network under the trade name Bonpoly.

2.3 UNITS OF BRPL

Production units of BRPL are divided into three sectors. These are **Refinery sector, Petrochemicals sector** and **Polyester Staple Fibre (PSF) Plant**. In addition to above, the company has developed all necessary **Utility units** in order to cater the need for business operation.

2.3.1 Refinery sector

BRPL is the first refinery installed in India based on indigenous technology. Refinery units consist of Crude Distillation Unit (CDU), Delayed Coker Unit (DCU), Kerosene Treating Unit (KTU), Coke Calcination Unit and LPG Bottling Plant. **Crude Distillation Units (CDU)** are the mother units of refinery. There are two Crude Distillation Units (CDU-I&II) with a total crude processing capacity of 2.35 MMTPA in BRPL. In these units crude oil is distilled in atmospheric distillation column. The finish products of CDU are LPG, Straight Run Naphtha, Reformer Feed Naphtha, Raw Kerosene, Diesel Oil and Reduced Crude Oil. Kero-I and Kero-II, the intermediate products of CDU are feed to **Kerosene Treating Units (KTU)** and obtain Superior Kerosene Oil (SKO) and Aviation Turbine Fuel (ATF) as finish products. Processing capacity of KTU is 2,37,500 MTPA of raw Kerosene (Kero-I & II). Reduced Crude Oil (RCO) the heaviest intermediate products from CDU further processed in **Delayed Coker Units (DCU).** There are two DCU units in BRPL, each having capacity to convert 5,00,000 MTPA of Reduced Crude Oil from CDU into Fuel Gas, LPG, Coker Naphtha, Coker Kero, LGO/HGO, Coker Fuel Oil (CFO) and Raw Petroleum Coke (RPC). LPG and RPC are marketed as finish products, however other products of DCU are blended with the products from CDU and KTU to produce Naphtha, MS, HSD and LDO. Part of RPC product is further processed in C**oke Calcination Unit (CCU).** CCU is designed to convert 75,000 MTPA of Raw Petroleum Coke available from DCU into 52,500 MTPA Calcined Petroleum Coke (CPC). In this unit volatile materials contained in RPC is removed by passing through the rotary kiln to produced CPC. LPG produced in CDU and DCU units are bottled in the **LPG Bottling Plant**. The bottling capacity of this unit is 22,000 MTPA.

2.3.2 Petrochemicals sector

Petrochemicals units of BRPL are running based on refinery-generated feedstock as downstream industries. It consists of Xylene Plant, Dimethyl Terephthalate (DMT) Plant Polyester Staple Fibre (PSF) Plant. **Xylene Plant**t was Built by integrating indigenous and foreign technologies supplied by UOP (USA), IFP (France) & Englehard (UK), the plant can produce 29,000 MTPA of Para-Xylene, 6,000 MTPA of Ortho-Xylene and 10,000 MTPA of Ceenine. It can also produce 40,000 MTPA of mixed Xylene in non Para-Xylene mode of operation. Para-Xylene is used as feedstock for DMT/PTA plant and Mixed Xylene, Ortho-Xylene and Ceenine are used in the manufacture of paints, Pesticides, Insecticides etc.

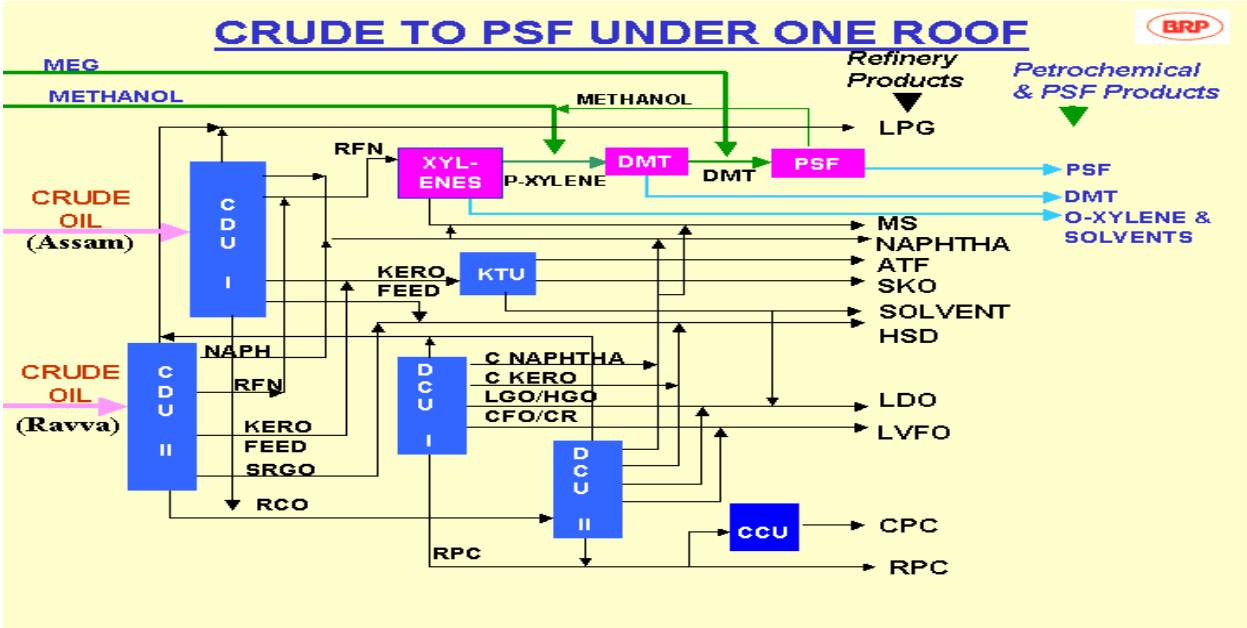
The Reformer unit of this plant was de-bottlenecked in August 1995 increasing the naphtha utilisation capacity from 80,000 MTPA to 1,07,000 MTPA. **Dimethyl Terephthalate Plant (DMT)** has the capacity to produce 45,000 MTPA of DMT. The two basic raw materials used in the plant are Para-Xylene and Methanol. Para-Xylene is available from the Xylene plant. Methanol is partly purchased and partly available from own PSF plant. The plant is based on the technology of M/s. Dynamit Nobel, Germany (presently HULS AG) and engineering was provided by Krupp-Koppers,Germany.

2.3.3 Polyester Staple Fibre (PSF) Plant

Polyester Staple Fibre (PSF) Plant is designed to produce 34,200 MTPA PSF based on technology supplied by DuPont, USA and engineering by Chemtex, USA. DMT available from DMT Plant and MEG procured from other sources are the two basic raw materials. BRPL's PSF is sold in the market in the trade name BONPOLY. The plant has four draw lines. Initially two Draw lines were designed for production of Annealed fibre and the other two for Relaxed fibre. The annealed fibre production capacity has now been increased after converting one of the relaxed draw lines to annealed fibre line. Details of the PSF plant are as follows:

Integrated process flow chart of BRPL comprising of its refinery and petrochemicals sectors along with product streams are shown in the figure 2.1 below:

Figure 2.1: Process flow chart of BRPL



Sources: http://www.brplindia.com

2.3.4 Utilities of BRPL

Utilities are important areas, which support operation. To meet the power and steam requirement BRPL has set up **Captive Power Plant (CPP).** The plant consists of three steam Turbo Generators of 16 MW capacity each & five Oil and Gas duel fired boilers of 84-t/hr Capacity each to cater the needs of the Power and Steam of the Complex. In addition to above one DG set of 5 MW Capacity is also available for emergency power requirement and quick start up of unit in case of total power failure. To cater the need of water for drinking, equipments cooling, fire fighting etc. **tube walls, pump house** and **cooling towers** are installed. Similarly **air compressor** has been installed in order to cater the need of compressed air. Treatment of industrial effluent is a part of refinery activities from the

environmental point of view. BRPL has installed **Waste Water Treatment Plant (WWTP)** to treat the oily waste and chemically contaminated waste coming different units of refinery, petrochemicals, PSF and OM&S and also the sanitary waste coming from township. This plant has the facility to recover the oil and to treat the contaminated water up to the environmentally acceptable limit. Treated water in WWTP is further retreated in **Tertiary Treatment Plant (TTP)** and recycled back to the plant as cooling water make up. The philosophy behind recycling of water is to maintain zero discharge of water to the environment in order to make the plant environmental friendly and to minimize use of raw water. In order to cater the need for storage, delivery of crude and products by road, rail and pipeline and operational requirements such as feeding in units, tank to tank product transfer etc., BRPL developed adequate infrastructure facilities such as crude and products storage tanks and product loading gantry/ bays etc.

2.4 VISION AND MISSION OF THE COMPANY

Mission and vision are two important statements showing the purpose, major goals and interactions of the company. Mission explains the reason of the existence of an organisation and its relationship toward customers and other stakeholders **(Schermerhorn, 1999, pp.159-161).** Vision describes where the company is going in the most general, conceptual terms and it also provides emotional direction **(Higgins, 1993, p.64).**

In case of BRPL vision sees the company to emerge as a vibrant, integrated and diversified petroleum company of national prominence with strong environmental conscience.

In order to fulfil the vision, the company has the following mission:

- To achieve excellence in refining and petrochemical businesses
- To adopt and assimilate state-of-the-art technology
- To diversify and expand operations in upstream/downstream activities
- To endeavour excellence in professionalism and continuous up gradation of knowledge and skill
- To contribute towards region's and nation's socio-economic development and generate goodwill of the people around
- To foster spiritual attachment for ensuring ecology protection
- To maximize value for shareholders
- To imbibe ethics in work and businesses
- To promote trust, teamwork and openness among all employees and value their ideas

CHAPTER 3

PROFIT IMPROVEMENT PROGRAMME AND PROCESS

3.1 DECISION MAKING PROCESS

Success of an enterprise depends on how correctly decisions are taken in right time and in a right way. Although, enterprises are aware about the importance of decision making process, even though often they are experienced with poor or wrong decisions time to times. **Implementation of a programmme based on wrong decisions may often decrease the potential results of the subject rather than increase the improvement of the achievement of the subject's goal**. Improper decisions do not resolve problems but cause new problems. Consequences of wrong decisions are poor results of the enterprises.

Before talking about decisions making process, one should know the reasons as to why decision fails. The failures are basically due to the very nature of decisions: risks and uncertainty involved. Decisions made today will have influence on the future. They will be implemented in a more or less unknown future. Within the decision making process failure appears in two basic steps: in problem identification phase and in the phase of determining the problem solution.

One of the most important steps in making a decision is to correctly identify the problem of the subject on which the decision will be made. If the problem is not identified the decision will not improve but deteriorate the subject. "The most frequent cause of failure – that is most under our control is insufficient cognition of the subject (and its environment) of our decision. The problem identification of the subject is often not satisfactory. Although it is quite obvious that decisions on a subject will be better if we know the subject well, the cognition of the subject is rarely discussed in details and the problems are taken as given. We even see the whole decision making process as a mere choice among alternatives " **(Rozman, 2000, p. 51).** Cognition of the subject on what decision is made or the identification of the proper problem is very important.

The knowledge on the subject can be obtained in two basic ways: by intuition and/ or by analysis. In intuition decisions making, experience and judgment rather than sequential or explicit reasoning are used. It is based on practice and experience often stored in subconscious. Learning on the basis of intuition is slow. Development of experience is trial and error approach. This might be good approach in a simple and unchanging environment. But in today's complex and changing world it is not correct to rely on intuition only. For making a good decision, one has to build knowledge on the subjects through scientific approach and systematic research with a conscious cognition of the subject. Cognitive process is conducted in a logical and systematic way. It is known as process or method of analysis.

Decision making process can be defined as a process consisting of the following steps:

- Finding reason to make a decision

- Search for alternative solutions
- Selecting the best possible alternative.

Finding reason means to find a problem that requires to be solved. However, it can also mean to take a decision to prevent a problem. Decisions are always made on the subject, with some purpose. There are always alternative solutions to the problem. If applied they yield different results so only one solution can be applied to get appropriate result. The rational choice cannot be made at random. It should follow some criterion: to achieve the goal of the subject on which the decision is made.

Planning and controlling business or organization is decisions making process. Decision are made today with an influence on the future. **The purpose of planning decisions is to prevent future problems, to plan execution in such a way that business will run as smoothly as possible and the purpose of controlling is to resolve the existing problem.** "Within the enterprises there are three basic groups of decisions differentiated by subject and criteria (and by decision maker). They are decisions on product and process, decision on business functions, and overall business decisions **(Rozman, Course material, 2003). Planning** is concerned with developing the course of action in order to improve effectiveness and productivity and bring profits. Planning can be strategic, tactical and operational. Strategy is the business orientation that promises if it would be implemented to achieve objectives of a business or organisation (**Pučko, Course material, 2003**). **Strategic planning** is a process of developing and analysing the organisation's mission and vision, overall goals and general strategies and allocating resources. The over all-purpose of strategic planning is to deal effectively with environmental opportunities and threats as they relate to the organisation's strengths and weakness. Strategic planning includes **contingency planning** in order to deal with unexpected and rapid changes (positive and negative) in the environment that will have a large impact on the organisation and that will require a quick response. **Tactical planning** is the process of making detailed decisions about what to do, who will do it, and how to do it. Tactical planning is made for normal time horizon of one year or less. It is made for shorter time frame with detail planning. Tactical planning is useful for departmental managers to anticipate or cope with the actions of competitors, to coordinate with other departments, customers and suppliers and to implement strategic plan. It generally includes the following tasks:

- Choosing specific goals and the means of implementing the organisation's strategic plan
- Deciding on courses of action for improving current operations
- Developing budgets for each department, division and project

The purpose of this thesis is to make decision following basic criterion of improvement of the profitability. To bring the improvement in the profitability of the company, decision-making must involve analysis of business in order to avoid wrong decision. **Operational planning** guides the departments in setting priorities and accomplishing what needs to be done to fulfil our mission. It assists management in implementing, monitoring, and budgeting program

activities. In this way, operational planning ensures that programmed activities are best positioned to achieve strategic results. In profit improvement programme mostly tactical and operational planning are more predominantly applicable. Planning must be accompanied by suitable **controls** to ensure implementation of the plans and evaluation of their results. If the plan has not produced the desired results, there may be a need for changing execution or mission, goals or strategies or the plans.

3.2 ANALYSIS AS COGNITIVE METHOD

The method leading to the cognition of the subject is the analysis. The analysis in general is a process of cognition of a concrete subject, to enable to make proper decisions on the subject to achieve subject's goal. **Business analysis is a cognitive process of learning about business to ensure proper decisions that will increase the achievement of the goal of the business**. It can be defined as the process of cognition and as the basis of decision making to improve the business effectiveness from the user's standpoint **(Rozman, Course material, 2003)**. Analysis of the subject must follow some criteria. It breaks the subjects into connected parts. In case of business the subject can be split into business functions or business process. The analysis consists of three basic elements: subject, purpose, and method.

3.2.1 Subject, purpose and method of the analysis

3.2.1.1 Subject of the analysis

The subject of decisions making is the company i.e. business and its organization. Business means business processes of purchasing, personnel, production, sales and finance and their relationship. Organization means relationships and processes among people that ensure a rational achievement of a business goal. Linked to the cognition of the company is the cognition of the environment. To make better decisions, analysis on environment is essential, because while doing business, forecast on environment gives direction, too.

3.2.1.2 Purpose of the analysis

Determination of the purpose of the analysis is an important part of analysis. Purpose answers the question why would we like to be cognizant of the subject? Why is the analysis made? The answer is to make better decisions on the subject in order to increase the achievement of the goal of the analysed subject. A direct purpose of the analysis is to make a decision to turn the subject of analysis to the benefit of the organization either by resolving some problem or by utilizing some advantage and the purpose of the decision is to improve the effectiveness or efficiency of the subject. The connection between the subject and the goal is the decision. **The purpose of the business analysis is the profitability of organisation analysis is the efficiency and the environment analysis is to adapt or to change the company's actions. The economic purpose of the analysis, therefore, is to increase the effectiveness or the profitability.** Cognition depends on the purpose of the analysis. Cognition is different for long term and short term analysis. In long-term analysis are done from the perspective of

broad and important issues. It is basically applied in the long term strategic planning of an organization. However, in short term, like preparing annual budget or a yearly plan etc. more detailed analysis is required and long term impacts on the subject is not given due consideration. However in both the cases the goal of enterprise is defined as improvement of profitability. The economic purpose of the analysis is the same but the organizational purpose is different: firstly as long-term decisions on doing the right things and secondly as short-term decisions on ongoing things right. Programme on profitability improvement deals more with the short-term issues.

Depending on the purpose, analysis of the subject is to be made only on those parts that influence the goal of the subject. The purpose of the analysis is defined independently of the process of the analysis whereas the goal of the analysis is determined inside the analysis. If the purpose is not defined it is not possible to split the subject into parts and one may not be able to find out which part to be observed. Than the analysis becomes just for the sake of analysis without any purpose and goal. **Lenz and Lyles (1985, pp. 64-72)** and other **authors describe this as paralysis through analysis**. This problem is usually ascribed to an indecisiveness of the decision makers or to the nature of decisions themselves. It is an organizational problem arising as a result of not defining purpose.

Quite often the distinction between the purpose and goal of the analysis is not clear. Whereas the purpose of the analysis as the goal of the subject is determined outside the analysis, the goal of the analysis exists within the analysis. It is the cognition itself, the result of the cognition process. The goal of the analysis also depends on the purpose. Again, if the two issues are not distinguished the cognition is conducted for the sake of cognition and not to improve the subject.

3.2.1.3 Method of analysis

Cognitive process can be divided into observing facts through symptoms, determining reasons for symptoms by setting hypotheses, and verifying hypothesis. Such a process leading to cognition is called a method. One of the forms of cognitive processes is the method of analysis. Method of analysis and the goal can be discussed together. The goal is the last step in the process or the result of the method. It is the cognition of the subject. It answers the question of what is going to do to fulfil the purpose of analysis whereas the methods tell about how to do. Method can be regarded as an orderly way of thinking. Identification of variables and their impacts on the subject and its goal can be done through proper method only. This helps in influencing the variables and in decisions making. The analysis is reasonable only if there is a choice among alternatives solutions. Two basic part of the method of analysis are observation and diagnosis. Initial part of the analysis as a cognition process is **observation** of the subject, not as a whole but only the parts or those variables that influence the goal of the subject. To observe the proper factors in order to fulfil the purpose and to achieve the goal, analyst has to have theoretical knowledge. **Analyst must know and understand the relation between the influential factors or variables and the goal of the subject, otherwise some important variables are left out and some not important cause confusion.** Business facts

are observed through data, which are written or orally expressed facts. Facts and data apply to those factors that influence the achievement of the goal of the business. Analyst has to know how to determine the needed data and verify their availability and some other characteristic of them. In case of non-availability of some needed data, analyst has to assume similar data or decide to gather the data especially for the sake of analysis. Quite often some data need to be considered based on some assumptions. However this involves risk. So analyst must verify the accuracy of data, the reliability of the sources etc.

Once data are collected, it has to be compared with some basis to find out various information about the past, present and likely future trend. The choice of the comparison basis is not deliberate but dependent on the purpose of the analysis. For control purposes, comparison is made on actual data with planned or some standard data. In the planning process, comparison is made with the past data, however in strategic planning process comparison of achievement is made with the competitors or just with those of good companies. This is known as benchmarking. **If no comparable basis is available it should be assumed that everything could be improved and set a reasonable higher limit**. Comparison of data usually shows some difference or deviation. Deviation differs in their size and direction. Size of deviation is expressed in absolute or relative terms. Direction of deviation depends on its influence on the goal or the purpose of subject. A positive deviation increases the goal of the subject whereas a negative deviation results in a decrease of the goal of the subject. Unless reasons for deviation are known, it is not possible to find out the solution.

Process of analysis cannot be completed unless diagnosis on the deviation is made. **Diagnosis** of deviations is the process of finding the cause of deviation. Each deviation, theoretically, can be explained by variety of reasons e.g. higher costs can be due to different variables like higher purchasing prices, lower quality of materials, lower productivity, lower quantity of products, small series of production etc. To find a proper answer to reasons of deviation, the analyst has to review all the potential influential factors. These are based on theoretical approach. Therefore analyst should have good theoretical knowledge to find out the possible reasons and to determine the right problems and advantages. If problem is incorrectly identified or defined, any decisions made are directed towards solving the wrong problem. Most often analyst found one or more factors contributing to deviation. In such a case weight of the influences of each factors should be established.

It is possible sometimes that no reason for deviation is observed. There may be two possibilities either all the potential factors are not verified or there exist some additional, not known factors. In the latter case, analyst has to conduct research work. Problem arises in case of research because the behaviour of the subject cannot be explained by known reasons and new reason has to be found. Therefore it is time consuming. Moreover, it needs in-dept knowledge on the subject. It is difficult to find the reasons deviations. There are many methods or techniques to make decisions but there is no special technique to identify the problem. The only reasonable way to find out the problem is to follow the described logical method of analysis.

Each person making decision has to follow some logical process. However, in most cases the situation regarding analysis is simple and no special knowledge of the method of analysis and its use is required. But in complex cases, especially in the analysis of entire business, analysis requires more time and more analytical knowledge or logical reasoning. Some connections between variables and goals are very complex. Very often the observation is made but the right diagnosis is not put. Those how cause deviation tend to hide reasons. It is important to emphasize that the diagnosis is not made to punish the source but to improve the business and business results.

3.2.2 Business analysis

Business analysis covers a number of different approaches to analyse the business of the organisation. It consists of the analysis of business functions and of the enterprise goal i.e. profitability.

3.2.2.1 Analysis of business functions

Within the business functions we usually look at their size, structure, dynamics and relationships to find out whether it corresponds to other functions and how it impacts profitability.

Purchasing is the act and the function of responsibility for acquisition of equipments, materials, supplies, and services. In a narrow sense, the term describes the process of buying. In a broader sense, the term describes determining the need, selecting the supplier, arriving at a fair and reasonable price and terms, preparing the contract or purchase order, and following up to ensure timely delivery.

Impact of purchasing in the overall business operation as well as in the profitability of the company is significant. For example, it is not possible to get a quality output without a quality input. If input materials have not timely arrived, the whole business process suffers. Similarly, if the cost of input materials is high, obviously the cost of production becomes higher. All these factors are affecting the profitability of the company. Management must therefore monitor the delivery, performance, quality, quantity and price of inputs from Suppliers. Purchasing control seeks to ensure availability, acceptable quality, continued reliable resources and at the same time, reduced cost.

For managing purchasing and inventories, **Economic Order Quantity (EOQ) model** is very effective. The EOQ model seeks to balance four costs (purchase costs, ordering costs, carrying costs, Stock out costs) involved in ordering and carrying inventory. The objective of EOQ is to minimise the total cost of two of these four costs i.e. ordering costs and carrying costs. As the amount of order gets larger and larger, average inventory increases, and so do carrying costs. But placing larger order means fewer orders and thus lowers ordering costs. Therefore it is important to calculate the optimal order quantity to achieve EOQ. Another way of managing purchasing and inventories is to establish supply chain with the qualified

suppliers. Outsourcing of supply is also a possible way of purchasing and inventories managing technique that can help to bring down inventory to zero level.

Production analysis provides decision-makers with a detailed understanding of production capacity, production line operations, work order flow, yield, product quality, and costs. It involves analysis of technology, optimisation of process and product mix etc. Analysis of technology helps in understanding its limitation and the scope of modernisation. Optimisation of processes helps in finding the best possible ways for improvement of quality and yield of products whereas optimisation of products helps in innovation of new products and finding possible improvement measures in producing high value products at the cost of inferior products by way product mix optimisation.

Monitoring, analysing, and reporting on issues related to scheduling, routing, forecasting, and thereby reduced cycle times, become more efficient and innovative production processes. The end result is lowering production costs for increased competitiveness and improves product delivery system for better customer relations. Production analysis enables us to:

- Improve yield and yield variance by plant and shift
- Guide and monitor quality improvement programs within and across plants
- Identify trends in product quality
- Decrease material costs
- Increase capacity utilisation etc.

Product **sales analysis** typically involves large volumes of transactional data and sophisticated analytical techniques. It involves continuous analysis of product inventory in order to help the organization in matching supply to demand and thereby saving money by reducing idle inventory and also by preventing lost sales. Monitoring of important inventory indicators like consumption, turnover, returns and material movements in order to minimize inventory while still ensuring adequate product supply exists to satisfy demand. Inventory of finished products analysis consists of reporting current inventory status, analyzing inventory levels by location, and notifying of shortages via alerts. Business intelligence can also quantify the monetary impact of inventory shortfalls on sales, predict future inventory needs and automate the reorder process based on demand forecasts.

Product sales analysis involve analysis of quantity sold, product structure, value, product market structure, customers, region-wise supply and demand of products, competitors and market dynamics. Most common user of sales analysis are retailers, to enable to continuous monitoring of point-of-sale data to uncover sales trends, investigate product demand and optimise merchandising strategies. Various levels of analysis, from summary reporting to statistical trending, are required by executives, store managers, product managers, marketing analysts, as well as external suppliers who provide materials or finished goods. Business intelligence makes sense of the growing volume of transactional data by identifying trends and opportunities that create competitive advantage for companies that know and understand their sales drivers.

Financial analysis is conducted to assess the financial position of the company. To understand the financial position of a company it is necessary to analyse liquidity ratios, leverage ratios, efficiency ratios at least for a minimum period of three years. Liquidity ratios provide measures of a firm's capacity to meet its short-term financial obligations whereas leverage ratios provide an indication of firm's financial risks that is relative proportion of its debt to its equity. Efficiency ratios reflect whether or not a firm is using its resources efficiently.

Analysis of human resources of an organisation is important as they strongly influence the results. Effective and well-motivated employees overcome the deficiencies of poor structure and processes, while the best structure and processes will not work without employees' full co-operation. Analysis of human resources involves analysis of number of employees and their structures. The basic aim of human resources analysis is to designing works to maximise employees' innovation, creativity, product quality and customer services, determining employees' productivity and quality of works and measuring employees attitudes about the work and work environment. **Two broad approaches to analysis of personnel are psychometric tests and assessment centres.** Psychometric tests are conducted aiming to assess ability and capacities. While assessment centres are based on observation of the performance. Right sizing is a methodology designed to determine the appropriate levels of resources for particular levels of services. This help the organisation to change the level of the resources allocated to a particular activity to meet the requirements of markets, competition, or economic and other constraints. Peoples' attitude survey can also be done in order to measure employees' perceptions of organisational climate and leadership style. This helps in determining whether or not the messages about the organisation's overall mission and objectives have been understood and acted on. These may be strong indicators of any actual or potential organisational problems.

3.2.2.2 Analysis of profitability

Profitability is a measure of return on certain critical resources employed in business. It is generally calculated as a return on capital or assets employed in business after making adjustment for current costs of assets valued historically. Profitability is often regarded as an overall measure of effectiveness as also the efficiency with which the productive assets and resources are being maintained and utilized. **Profit is needed for sheer survival development of the company, apart from serving several other purposes viz. reward for risk taking, resource for expansion and rallying point for enterprise effort and so on.** Every company sooner or later face with the necessity to mount a cost or profit improvement effort to accomplish results, which have not been possible in the normal routine budgeting **(Jones, Trentin, 1971 p. 240)**. Authors suggest preparing and conducting different profit improvement programme. They also suggest most reasonable processes to prepare such programme. Authors suggest to follow the process of analysis **(Rozman, 2000, p. 51**) to find out signs or symptoms of crises and than to find out their causes. Authors in crisis management emphasize that finding out the real problems is very difficult and often fails. **Slatter (1987, p. 25)** and other authors discuss most frequent problems for not achieving

profitability. Some of the authors **(e.g. Plott, 1998, p. 6)** are emphasizing that in most cases problems derive from the company not by environment. Following diagnosis, authors suggest different measures for improvements; strategic, tactical and operational.

Profitability of a company can be determined by ratio analysis. **Du-Pont analysis determines** the Rate of Return (ROR) of a company, which is the product of net profit margin and investment. Mathematically, it denotes as below:

$$\frac{EAT}{Sales} \times \frac{Sales}{Average\ total\ Assets} = \frac{EAT}{Average\ total\ Assets}$$

Note: EAT = Earnings After Tax

Other analysis for determining profitability is Return on Assets (ROA), and Return on Equity (ROE). Mathematically these can be denoted as below:

- Return on Assets (ROA) = {EAT + Interest}/ Average total Assets
- Return on Equity (ROE) = EAT/Average total shareholders' equity

Profit analysis helps in understanding the net earning per unit sales. It can be determined by Net Profit Ratio analysis. Higher the ratio indicates more profit is the business operation. Mathematically, it denotes as below:

- Net Profit Ratio = Earnings After Tax (EAT)/ Net Sales

Assets analysis is made to measure the efficiency of the firm from the perspective of utilisation of its assets. It is related to assets and sales.

3.2.3 Analysis of organization

3.2.3.1 Definition of organisation

Organisation can be understood in two different ways: as social units or institutions and as structure of relationship. The organization in the latter sense consists of organization processes like governing, managing, planning, communicating etc. and of its structure.

Organisations (understood in the former sense) are social units consisting of people. They are social units with a purpose or goal. Goal of enterprises could be making profit (as in the case of an enterprise), getting pay increase for its members (as in the case of a trade union) or meeting spiritual needs (as in the case of a religious organisation). An organisation is the arrangement and use of resources (human, materials and financial) for the accomplishment of

goals. “An organisation is a social entity that is goal directed and deliberately structured” defines the organisation **Draft (1995, p.13).**

According to the other author, organization is a structure of relationships among members of a social unit that ensure the existence and characteristics of thus formed unit and a rational achievement of social unit’s goal **(Rozman, Course material, 2003).** This is the definition of organisation in the sense of relationships, which are well described and analyse.

If an organisation is ineffectively or inappropriately set up in either its arrangements or structure or in its uses or purposes, it will not be effective in achieving its goals. Managers must therefore be concerned about how the organisation is designed or structured and how well it operates or functions **(Dyer, 1990, pp. 314-315).**

The analysis of organisation consists of analysis of structures, culture and processes

3.2.3.2 Analysis of organisational structure

An organisation’s structure is the framework, which explains how its resources are allocated and managed, and the lines of communication and decision-making. The main purpose of the structure is to ensure that the organisation is designed in the best way to achieve its goals and objectives. However, an organisation’s structure exists to achieve a number of purposes as stated below:

- Support the organisation’s strategy. The structure should be designed in such a way as to ensure the attainment of the organisation’s goals and objectives. Strategy is one of the main determinants of structure
- Organise resources in the most efficient and effective way
- Provide for the effective division of tasks and accountabilities among individuals and groups. Division in this way allows for specialisation within specific disciplines and activities, which becomes more essential as organisations grow in size and complexity
- Ensure effective co-ordination of the organisation’s activities and clarify the decision making processes
- Enhance and clarify the lines of communication up, down and across the organisation
- Allow for the effective monitoring and review of the organisation’s activities
- Provide mechanisms for coping with change in markets
- Facilitate the handling of crises and problems
- Help to motivate, manage and give job satisfaction to individual members of the organisation
- Provide for management succession

Factors that are influenced in structuring an organisation are their history, products and services, customers and markets, processes, people, size, technology and geographical dispersion of an organisation

The organisation's present structure may have evolved over a number of years, as functions have been added, changed or deleted. **Older the organisation, the more important history is likely to be.** It is also more likely to have determined the current structure if there have been relatively few pressures on the organisation to adapt to changing circumstances, either because it has monopolistic power or because the industry in which it operates is relatively slow moving.

The kind of **products or services** provided by the organisation also affects its structure. Manufacturing company may have geographically dispersed plants with production lines, storage and warehousing facilities and distribution networks. Structure of the organisation is to be designed in order to achieve its goals and objectives. Service organisations have different requirement and priorities and different functions. The line of communication between customer and service provider should be shorter than the manufacturer and customers.

The type of market and customers services affects the organisational structure. In a customer responsive environment it should be one of the main determinants of structure. If the organisation is providing services to a wide range of customers in a large number of locations, it may need to have numerous branches. Similarly, markets where products are to be sold may also have different requirement.

The **process** used within the organisation also affects the organisational structure. A production line process consists of a number of separate tasks carried out by people specialising in those tasks at different stages of process. The rationale behind this kind of approach is that specialisation means that people can develop high skills and speed, resulting in high output at low cost. However maintaining the motivation and morale of production line operator is important for its effectiveness.

People can affect an organisation in many ways. Firstly, structures do not appear without people, they are the result of people's views and beliefs and their approach to manage the organisation. The types of jobs and people within the organisation will also affect the structure. Structures with the large number of professionals are more likely to involve team working, and therefore to be relatively flat compared with an organisation that has to accommodate a range of jobs from the production line operator to Chairman.

Major influence on the structure of an organisation is its **size**. Larger the organisation, greater the need of coordination of various activities vis-a- vis formal systems of communication and control. In such organisations there are more likely to be a number of specialist departments with coordination frequently taking place through meeting between departmental heads. The degree of formality is likely to increase directly in line with size. In large organisations issues of centralisation and decentralisation become very important.

Technology can have impact on an organisation's structure in two ways. Firstly, the predominant technology with which the organisation is operating will affect the way work is

done and how the organisation is structured. Secondly, the event of the new technology will continue to change working patterns.

The **geographical dispersion** of an organisation, because of the need to be near raw materials or customers, will affect its structure. Where there is significant number of dispersion, there is likely to be more need for careful coordination and control than with a single site location.

The key elements or characteristics of organisational structures are:

- Division of labour and work specialisation
- Chain of command
- Formalisation
- Departmentalisation
- Span of Control
- Centralisation and Decentralisation

Division of labour and work specialisation refer to the process of dividing the total task of a unit into successively smaller jobs. People working together through a division of labour are able to produce more than they could if they were working alone. The key issue associated with division of labour concerns the extent to which jobs should be specialized. Specialisation is low when employees perform a variety of different tasks and high when each person performs only a single task. **(Cherrington, 1994, pp. 488-489).**

Chain of command refers to superior-subordinate authority chains those extents from the top of the organisation to the lowest echelon. As a link in the chain of command, the manager has the right to direct the work of subordinates and to make certain decisions without consulting others. In the chain of command, every manager is also subject to the direction of his superior **(Robbins, 1993, p. 493).**

Informality in organisations functions as a lubricant. But too much of it may create messiness and slipperiness. Some formalisation is needed to increase the effectiveness of its employees, in terms of better use of discretion by them **(Pareek, 1997, p. 422)**. **Formalisation** refers to the degree to which the jobs within the organisation are standardised. It results in a consistent and uniform output. There are explicit job descriptions, lots of organisational rules and clearly defined procedures covering work processes in organisations where there is high formalisation **(Robbins, 1993, p. 488).**

In an organisation, the unit tasks necessary to achieve the purpose of the organisation (like productive, services, co-ordination and supervisory activities), are grouped into individual jobs. The jobs are grouped into administrative units, which are again grouped to form departments. The groupings are made so as to minimise the total costs of carrying out the activities (**March, 1993, p. 40).** There are several approaches to structural design that reflect different uses of the chain of command in **departmentalisation**. These are functional, divisional, customers, geographical, matrix, teams, and networks.

Span of control refers to the number of people reporting to a manager. It is important, because it determines the number of levels and managers an organisation has. All things being equal, the wider the span, the more efficient the organisation. The more training and experience the subordinates have, the less direct supervision they need. So managers who have well-trained and experienced subordinates can function with a wider span **(Robbins, 1993, p. 502)**

Other situational variables that will determine the span of control include:

- Contact required between the manager and subordinate: Jobs requiring more contact need narrow span of control.
- Ability to communicate: When job related discussions are more important, a narrow span of control is appropriate. When instructions can be written and disseminated, a wider span of control is possible.
- Nature of task: Wide spans of control are possible when nature of task is repetitive and stable.

Generally managers are often encouraged to eliminate hierarchical levels, by increasing spans of control to improve organisational productivity **(Cherrington, 1994, p. 493).** When all the power of decision-making rests at a single point in the organisation, it is said that the structure is **centralised** and to the extent that the power is dispersed among many people, it is said that the structure is **decentralised**. Centralisation is the tightest means of coordinating decision making in the organisation. The most common error committed in organisational design is centralisation of decision-making. The top managers empowered to design the structure see error committed below and believe that they can do better; either because they believe themselves smarter or because they think they can more easily coordinate decisions. Unfortunately, in complex situations, this inevitably leads to a state known as "information overload". Reasons for decentralisation are that it allows the organisation to respond quickly to local conditions and is a stimulus for motivation. The dispersal of power down the chain of line authority is called vertical decentralisation. This happens when the chief executive chooses to disperse or delegate power to levels lower down in the vertical hierarchy. When decisional power may remain with line managers in the system of formal authority, it may flow to people outside the line of structure like analysts, support specialists etc. Thus **horizontal decentralization** refers to the extent to which non-managers control decision processes.

In **selective decentralization,** the power over different kinds of decisions rests in different places in the organisation. For example, finance decisions may make at the strategic apex, marketing decisions in the support units and production decisions at the bottom of the middle line by the first line supervisors. **Parallel decentralization** refers to the dispersal of power for many kinds of decisions to the same place.

3.2.3.3 Analysis of organisational culture

The organisation's culture has an impact on the efficiency and effectiveness and therefore analysing it is an important part of gaining a full understanding of the organisation. The organisational culture is made up of the deeply held beliefs about the way the organisation should operate. It is organisations value system and will influence the way in which work is carried out and how employees behave. **Organisational culture can be viewed as a complex set of values, beliefs, assumptions and symbols that define the way in which a firm conducts its business.** Organisational culture has a major influence on goals, strategies, and policies; it also facilitates or inhibits the implementation of a chosen strategy.

Culture can be thought of as consisting of three levels: at the surface are visible artefacts such as manner of dress, patterns of behaviour, physical symbols, organisational ceremonies, and office layout. These include all the things a person can see, hear and observe by watching member of the organisation. At a deeper level are expressed values and beliefs, which are not observable but can be discerned from how people explain and justify what they do. These are values that members of the organisation hold at a conscious level. Some values become so deeply embedded in a culture that organisational members may no longer be consciously aware of them. These basic, underlying assumptions are the essence of the culture. These assumption might includes (1) that individual employees are the sources of all innovation, (2) That each individual must think and act for him or herself, even if it means defying supervisors, and (3) that organisation members are part of a family and will take care of and support each other in taking risks. Figure 3.1 indicates three levels of organisational culture.

Figure 3.1 Three levels of organisational culture

Culture that can be seen at the surface level	**Visible** 1. Artefacts such as manner of dress, patterns of behaviour, physical symbols, organisational ceremonies
Deeper values and shared understandings held by organisation members	**Invisible** 2. Express values, such as "The Penny Idea," "The HP Way" 3. Underlying assumptions and deep beliefs, such as "Organization members care about each other like a family."

Sources: Course material Rozman, "Management and Organisation, 2003"

According to some criteria, authors distinguish different types of culture. It is important to know how to observe and detect culture and to change it **(Martin, 2001, pp. 590-592).**

3.2.3.4 Analysis of organisational processes

Analysis of organisational processes involves analysis of planning, organising, leading and control of an organisation.

Planning is a process of thinking ahead for developing course of actions in order to improve effectiveness, productivity and to bring profits to organisation. It sets the direction and objectives. The purpose of **planning** is to prevent future problems, to plan execution in such a way that business will run as smoothly as possible. Planning can be strategic, tactical and operational. **Strategic planning** is a process of developing and analysing the organisation's mission and vision, overall goals and general strategies and allocating resources. It is generally useful in corporate decision-making processes. **Tactical planning** is the process of making detailed decisions about what to do, which will do it, and how to do it – with normal time horizon of one year or less is called tactical planning. It is made for shorter time frame with detail planning. Tactical Planning is useful for departmental managers to anticipate or cope with the actions of competitors, to coordinate with other departments, customers and suppliers and to implement strategic plan. **Operational planning** guides the department in setting priorities and accomplishing what needs to be done to fulfil our mission. It assists management in implementing, monitoring, and budgeting program activities.

Organising is the deployment of organisational resources to achieve strategic objectives. It brings the resources together to run the plans into action. The deployment of resources is reflected in the organisation's division of labour into specific departments and jobs, formal lines of authority, and mechanisms for coordinating diverse organisation tasks. The organising process leads to the creation of organisation structure, which defines how tasks are divided and resources deployed.

Leading builds the commitments and enthusiasm needed for people to apply their talents fully to help accomplish plans and leadership is the process of inspiring others to work hard to accomplish important tasks. The foundation of effective leadership lie the way manager uses power to influence the behaviour of the people. The power of manager emerges from official status and his unique personality. The power immerses from official status is known as **position power, which has three bases: reward power, coercive power and legitimate power.** Reward power is the capacity to influence or motivate people through reward. Coercive power is the capacity to punish or withhold positive outcomes as a means of influencing people. Legitimate power is the capacity to influence people by virtue of formal authority, or the rights. Personal power lies in the individual manager and the leadership emerges from his unique personal qualities. **Personal power has two bases: expert power and referent power.** Expert power is the capacity to influence other people because of specialised knowledge and referent power is the capacity to influence other people because of their desire to identify personally with you. For effective leading of an organisation, leader should influence and motivate people by position as well as personal power because position power is often insufficient to achieve needed influence.

Organisational control system should be simple; it has to enable us to react quickly. It can be divided into three forms strategic, management and operational control. **Strategic control** is the process of evaluating strategy just after formulating strategy. **Management control** is the process of ensuring that major subsystems' progress toward strategic objectives is satisfactory. **Operational control** is the process of ascertaining whether the role behaviours (performance) of individuals and work groups satisfy their job descriptions. Controlling system fails main due to lack of quantitative objectives or performance standards and lack of timely provided or valid information. For effective controlling organisation must determine what to measure, establish performance standards, measure actual performance, compare actual performance with the standard and identify the gaps and take corrective actions.

3.3 ANALYSIS OF ENVIRONMENT

3.3.1 Definition of environment and environmental analysis

Business environment is a set of political, economic, social and technological (PEST) forces that are largely outside the control and influence of a business, and that can potentially have both a positive and a negative impact on the business.

Analysis of business environment is a part of corporate strategic analysis in order to design suitable corporate strategies and their effective implementation and control. Environmental analysis process involves information collection and interpretation concerning outside forces, events, and relationships as they affect or may affect the future of the organisation. It helps in identifying opportunities and threats and also provides information for strategic decision making and encouraging strategic thinking in organisation. **Environmental analysis focused on the macroeconomic, governmental, technological, social and natural environments**. Identifying and evaluating relevant environmental change are essential means for capitalising on new opportunities and circumventing treats to markets and marketing strategies. Demographic shifts, technological innovations and altered lifestyles are continual phenomena and the trends spill into each other, and the ripples reach every corner of society. Therefore it is important to anticipate the environmental forces and adapt in time. However, building adaptive strategies requires an understanding of both the nature and the rate of changes. It is not easy to predict environmental forces because of high level of uncertainty. To make effective decisions managers must understand the external environment in which their firms operate.

External environment can be divided into four major sections. The first two sections cover environmental scanning and competitor intelligence, which describe how firms collect information about important environmental trends and detailed intelligence on major competitors. The next two sections describe about the general environment and competitive environment. General environment includes demographic changes, socio-cultural changes, political and legal environment, technological developments and macro economic

environment. Competitive environment includes industry-related factors such as potential entry by new competitors and rivalry among existing competitors.

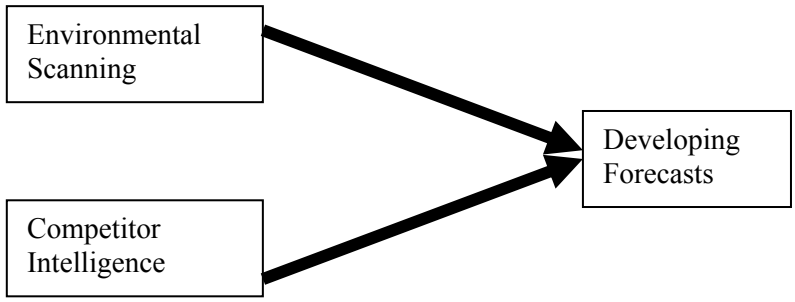
Environmental scanning activities involve monitoring and evaluating information from the external environment and disseminating it to key people within the organisation. Business must direct their efforts to evaluate those trends that have a significant impact on their present and future product-market activities. To remain competitive, firms must scan important global trends and events such as important inventions, improvement in manufacturing processes, and innovations in fabricating or assembling products etc. Continuous scanning of changes in the external environment enables managers to determine how the firm should positioned in the long run to exploit new opportunities.

However, in short- to-medium term, it is equally important for the firm to anticipate the actions of its current competitors and beware of potential entrants. **Information about the competition helps managers develops strategies to counteract or pre-empt their competitors**. Firms gather information about competitors by systematically looking at large number of factors, including planned new-product introductions, capacity increases, cost structures, executive incentive and compensation plans and financial position.

Once information is gathered by scanning the external environment and by collecting intelligence on competitors managers are able to make forecasts about the future. Forecasting involves the prediction of future events or trends. As a part of environmental forecasting managers need to anticipate long term changes in the national and international economies, as well as broad social changes. These changes often have profound implications for the formation and implementation of their firms' strategies.

Inter-relation between environmental scanning, competitor intelligence and forecasting are shown in the figure 3.2

Figure 3.2: Model of forecasting



Source: Dess, Miller Alex, 1993, p. 39

Forecasting has its limitation due to several factors. One of the major causes of incorrect forecasts is referred as safe forecast problem. **In this situation planners, fearful of adverse reactions, tend to become conservative in their forecasting in order to avoid risk**. This prevent organisation from taking advantage of new opportunities. Another related problem is

the urge to gather excessive amount of information rather than to think critically about key information. A survey of forecasting practices in corporations identified four major stumbling blocks to the successful application of forecasting. These are:

- A lack of effective communication between forecast preparers and managers who used the forecasts for decision-making.
- A lack of effective forecasting skills
- A disparity between forecast preparers and users in perception of the company's forecasting requirements
- A failure to plan a set of actions that realizes the full benefit of the forecasting activities.

3.3.2 General environment (PEST) analysis

General environment consists of factors external to the industry that may have a significant impact on the firm's strategies. Many developments in the general environment are difficult to predict with any degree of accuracy. Macroeconomic developments such as interest rates, the rate of inflation, and exchange rates are extremely difficult to predict on the medium and long-term basis. However, some trends in general environment, such as population distribution by age, ethnicity, and income levels, can be forecast with a high degree of accuracy. General environment consists of many diverse but interrelated parts like demographic, socio-cultural, political/legal, technological, macroeconomic and global. Development in the general environment often provides a firm with opportunities for expansion in terms of both products and markets.

Demographic changes include the aging of the population, population shifts among regions, change in ethnic composition, educational levels, household pattern etc. Market are keenly interested in the size and growth rate of population in different cities, regions, and nations. Market-product demand is highly sensitive to age group of society, need of products among different age groups are different. Similarly, people of different groups have certain specific wants and buying habits. Educational level in the society and household pattern likes family structure etc. of the society, population shift among regions are also have great impacts in the business environment, which a managers must study and understand.

Social attitudes and cultural values constantly evolve and can have significant impact on the business. If we look at the society, we find people are now adopting more conservative behaviours and ambitions. They are more cautious in their spending pattern and more value-driven in their purchase. People's views on corporations, government agencies, trade unions and other organisations are different for different people. Company often need to find new ways to win back consumer and employees' confidence. Therefore it is imperative to conduct social audit and try to improve public image.

Political and legal development can expand or limit a company's freedom of action and make the environment more hostile or more supportive of its activities. Therefore, manager

must closely observe and political and legal situation of the nation in which the business is operating.

Technological developments affects most products and services as well as the process by which they are created and delivered. Such advances create new products, shorten the life cycle of existing products, and change the level of capital investment and production costs of individual products. Every new technology is a force for creative destruction. It provides superior value in satisfying needs stimulate investment and economic activity. **New technologies create major long run consequences that are not always foreseeable.** Scientist today is working on a startling range of new technologies that revolutionize product and production process. Therefore managers should watch the accelerating pace of technological advancement.

Overall **economy** of a state greatly influences the strategies and performance of various industries and competitor within each industry. Some of the important indicators by which the health of an economy can be judged are growth in GNP, interest rates, inflation rates, savings rates and trade & budget deficits/surpluses. All these indicators are interrelated. GNP represents the dollar measure of the value of goods and services produced within the economy. Increase in GNP is generally associated with higher levels of consumer and industrial demand for product and services.

Demand for goods and services rises and falls according to fluctuations in interest rates, higher the interest rate lower the demand. The cost of the capital goes up during the periods of higher interest rates thus depressing capital investment. Interest rates are important factor in decision-making process involving major expenditures for plant and equipment; therefore managers need to monitor them closely. The world has experience major change in inflation rate due to fluctuation of oil prices during 1980s. Early in the decade, soaring oil prices fuelled inflation to double-digit levels. When oil prices fell in mid 1980's, the inflation rate dropped to below two percent. Other two important issues that continue to play a major role in the macroeconomic environment are the trade and budget deficits because trade and budget deficits are ultimately financed by increasing debt or by the sale of national assets. The affects of trade and budget deficits lead to formation of new government policy on taxation and other legal areas, which are often not conducive to business environment. In today's increasingly **globalised business environments**, no business can run without considering the impact of global business environment. The business trend has accelerated by factors such as cheaper and faster means of transportation, more powerful communication, technological advancement, system atomisation etc. In today's scenario, managers must be aware of potential competition from national and international competitors.

3.3.3 Competitive environment (Industry)

The profitability of the firm and the nature of competition in the industry are more directly influenced by development in the competitive environment **(Dess, Miller, 1993, p.55**). Competitive environment consists of factors relevant to a firm's strategy, including

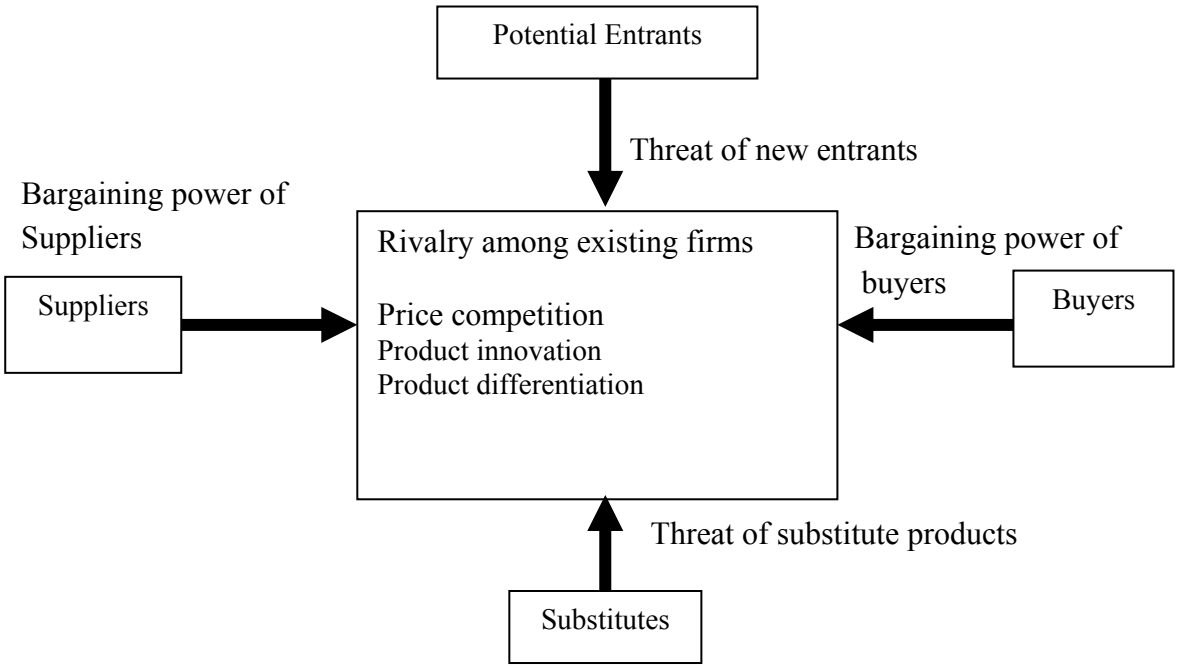
competitors (existing and potential), customers, and suppliers. **The "five forces model," developed by Michael Porter is the most commonly used analytical tool for examining the competitive environment**. It describes the competitive environment in terms of five basic competitive forces:

1. Threat of new entrants
2. Bargaining power of firms suppliers
3. Bargaining power of firms customers
4. Threat of substitute products
5. The intensity of rivalry among competing firms

These forces determine the natures and extend of competition, as well as the profit potential of an industry. Managers should understand how each of these five forces affects the competitive environment of the industry in which the firm competes. It helps manager to determine the most appropriate and defensible strategic position within the industry.

Inter-relation among five competitive forces are shown in the figure 3.3

Figure 3.3: Porter's model of five competitive forces



Source: Dess, Miller Alex, 1993, p.56

Porter's model shows how five competitive forces are influenced the external business environment of an organisation.

3.3.3.1 The threat of potential entrants

A new entrant into an industry represents a competitive threat to existing firms; it adds new production capacity and the potential to erode the market share of existing competitors. The

new entrants may bring substantial resources, which were not previously required for success of industry. To reduce the threat managers may have to erect substantial barriers such as:

- Economies of scale : Reduction of cost due to production in large volume
- Product differentiation: Differences in physical or perceptual characteristics which make a product unique in the eyes of the customer
- Capital requirement: Amount of investment required to enter an industry, including plant and equipment as well as working capital
- Switching costs: Costs incurred by a user in changing from one supplier to another. These may include psychological costs in addition to financial costs.
- Access to distribution: Costs associated with developing a means to distribute a product or services
- Cost disadvantages independent of scale: Factors that provides an advantage to existing competitors even when new entrant has comparable economies of scale like proprietary product knowledge, favourable access to raw materials, favourable locations, and government subsidies.

3.3.3.2 Bargaining power of firm's suppliers

There are many ways in which suppliers can affect an industry's profit potential. Suppliers can increase their prices or reduce the quality of goods and services that they provided to the industries. Conditions under which a supplier group would be powerful include:

- Dominance by a few suppliers
- Greater concentration than buyer industry
- Non-availability of substitute products
- Relative lack of importance of the buyer to the supplier group
- Importance of supplier's product or service to the buyer
- High differentiation by the supplier
- High switching costs for the buyer
- Credible threat of forward integration by suppliers

3.3.3.3 Bargaining power of customers

Buyers of an industry's product can exert bargaining power over the industry by forcing prices down, by reducing the amount of goods they purchase from the industry, or by demanding better quality for the same price. Factors that lead to greater buyer power include:

- Greater concentration than the supplier group

- Large volume purchases
- Undifferentiated or standard products or services of the supplier
- Credible threat of backward integration by buyers
- Accurate information about the cost structure of the supplier

Also, the greater the price sensitivity of the buyer, the lower the profit potential of the supplier industry. A buyer industry is likely to be more prices sensitive if the following apply:

- The products represent a significant fraction of the buyer's total cost
- It earns low profits
- The supplier's product is unimportant to the quality of the buyer's final product
- The supplier's product may lead to only marginal savings for the buyer

3.3.3.4 Threat of substitute products

When prices of existing products rise above that of the substitute product, customers tend to switch to the substitute. A firm competing against a substitute product can attempt to differentiate its product. Alternatively, the firm can attempt to increase the buyer's costs of switching between product and a substitute product. Substitute products' performance trend, pricing should be closely monitored.

3.3.3.5 The intensity of rivalry among competing firms

In the free market economies, high-level competition among existing firms prevails and is characterized by intense price competition, product differentiation, or product innovation. Managers must realise that these forms of competition may not always mutually exclusive and may occur at the same time. Intense rivalry usually results from the interaction of the following factors:

- Numerous or equally balanced competitors
- Slow industry growth
- High fixed or storage cost
- Lack of differentiation or switching costs
- Manufacturing capacity increases possible only in large increments
- Competitors with diverse strategies, origins, and personalities
- High strategic stakes
- High exit barriers for economic, strategic or emotional reasons

Intense rivalry among competitors in an industry can take three specific forms: price competition, product innovation, and product differentiation.

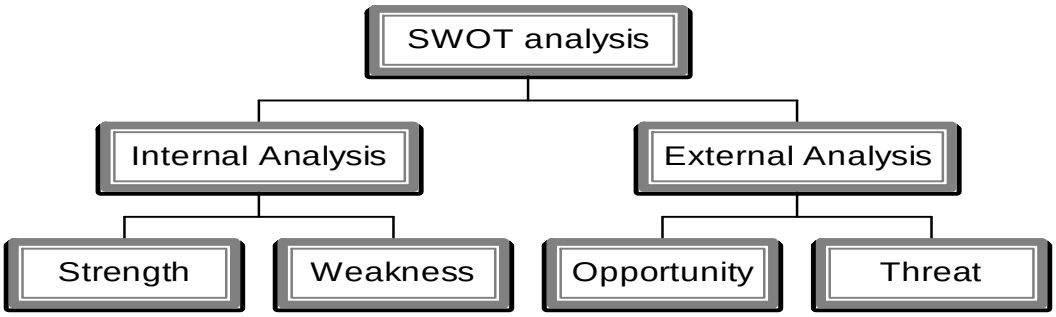
3.4 SWOT ANALYSIS

3.4.1 Definition of SWOT analysis

Though the described analysis of the company and its environment we can see strong and weak points of the company as well as the opportunities and threats that are forcing it. Most managers know them on the basis of their experience and knowledge. But we emphasised that in today's complex environment a logical and methodological approach is necessary. We could even define the purpose of the analysis as finding out strengths, weaknesses, opportunities and threats. SWOT is an acronym for Strengths, Weaknesses, Opportunities, and Threats. The aim of the business and organisation analysis is to find strengths and weaknesses of the company. The aim of environmental analysis and forecast is to find out opportunities and threats. We can combine both in SWOT.

The SWOT analysis is an extremely useful tool for understanding and decision-making for all sorts of situations in business and organizations. SWOT analysis provides information that is helpful in matching the firm's resources and capabilities to the competitive environment in which it operates. As such, it is instrumental in strategy formulation and selection. Figure 3.4 shows how a SWOT analysis fits into an environmental scan.

Figure 3.4: SWOT analysis frame work



Source: Adopted from http://www.quickmba.com/strategy/swot

Internal analysis examines the capabilities of the organization and its business. This can be done by determining and analysing organization strengths and weaknesses. External analysis looks at the main points in the environmental analysis, and identifies those points that pose opportunities for the organization, and those that pose threats or obstacles to performance.

A firm's strengths are its resources and capabilities that can be used as a basis for developing a competitive advantage. To know about the strength of a company, it is important to analyse about what the company does well and what makes the company stand out from competitors. What advantages do the company have over other competitors. The absence of certain strengths may be viewed as a weakness.

To determine the weaknesses, we can list the areas that are a struggle for the company. The external environmental analysis may reveal certain new opportunities for profit and growth. Therefore it is important to analyse the external environment and try to uncover areas where the strengths are not being fully utilized. Changes in the external environment may present threats to the company. Analysis of threats is important for understanding and estimation of damage that could happen due to the influence of external environment. To find out the threats to the company, analyser should study the strength and weakness of competitors and their emerging business trends that may amplify the weaknesses. Apart from that any other external threats that may hinder in the success of the company should also be examined carefully.

3.4.2 SWOT matrix as the basis for performing strategies

SWOT Analysis is an effective way of identifying strengths and weaknesses, and of examining the opportunities and threats of an organisation. It helps to focus activities into areas where the organisation is strong and where the greatest opportunities lie and use for all sorts of decision-making process. **SWOT template enables proactive thinking, rather than relying on habitual or instinctive reactions.** It is important to clearly identify the subject of a SWOT analysis, because a SWOT analysis is a perspective of one thing, be it a company, a product, a proposition, and idea, a method, or option, etc. In general, SWOT analysis can be used to assess:

- A company (its position in the market, commercial viability, etc)
- A method of sales distribution
- A product or brand
- A business idea
- A strategic option, such as entering a new market or launching a new product
- A opportunity to make an acquisition
- A potential partnership
- Changing a supplier
- Outsourcing a service, activity or resource
- An investment opportunity and similar issues. It is the basis for preparing good decisions.

A firm should not necessarily pursue the more lucrative opportunities. Rather, it may have a better chance at developing a competitive advantage by identifying a fit between the firm's strengths and upcoming opportunities. In some cases, the firm can overcome a weakness in order to prepare it to pursue a compelling opportunity. To develop strategies that take into account the SWOT profile, a matrix of these factors can be constructed as shown in figure 3.5 below:

- S-O strategies pursue opportunities that are a good fit to the companies' strengths
- W-O strategies overcome weakness to pursue opportunities

- S-T strategies identify ways that the firm can use its strengths to reduce its vulnerability to external threats
- W-T strategies establish a defensive plan to prevent the firm's weaknesses from making it highly susceptible to external threats.

Figure 3.5: SWOT / TOWS Matrix

	Strengths	**Weaknesses**
Opportunities	S-O strategies	W-O strategies
Threats	S-T strategies	W-T strategies

Source: Adopted from http://www.quickmba.com/strategy/swot

3.4.3 Development of competitive advantage

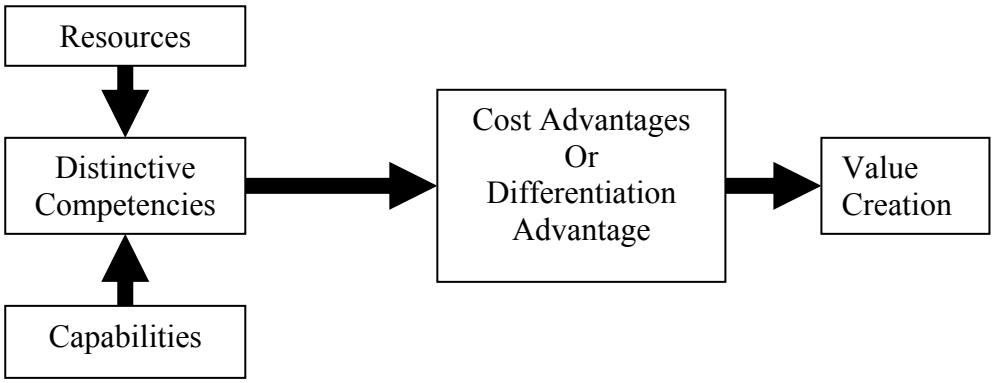
Companies achieve competitive advantage through acts of innovation. They approach innovation in its broadest sense, including both new technologies and new ways of doing things **(Higgins, Vincze, 1993, p.411)**. When a firm sustains profits that exceed the average for its industry, the firms is said to possess a competitive advantages over its rivals. Michael Porter identified two basic types of competitive advantage:

- Cost advantage
- Differentiation advantage

A competitive advantage exists when the firm is able to deliver the same benefits as competitors but at a lower cost (cost advantage), or deliver benefits that exceed those of competing products (differentiation advantage). Competitive advantage enables the firm to create superior value for its customers and superior profits for itself. The cost and differential advantages are known as positional advantages since they describe the firms positioning the industry as a leader in either cost or differentiation. A resource-based view emphasized that a firm utilizes its resources and capabilities to create a competitive advantage that ultimately results in superior value creation. Figure 3.6 below combines the resource-based and positioning views to illustrate the concept of competitive advantage:

Resources are the firm-specific assets useful for creating a cost or differentiation advantage. Capabilities refer to the firm's ability to utilize its resources effectively. **The firm's resources and capabilities together form its distinctive competences.** These competencies enable innovation, efficiency, quality and customer responsiveness, all of which can be leveraged to create a cost advantage or a differentiation advantage. The firm creates value by performing a series of activities, which is known as value chain. To achieve a competitive advantage, the firm must perform one or more value creating activities in a way that creates more overall value than do competitors. Superior value is created through lower costs or superior benefits to the consumer (differentiation).

Figure 3.6: Model of competitive advantage



Source: Adopted from http://www.quickmba.com/strategy/competitive-advantage

3.4.4 General questions for SWOT analysis

It is not only possible or necessary to make SWOT analysis in the way we described. SWOT matrix can be prepared directly on the basis of the knowledge and experience of managers. Though their discussion and / or questionnaires SWOT matrix can be prepared. Finding on SWOT analysis varies depending upon the purposes and the organisation on which analysis is to be done. It is important to clearly mention the description of the subject for which SWOT analysis is to be carried out so that people contributing to the analysis, and those seeing the finished SWOT analysis, properly understands the purpose of the SWOT assessment and implications. In the process of SWOT analysis, an analyser generally tries to find the answers to the following questions as shown in matrix figure 3.7 below:

Figure 3.7: General questions for SWOT analysis

STRENGTHS	WEAKNESSES
• Advantages of proposition? • Capabilities? • Competitive advantages? • USP's (unique selling points)? • Resources, Assets, People? • Experience, knowledge, data? • Financial reserves, likely returns? • Marketing - reach, distribution, awareness? • Innovative aspects? • Location and geographical? • Price, value, quality? • Accreditations, qualifications, certifications? • Processes, systems, IT, communications? • Cultural, attitudinal, behavioural? • Management cover, succession?	• Disadvantages of proposition? • Gaps in capabilities? • Lack of competitive strength? • Reputation, presence and reach? • Financials? • Own known vulnerabilities? • Timescales, deadlines and pressures? • Cashflow, start-up cash-drain? • Continuity, supply chain robustness? • Effects on core activities, distraction? • Reliability of data, plan predictability? • Morale, commitment, leadership? • Accreditations, etc? • Processes and systems, etc? • Management cover, succession?

Continuation of figure 3.7

OPPORTUNITIES	THREATS
• Market developments? • Competitors' vulnerabilities? • Industry or lifestyle trends? • Technology development and innovation? • Global influences? • New markets, vertical, horizontal? • Niche target markets? • Geographical, export, import? • New USP's? • Tactics - surprise, major contracts, etc? • Business and product development? • Information and research? • Partnerships, agencies, distribution? • Volumes, production, economies? • Seasonal, weather, fashion influences?	• Political effects? • Legislative effects? • Environmental effects? • IT developments? • Competitor intentions - various? • Market demand? • New technologies, services, ideas? • Vital contracts and partners? • Sustaining internal capabilities? • Obstacles faced? • Insurmountable weaknesses? • Loss of key staff? • Sustainable financial backing? • Economy - home, abroad? • Seasonality, weather effects?

Source: Adopted from http://ww.businessballs.com/swotanalysisfreetemplate.htm

Above questions are general in nature however some more points may have to be analysed based on the nature of a business or organisation.

3.5 SETTING GOALS AND PROPOSE MEASURES

The strengths, weaknesses, opportunities and threats within the SWOT analysis are a rational basis to make decisions, which will resolve the problems, make use of strengths and opportunities and minimise consequences of weaknesses and threats.

Decisions can be strategic, tactical or operational. Within the profit improvement programmes mainly tactical and operational decisions are included. Goals are understood as desired solution, outcome as compared to the actual one. Strategies and tactics are the ways to arrive to the goals. Within the profit improvement programmes decisions are mainly trying to increase sales, decrease costs, decrease assets, increase liquidity, increased productivity etc.

The goal of the analysis is to find out main areas of improvements and to help in making better decisions within selected areas, which will lead to improvement of profitability. Increasing quantity of sales can increase profitability of a company. However, the sale price must cover the cost of production. **Increase in sales** is possible only by increasing production. Increase in production can be maximised up to capacity of the production units beyond which it is not possible. Therefore further increase of production vis-à-vis sales is possible by

enhancement of capacity. Enhancement of capacity is a long-term process and it involves major investment and therefore it is not a good proposition for profitability improvement in a short-term basis. However, company should put effort to maximise capacity utilisation in order to increase the volume of sales.

Profitability can be improved by **reduction of assets** employed in the business. Assets can be reduced by optimisation of inventory. Another way to bring improvement in the profitability is to reduce the cost of production.

Production costs depend on various factors likes cost of raw materials, manpower employed, technology and effective operation and maintenance of the plant. Cost of raw material is dependable on external factors, where no significant measures can be taken to reduce cost. However, it may be possible to reduce the number of employee by careful analysis of volume and nature of jobs. This may be the cause of resentment in an organisation, which can affect in the overall organisational goal. Company can introduced voluntary retirement scheme (VSR) to employees, however this scheme works only when it is attractive in terms of financial volume. Another problem of VRS is that there is a probability of losing efficient employee, whose service is important for the company. Therefore, before implementation of such schemes management must consider all the above factors. Cost of production drastically varies depending on which technology is adopted. Latest and improve technologies are progressively more cost effective. However, all technologies in one they become older and not comparable to new technologies. Therefore all existing installation must find out some solution to reduce the cost of production. This can be achieved by improving the efficiency in operation and maintenance and also be optimisation of energy consumption. Improvement of efficiency in operation is possible process and product mix optimisation, where maintenance can be more effective by proper planning in resources utilisation. Energy consumption can be optimised by systematic study of critical areas to find out the potential scope for saving and adopting proper method for implementation of energy optimisation schemes.

Goals or objectives and measures or decisions to achieve them are determined as an interactive way. Objectives, representing the desired future situation can be achieved in different possible ways. We have creatively to think of different solutions and then select the best.

Following the process of goals setting and measures selection, we prepare the necessary planning tables to verify the expected results and to enable control to compare.

Duties, responsibilities and authorities are assigned to managers and employees. A follow-up and controlling processes are established.

Profit improvement programmes are rather complex. They should be properly organised.

3.6 PROFIT IMPROVEMENT PROGRAMME (PIP)

Profit improvement programme is defined as an organised effort to promote and manage the identification and implementation of necessary and worthwhile changes in areas of operation which management controls and decisions are made largely on the basis of economics.

Profit of an organisation can be improved by improving net profit margin per rupee of sales or by generating more sales revenue per rupee of investment. Increase of sales revenue is possible by maximise capacity utilisation however it has limitation. The other way of increasing profit is to reduce expenses without diminishing sales or to eliminate sales that do not contribute to profit. Every management strives to do so. When efforts to improve profit or to reduce costs fall short of their objectives, it is generally not lack of trying but only because the proper tools have not been used. So it is important to correctly identify the tools and apply in the form of a profit improvement program.

The need for constant improvement in all areas of operation is one of the basic and continuing responsibilities of the management. For constant improvement management has to emphasis that not only profit improvement but also other criteria like ecology should be observed. However, because of day-to-day operating problems, too little attention is often given to the need for continual adaptation to changing conditions. Profit improvement program should be a permanent function. To ensure continuous improvement especially in production units, management may take **clean production approach**. It describes a preventative approach to environmental management. Cleaner production is a 'win-win' strategy; it protects the environment, the consumer and the worker while improving industrial efficiency, profitability, and competitiveness. It is supportive to profit improvement. Maintaining ecological balance is most important topic in today's situation. Industries being the major contributors to environment pollution, it is a statutory obligation to all the industries to maintain these standards. Improvement of profitability and maintaining environmental standard are parallel activities of an organization. Clean production is the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase the overall efficiency and reduce risks to human and the environment. This can be implemented by input-output analysis, material flow analysis and by development of indicators to measure and to compare actual improvement with plan or with other enterprises. Approach to clean production could be better housekeeping, replacement of raw and auxiliary materials, technological modifications, internal recycling and change of products etc. The basic goal of clean production approach is to avoid generating pollution, reduce waste, emissions and environmental and health impacts, realize benefits from these reductions and use of new markets. Clean production strategy cuts costs of production, reduces risks and identifies new opportunities and can be the most efficient way to operate process, produce products and to provide services.

Maintaining a fully organized profit improvement program requires substantial efforts; this may lose momentum after a while and need fresh stimulus and a new approach. The best answer may lie in a combined approach, where certain of the features of the program are

maintained as a continuing effort and other are applied periodically and for limited duration to re-stimulate interest and intensity. With the rare exceptions, there is no way to make the customers buy more goods or pay higher prices at a particular time just because the company needs the profits. Increased sales or prices of present products or addition of new products is therefore outside the domain of a profit improvement program effort **(Jones, Trentin, 1971, page 241).** Company must rule out wage rates and related factors involving labour negotiation, or taxes and similar factors involving a branch of government, instead concern with the things the company buys, including the services of its employees and the manner in which it operates internally. **In short, the profit improvement program is usually concerned with the factors, which are completely controlled by management**. Internal operation is the proper area for a profit improvement program because decision on what changes could or should be made can be based on economic considerations of improving profit or return on investment and are not critically dependent on their acceptability to anyone outside the organization. These are not necessarily under the control of single individual within management. There are many aspects of operation, which could be made the objects of special improvement programs such as productivity, energy optimisation, product quality, customer services, or return on investment etc.

PIP is to be implemented in different critical areas and therefore involvement of functional managers is important. Responsibilities and authority of all functional managers are to be defined. Chief Executive Officer (CEO) of the company being holding the overall responsibility and authority of a company, his direct involvement in the programme helps gaining the priority. However, it may not be possible for his constant attention particularly in a large organisation therefore management should make some one responsible with authority in formal way. Depending on the magnitude and urgency of the job, this may be a full time position or part of an established job, involving the following four steps:

- Obtaining ideas on how to improve profit and putting these in the form of specific proposals or recommendations.
- Obtaining the information, which is needed for proper evaluation of each proposal.
- Presenting the proposal to the members of management who are in the position to evaluate it and to direct its implementation.
- Providing necessary follow through to see whether the expected results have been obtained and reporting overall progress to top management.

In the areas like production, accounting, research, quality control, or maintenance, the profit improvement program should be concentrated on the question of how or by what methods these projects are executed. It is in principle possible to compare the cost of one method with another. The methods improvement program approach is best applied to operations which are repetitive, such as production scheduling and unit operation, order handling and billing, quality testing and inspection, inventory control, maintenance, house keeping etc. However it is important to determine which area offers the greatest potential for improvement. The first job is to identify opportunity for improvement, and it is best characterized as a survey or

review of the operation under scrutiny. The factual information compiled for a survey or review study may include a description of how the operation is carried out; statistics on its performance in terms of throughput, output rates, organization, costs, delays encountered, its relation to other areas and problems. This facilitates in analysing and organizational learning process and help in finding solution to the problems. However to be effective, person concern to survey studies must be familiar with the operation involved; should know what should be the good practice in this sort of work and trained to examine critically and identify inefficiencies. Mechanization and automation plays important roles in cost reduction not only in production but also in office operations, it is important to involve the trained professionals specialist about the devices during survey study in order to identify the relative merit and demerit in applications.

It is sometimes difficult to take a decision for implementation of the program even after survey study, in such a situation it is important to conduct detail feasibility study, because success or failure of a program depends on how critically the feasibility of the program is evaluated. Sometimes question arises, how and where to begin with the profit improvement program. The best way to begin with, where expenditures are greatest and where management is most interested and sympathetic.

There are many instances of slippage between estimates of savings and the actual estimate. The estimate must be effectively prepared, in a way, which permits allocation of total estimated savings to individual accounts or budgets. The degree to which this can be accomplished depends on the sophistication of both the estimate and the budget system. Estimating and scorekeeping in a profit improvement program are greatly facilitated through use of standard costs and variable budgets, which includes:

- Documentation of standard operating procedures or process sheets, and determination of standard quantities of raw material, direct labour, and certain manufacturing expense elements per unit of product.
- Approval of standard procedures and quantities by manufacturing, engineering, quality control, safety, or other interested departments.
- Pricing of standard quantities and hours at standard unit purchase costs and standard labour rates developed by accounting.
- Predetermination of acceptable overhead expense at various operating or production levels and determination of what portion of overhead is to be considered fixed, what portion semi-variable, what portion variable, and what basis (example; direct labour) is to be used for budgeting the variable and semi-variable portions.
- Establishment of the operating or production level of each product or department for the budget period, based on forecasts provided by sales or planning personnel.

In summary, the basic features in setting up a profit improvement program is:

- Definition of the scope of the program, which is usually the identification and implementation of necessary and worthwhile changes in method of operation and is generally limited to areas of internal operation where decisions are made largely on the basis of economics.
- Recognition of three basic objectives: reduction of expenses, reduction of unprofitable sales, and reduction of inventory and working capital investments.
- Appointment of coordinator (full or part time) to head the program, assisted by management review committee.
- Use of professional engineering and system personnel to carry out studies both to identify opportunities and to verify desirability of proposed changes.
- Establishment of a procedure for estimating savings based on fixed ground rules, which are realistic, understood by everyone, and accepted as a basis for budget adjustment.
- Use of budgetary procedures to monitor and control implementation of changes and also to provide information for keeping score on individual performance.
- Use of a system of formal proposals, survey and study reports, and progress reports, with appropriate review and follow-up procedures.
- Maintenance of high standards of accuracy and integrity in all facets of the program.

CHAPTER 4

BUSINESS AND ORGANISATIONAL ANALYSIS OF BRPL

4.1 ANALYSIS OF BUSINESS FUNCTIONS

4.1.1 Analysis of purchasing

Purchasing of goods from crude oil to different materials like chemicals, equipments, and maintenance spares etc. BRPL has set up separate wings for its convenience. Purchase of crude oil is dealt by Oil Account Department whereas Materials and Warehouse Department deal purchase of materials used in the plants and maintenance. Similarly, project purchase department purchases all materials required in the project.

Supply of crude oil is done through crude pipelines coming from Upper Assam Oil fields and Haldia-Barauni pipeline. Crude pipelines are partly owned by Oil India Limited and IOC. Presently the company is processing crude oil coming from Assam oil fields and Krishna Godavari basin of southern India. Transportation of crude oil is also comparatively higher due to its distance from the oil fields. Further, the refinery never utilised its full capacity due to shortage of crude oil in the country. Shortage of crude oil can be mitigating only by importing from other country, for which the company must take strategic decision.

Materials required in the operation and maintenance of the plants is purchased from the qualified vendors based on their quality and performance. Since the materials are standard in nature and the consumption pattern is known, therefore the company has not encountered major problem so far in purchasing these materials. Purchasing of materials related to projects is most often problematic due to difficulties in finding vendors and also timely identification of materials with exact quantities. Some times it leads to delay in completion of project. Transportation of goods often interrupted due to flood and on and off political disturbance in the region. Geographical location of the industry is not favourable for transportation of goods. However company can do very little in this regard.

4.1.2 Analysis of production

BRPL is operating business in the field of crude oil refining and downstream petrochemical industries. Various products and processing units of BRPL are already discussed in **chapter 2**. In addition to crude oil shortage, the refinery units are operating at under capacity due to other factors such as products containment problem due to wrong production and dispatch planning, frequent shutdown of the plant due to technical reasons. Refinery units are interrelated to each other, lower capacity utilization in the primary crude processing units (CDU-I&II) has subsequent cascading affects to the secondary processing units (KTU, DCU-I&II and CCU) and ultimately all the units remained under-utilized. On the other hand, if products are not timely moved that creates containment problem and subsequently plants are forced to run at lower throughput and finally unit undergoes forced shutdown, if no improvement in products movement take place. Also, some times plants need to be taken unplanned shutdown due to

technical reasons. Frequent shutdown of the plants not only contributes to capacity under-utilization but also it increases the operation losses and maintenance costs. All the above conditions contribute to capacity under utilization and therefore profitability of the company affected. Table 4.1 below shows physical performance highlight of BRPL during the year 1998 to 2003. The refinery was operating at 62.3 % to 81.1 % capacity during 1998 to 2003.

Table 4.1 Physical performance of BRPL during the year 1998 to 2003

(In Metric Tonne)

Finan -cial year	Crude Throughput		Light Distillate		Middle Distillate		Heavy Ends		Fuel & Loss	
	Quantity	(%)*	Quantity	(%)#	Quantity	(%)#	Quantity	(%)#	Quantity	(%)#
98-99	1658227	70.5	267621	16.2	1038782	62.8	237345	14.4	135184	**8.2**
99-00	1905851	81.1	315732	16.6	1180568	61.9	252034	13.2	146295	**7.7**
00-01	1487562	63.3	275309	17.9	930243	63.1	239407	16.1	114485	**7.7**
01-02	1475071	62.8	271354	18.4	925854	62.8	190741	12.9	96.486	**6.5**
02-03	1469037	62.3	274700	18.8	936328	64.0	173942	11.9	95162	**6.5**

Note:
(%)* indicates percentage capacity utilisation on design capacity of 2.35 MMTP
(%)# indicates percentage on actual crude throughput

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

The refinery technology is older compared to new refineries of the country, which are installed, in recent years. Although there are few comparatively older and below sized refineries in the country but majority refineries are larger. Processing cost of the refinery is higher compared to new refineries with higher processing capacity and new technology. **Optimisation of energy** is one of the most important aspects, which has direct on the profit fuel and loss of the company. BRPL has put many efforts to make most energy efficient plant by way of optimisation and brining awareness among the employees. A considerable amount has already invested but still there is scope for improvement. Table 4.1 shows continual reduction of fuel and losses since 1998-99 to 2002-2003.

To facilitate the need for crude and products movement and storages the company builds crude and products tanks. As an environmental keeping up measure, the company has engaged regular house keeping contracts in all the operation areas.

Refining capacity of the company (2.35 MMPTA) is remaining as bottleneck for the company. No significant growth/expansion took place in the business during last few years

and resulting stagnation in promotion and employees' personal development. The company needs huge investment to enhance its processing capacity even up to minimum economic size.

4.1.3 Analysis of sales

Petroleum products of BRPL are marketing by IOC, a public enterprises to the government of India, who is holding the major share in refining as well as marketing of petroleum oil business in India. BRPL is the subsidiary concern of IOC. However, BRPL's marketing division sales the petrochemicals products through own marketing networks. Table 4.2 shows the year-wise sales revenue since 1998 to 2003.

Table 4.2: Year-wise sales revenue since 1998 to 2003

Rupees in Million

Year	1998-99	1999-00	2000-01	2001-02	2002-03
Sales Revenue	10985.67	11131.49	12844.54	11798.75	16641.29
% increase over previous year	-	1.3	15.4	(8.1)	41.0

Note: Figure under bracket indicates negative

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

From figure 4.2 it appears that the sales revenue of the company is in the increasing trend except in the financial year 2001-02. In fact the company incurred losses during the financial years 2000-01 and 2001-02 due to having no profit margin and hence the production and sales have been restricted. However, in the subsequent financial year i.e. 2002-03 the sales revenue jumped to 41.0 % increase over the previous year. Trend of financial year 2003- 04 is even better.

The demand and supply trends of petroleum products in the country is encouraging. The hydrocarbon vision 2025 formulated by the Ministry of Petroleum & Natural Gas in 1999 emphasized 90% self-sufficiency in middle distillate (Diesel/kerosene group) in the sector with an appropriate mix of national oil companies, foreign players and private Indian players so as to develop a globally competitive industry. **According to this report, the country would require 277 MMTPA petroleum products and 358 MMT refining capacity is to be build up in order to achieve 90 % self-sufficiency.**

From the growing performance of BRPL as well as the country's demand forecast, it is anticipated that sales of petroleum products will not be a problem in near future.

4.1.4 Analysis of financing

Analysis of current ratio of BRPL shows fluctuating scenario during last five years since 1998 to 2003. Table 4.3 shows the year-wise current ratio position of BRPL. From the figure it

appears that during the financial years 1998-99 and 1999-00 and 2000-01, the current ratio are gradually decreased from 2.05 to 1.74 and that has come down to 0.69 in the year 2001-02. This indicates poor liquidity position of the company. However, in the financial year 2002-03 significant improvements have been made compared to 2001-02. This indicates that the liquidity position of BRPL is fluctuating and even thought it is in improving trend but the capacity to meet the short-term financial obligation is still below the optimum level.

Table 4.3: Current ratio of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Current Assets	Current Liabilities	Current Ratio
2002-03	7796.27	5606.75	**1.40**
2001-02	3474.77	5040.59	**0.69**
2000-01	3843.02	2203.52	**1.74**
1999 - 00	3706.50	1821.29	**2.04**
1998 - 99	3580.66	1747.48	**2.05**

Note: Current Ratio (CR) = Current Assets (CA)/Current Liabilities (CL)

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

Table 4.4 Debt equity ratio of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Total Debt	Total Shareholders' Equity Funds	Debt equity Ratio (In Percentage)
2002-03	1777.54	4227.61	**42.0**
2001-02	1267.42	3051.78	**41.5**
2000-01	851.44	5603.93	**15.2**
1999 - 00	524.23	6178.34	**8.5**
1998 - 99	617.54	5973.88	**10.3**

Note: Debt Equity Ratio = Total Debt/ Total Shareholders' Equity Funds

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

Debt –equity analysis of the company for the financial years 1998-99 to 2002-03 is shown in the table 4.4 below. It indicates that the debt-equity ratio of the BRPL was only 10.3% in the financial year 1998-99 but that has increased to 42.0 % during the financial year 2002-03. There fore the company's margin of safety has been diminished in the event of financial crisis and the company's flexibility for borrowing money in case of crises or investment may be a problem. In such a situation investment for capacity enhancement does not seem to be a good proposition. However, the company has to think for short-term profitability improvement measures with the existing set up of the company rather than investing money for capacity enhancement.

Financial stability of a company can be determine by the following ratio analysis:

- Financial Stability = (Equity + Long-term debts)/ Fixed Assets
- Financial Stability = Equity / Fixed Assets

Financial stability of BRPL during the financial year 1998 to 2003 are shown in table 4.5 and table 4.6 below:

Table 4.5: Financial stability of BRPL during the financial year 1998 to 2003 (I)

(Rupees in Millions)

Financial Year	Equity	Long- term Debt	Fixed Assets	Stability Ratio (percentage)
2002-03	1998.18	1777.48	4383.96	86.1
2001-02	1998.18	613.48	4672.42	55.9
2000-01	1998.18	524.09	4700.89	53.7
1999 - 00	1998.18	522.20	4612.02	54.6
1998 - 99	1998.18	614.06	4612.17	56.6

Note: Financial Stability = (Equity + Long-term debts)/ Fixed Assets

Stability ratio analysis of BRPL from table 4.5 indicates 53.7% to 56.6% during the financial year 1998-99 to 2001-02, which shows stable financial condition of the company. However, the same has jumped to 86.1 % during 2002-03. The basic reason for increase of this ratio was due to borrowing of long-term loan in order to increase the working capital. In-spite of making profit during 2002- 03, BRPL faced shortage of working capital due to the fact that the company incurred losses during the financial year 2000-01 and 2001-02. However the assets of the company are still higher compared to equity and long-term debts combine.

Table 4.6 below indicates that the equity and fixed assets ratio of BRPL during the financial year 1998-99 to 2002-30 was within 42.5% to 45.6%. Which show a stable financial condition.

Table 4.6: Financial stability of BRPL during the financial year 1998 to 2003 (II)

(Rupees in Millions)

Financial Year	Equity	Fixed Assets	Stability Ratio (percentage)
2002-03	1998.18	4383.96	45.6
2001-02	1998.18	4672.42	42.8
2000-01	1998.18	4700.89	42.5
1999 - 00	1998.18	4612.02	43.3
1998 - 99	1998.18	4612.17	43.3

Note: Financial Stability = Equity / Fixed Assets

From the above analysis it is seen that in case of any eventualities, the company has the capabilities to repay all the debts and equity.

4.1.5 Analysis of personnel functions

BRPL is having 1777 employees; as of 31st March 2003.This was 1810 as of 31st March 2002. Reduction of manpower during 2003 was basically due to superannuation, resignation, death, and voluntary retirement under Voluntary Retirement Scheme (VRS). Employees of BRPL are long experienced and skilled in their field of work. Most of them are working in the company over fifteen years. Employees are more or less qualified as per the requirement for the job. The company ensures minimum qualification to its employees by proper selection criteria. Moreover, BRPL gives importance to knowledge and skilled up-gradation to be in line with industry standard for which necessary training programme conducted, which include in-house refresher programme/ training by internal as well as external faculty, external in country and foreign training in various spheres such as profitability model, ethics/value building etc. The company imparted training to 411 executives and 756 non-executives during 2002-03. Work forces are rational and they are basically supportive to management. Absenteeism and lateness of employees are no longer a problem to the management after introduction of electronic time recording system in the factory gate. Grievances from employees or disputes are the common problem to all the industries however rather than few grievances from union it is not significant in BRPL.

The composition of manpower includes people from various socio-economical backgrounds from all over the country including disabilities and ex-serviceman. At present 77 women employees are working which is 4.33 % on the total employees of BRPL. Proportionality of employees composition is maintained as per the presidential directives and government guidelines issued from time to time.

Recruitment of new employees during last few years was insignificant. However, employees with long experience and skill are retiring and would be retired within next few years, which

may tend to create vacuum in different areas. To avoid such sudden crises of manpower, it is time for BRPL to emphasize on recruitment of fresh manpower with long-term planning.

As a welfare measure of employees, the company provided well-developed township facilities with hospital and other recreational facilities like clubs, canteen, parks, playgrounds etc. 95% of the employees are residing in the township, maintaining communal harmony irrespective of caste and creeds. They are commonly celebrating various national and regional festivals on the behest of management, which develop interpersonal relationship among the employees and also improve the management- employee relationship. Medical policy of the company for employees and their families are attractive. The company introduced group insurance policy, which is beneficial for the employees in case of any accident. Salary and other benefits like parks, allowances etc. are at per with the other oil industries, which is attractive compared to most of other business sectors in India. All these facilities hold good for retaining experience work force of the company.

4.2 ANALYSIS OF PROFITABITY

Business performance of BRPL during 1998 to 2003 yields a mixed result of profit and loss. Highlight of the performance during these last five years is shown in table 4.7 below:

Table 4.7: Financial performance of BRPL during 1998 to 2003

(Rupees in Millions)

FINANCIAL	1989-99	1999-00	2000-01	2001-02	2002-03
Turnover	9393.61	12915.16	12552.99	11951.90	18616.95
Earning After Tax (EAT)	**342.60**	**322.38**	**(574.40)**	**(1986.14)**	**1784.46**

Note: figure shown under bracket indicates loss

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

The Company has recorded quantum jumps financial performances during the year 2002-03. The turnover in 2002-03 was Rs.18616.95 million and corresponding Earning After Tax (EAT) of Rs. 1784.46 millions. The sale value of petroleum products increased during this year due to realisation of import parity prices of the POL products. However, the company incurred losses during the financial year 2000-01 due to lower capacity utilisation of refinery on account of shortage of crude oil. The sales value in petroleum product during 2001-02 decreased due to lower allocation of indigenous crude oil and non-processing of targeted quantity of imported crude oil as processing of imported crude oil contributed negative profit margin.

Table 4.8 Rate of return (ROR) of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Earning after taxes (EAT)	Average Total Assets	Rate of Return (In Percentage)
2002-03	1784.46	12180.23	**14.7**
2001-02	(1986.14)	8147.19	**(24.4)**
2000-01	(574.42)	8544.10	**(6.7)**
1999 - 00	322.38	8318.52	**3.9**
1998 - 99	342.60	8192.83	**4.2**

Note: Figure shown under bracket indicates loss
Rate of Return (ROR) = Earning after taxes (EAT) / Average total assets

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

Table : 4.9 Return on assets (ROA) of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Earning after taxes (EAT)	Average Total Assets	Interest	Return on Assets (In percentage)
2002-03	1784.46	12180.23	258.86	**16.7**
2001-02	(1986.14)	8147.19	376.92	**(19.8)**
2000-01	(574.42)	8544.10	114.84	**5.4**
1999 - 00	322.38	8318.52	90.92	**5.0**
1998 - 99	342.60	8192.83	91.67	**5.3**

Note: Figure shown under bracket indicates loss
Return on Assets (ROA) = {Earning after taxes (EAT) + Interest}/ Average Total Assets

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

Table 4.8 and table 4.9 show rate of return (ROR) and return on assets (ROA) of BRPL during the last five years indicating the similar fluctuating financial performance of the company. ROR as well as ROA during the financial year 2002-03 has considerably improved

from the negative value during the financial years 2000-01 and 2001-02. This indicates overall improvement in the profitability of the company but considering the one-year performance it is difficult to predict the future business trend.

4.2.1 Profit analysis

Financial performance of BRPL during 1998 to 2003 was inconsistent. EAT of the company during the financial year 1998-99 and 1999-00 was Rs. 342.6 and Rs.322.38 millions against net sales of Rs. 9608.19 and Rs. 13814.73 millions respectively. Earnings during the financial years 2000-01 and 2001-02 was negative and corresponding sales also lower during these years compared to the year1999-00. However, performance of the company has substantially improved during the financial year 2002-03. Table 4.10 shows EAT, net sales during 1998-2003 and net profit ratio of corresponding years.

Table 4.10: Net profit ratio of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Earning after taxes (EAT)	Net sales	Net Profit Ratio (In percentage)
2002-03	1784.46	18615.30	**9.6**
2001-02	(1986.14)	11949.52	**(16.6)**
2000-01	(574.42)	12430.85	**(4.6)**
1999 - 00	322.38	13814.73	**2.3**
1998 - 99	342.60	9608.19	**3.6**

Note: Figure shown under bracket indicates negative
Net Profit Ratio = EAT/ Net sales

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

Table 4.10 shows fluctuating net profit ratio of BRPL during last five years from 1998 to 2003. Net profit ratio during the financial year 1998-99 (3.6%) and 1999-00 (2.3%) was quite low and the same gone down to negative during the financial year 2000-01 (- 4.6 %) and 2001-02 (-16.6). However, the same has substantially improved (9.6 %)during the financial year 2002-03. Fluctuating situation indicates uncertain trend in the petroleum refining business.

4.2.2 Analysis of assets

Total assets of BRPL during the financial year1998-99 to 2001-02 were steady within Rs. 8100 to Rs. 8500 millions and the ratio of fixed and current assets of the company were

proportional. However, the total assets of the company have increased to about one and half times during 2002-03. The basic reason for increase of current assets was due to increase of loan to meet the working capital of the company. Table 4.11 shows detail of assets of BRPL during 1998-2003.

Table 4.11: Details of assets of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Fixed assets	Current assets	Total assets
2002-03	4383.96	7796.27	**12180.23**
2001-02	4672.42	3474.77	**8147.19**
2000-01	4700.89	3843.21	**8544.10**
1999 - 00	4612.02	3706.50	**8318.52**
1998 - 99	4612.17	3580.66	**8192.83**

Inventory turnover ratio (ITR) of BRPL during 1999 to 2003 (Table 4.12) shown gradual improvement indicating that the finished goods are sold faster without remaining as inventory for longer period.

Table 4.12: Inventory turn- over ratio (ITR) of BRPL during 1998 to 2003

(Rupees in Millions)

Financial Year	Sales Revenue	Gross Profit	Finish Goods	Inventory Turn-over Ratio (Times in a year)
2002-03	18615.30	3077.06	1039.30	**15.0**
2001-02	11949.52	(3102.07)	865.09	**17.4**
2000-01	12430.85	(573.98)	1160.88	**11.2**
1999 - 00	13814.73	318.47	1334.84	**10.1**
1998 - 99	9608.19	351.15	876.40	**10.6**

Note: Figure shown under bracket indicates loss

Inventory turn-over ratio (ITR) = Cost of goods sold / Average finished goods stock

Cost of Goods Sold = Sales revenue – Gross profit

Sources: 26th , 27th , 28th and 29th Annual Report 1999-00 of Bongaigaon Refinery & Petrochemicals Ltd.

From the above table it is evident that the products demand in the market is improving progressively.

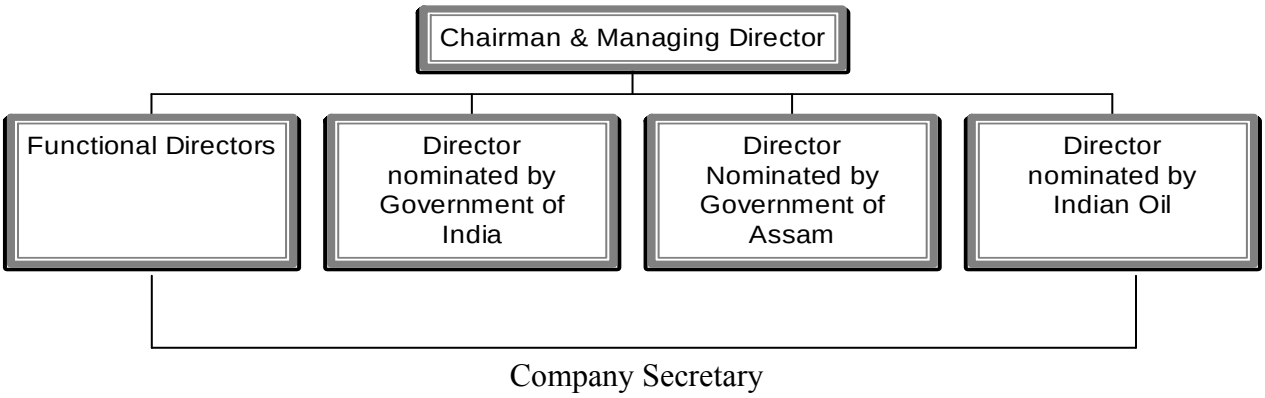
4.3 ANALYSIS OF ORGANISATION

4.3.1 Board of directors

The top governing body of BRPL consists of shareholders and is known as annual general meeting (AGM). Shareholders elect the central governing body: the board of directors. The philosophy of **corporate governance** of BRPL envisages transparency in all areas of operation, accountability, equity and reporting in its interactions with public, employees, government and stakeholders. It has been the constant endeavor of the company to maximize the value of its stakeholders. BRPL is committed to achieve complete compliance of conditions of corporate governance as enshrined in the agreement with stock exchanges.

Board of directors of BRPL formed with ten directors including C&MD of the company. It consists of functional directors, director nominated by the government of India (Central Government), director nominated by the government of Assam (State Government) and directors nominated by Indian Oil (IOC) and the company secretary. Chairman and managing director (C&MD) chaired the boards. C&MD along with other functional directors (Director - Operation, Director-Finance and Director –HR) are the full time directors and they are directly responsible for all corporate and business function operation. Company being the public enterprises to the government of India and it is located in the state of Assam; therefore both governments nominated their members as interested stakeholders of the company. BRPL is a subsidiary to IOC, public sector enterprises to the government of India. Two directors from IOC are also associated in the BRPL board of directors. Function of company secretary is to place the board agenda in the meeting. Board of directors are responsible for making corporate policy decision-making etc. However, before going for implementation the same has to be approved by the board of directors of IOC. Implementation of decision often takes long time due to long approval procedures by both BRPL and IOC boards. Board of directors meeting held at least once in every three months. Structure of board of directors of BRPL is shown in the figure 4.1 below:

Figure 4.1: Board of directors of BRPL



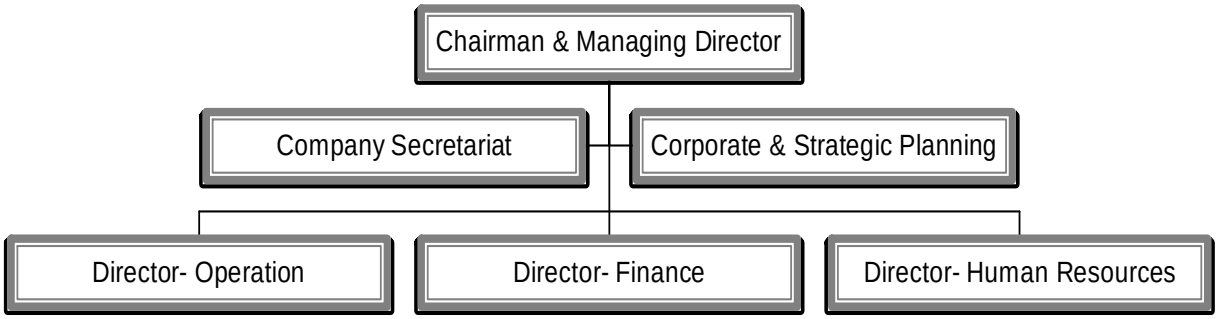
Source: Author

The decision making process of board of director is taking long time. This is the basic problem of existing in BRPL.

4.3.2 Corporate office and its inter-relation with functional divisions

Corporate office consists of the office the C&MD, all functional directors, company secretariat (CS) and corporate and strategic planning (CSP). Company secretariat is responsible for preparing boards agenda and maintaining all the records related to boards proposals, policy decisions etc. while corporate and strategic planning (CSP) department is responsible for preparation of strategic planning of the corporation. They are directly reporting to C&MD. Structure of BRPL corporate office is shown in the figure 4.2 below:

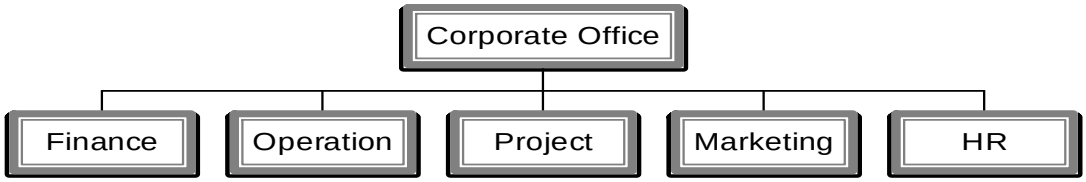
Figure 4.2 Corporate office of BRPL



Source: author

Inter-link between the corporate office and the functional divisions that are involved in business operation of the corporation are shown in the figure 4.3 below:

Figure 4.3 Inter-link between the corporate office and the functional divisions of BRPL



Source: author

Functional divisions are attached to functional directors and divisional heads are reporting to functional directors. In order to maintain and for continuous improvement in the business activities the corporation formed two high level committees. First one is management committee and another one is operation committee. Management committee is formed with the members of consists of all functional directors and the divisional heads not below the level deputy general manager (DGM). This committee conducted meeting once in every month and the meeting is chaired by the C&MD. Operation committee is formed with the members of consists of all functional directors and the divisional heads and departmental heads. This committee is also conducted meeting once in every month and the C&MD or the

senior most director of the corporation chairs the meeting. The basic aims and objectives of these meetings are to review the business strategies, business functions of the corporation and to percolate the necessary information and the guidelines to the respective divisional and departmental heads. These systems proved to be very effective in order to maintain timely flow of information in both ways and in maintaining continuous improvement in business functions operation.

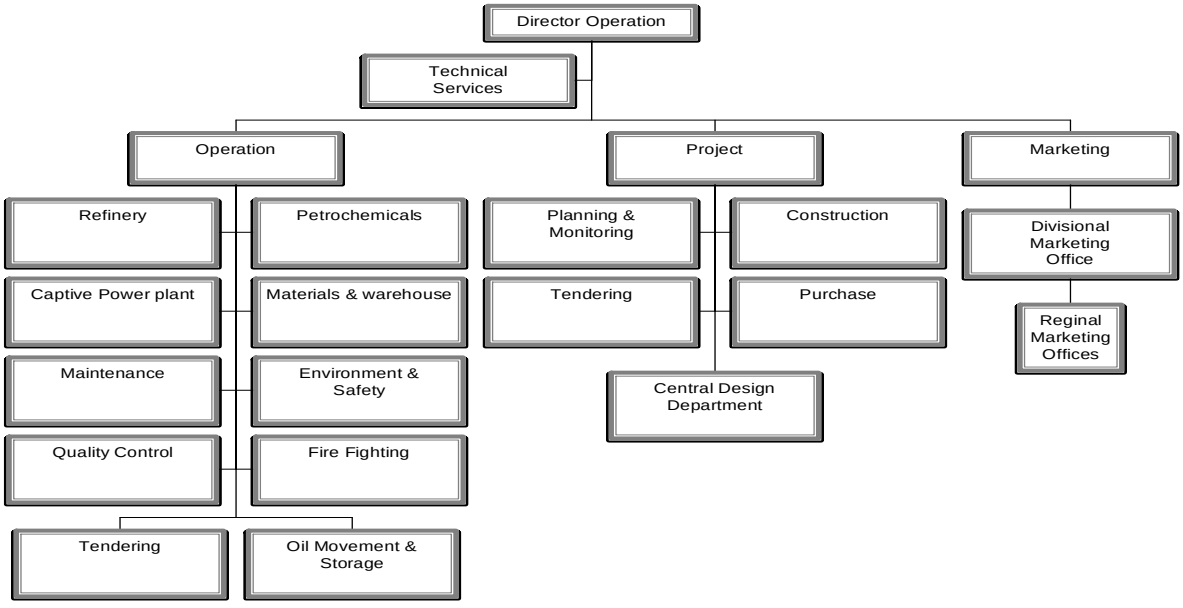
4.3.3 Functional divisions and departments

Divisional heads that is reporting to respective functional directors heads functional divisions. Each functional division are again divided into numbers of departments, which are headed by the head of the departments. Inter linkage of the functional divisions; their departments along with functional directors and their functions, responsibilities are detailed below:

4.3.3.1 Functional areas under Director – Operation

Functional heads of productions, projects and marketing are reporting to director-operation. Functional areas under director – operation is shown in the figure 4.4 below:

Figure 4.4 Functional areas under Director – Operation



Source: Author

Operation division basically consists of production sectors and it's associated other departments. Production sectors are refinery operation and petrochemicals operation including PSF section. **Refinery operation** is responsible for the operation of refinery units. Refinery units consists of two Crude Distillation Units (CDU–CDU-II & I), Kerosene Treating Unit (KTU), two Delayed Coker Units (DCU-I & DCU-II) and Coke Calcination Unit (CCU). In addition to that refinery operation involves in utility services like cooling water, firewater, drinking water, compressed air etc. BRPL is treating effluents in Waste Water Treatment Plant (WWTP) and this treated water is further retreated in Tertiary Treatment Plant (TTP)

and finally used as cooling water make-up. The basic philosophy of recycling treated water is to reduce to raw water consumption and avoid land and water pollution and also to minimise ground water table depletion. Refinery operational activities involve storage and handling of crude oil to all the above operational activities and they are responsible for ensuring quantity and quality of petroleum products, cooling water, compressed air, effluent etc. **Petrochemicals operation** is responsible for operation of the petrochemicals units consists of Xylene plant, DMT plant and PSF plant. PSF plant operation and maintenance are combined together for the convenient of plant operation and maintenance. All the production units are responsible for maintaining quality of the products as per ISO-9000 standard. On the job training is a part and partial of the operation activities.

BRPL is having its own **Captive Power Plant (CPP)** with 3X 16 Mega Watts (MW) power generation capacities in order to cater the power and utility steam requirements. In addition to above one five MW diesel generating set (DG Set) also available as a stand by in order to provide power supply for quick start-up of units during total power shut down or to fulfil the emergency needs. CPP department is responsible for operational activities of above units.

Materials and ware house department (M&WH) is responsible for purchase, supply and storage of equipments, spare parts, chemicals etc., requiring in plant operation and maintenance. There responsibilities lies from collecting indents, floating enquiry, placement of purchase order, ensuring timely supply materials in order to avoid any interruption in plant operation as well as maintenance activities and to store it properly. M&WH department has to ensure optimum stock of all necessary items so that inventory can be maintained at minimum.

Environment department is increasingly gaining importance, as industries are responsible for maintaining stringent environmental standards. Safety is another important aspects, which must be ensured in all fronts of activities of business functions. Environment and safety department has the responsibility to ensure meeting the environmental standards as per ISO-14001 and to ensure following of safety rules in all fronts. Similarly, fire fighting department has the responsibility to fight with any fire and emergency situation in the plant. Both the department are conducting training and awareness program in order to achieved their desired goal.

Maintenance is a supportive division of production units. BRPL is having well-established **maintenance department**. Maintenance is basically divided into four main departments namely mechanical, electrical, and instrumentation and plant civil maintenance. These departments are again sub-grouped based on the production and utilities units' requirement as refinery maintenance, petrochemicals maintenance, CPP maintenance, offsite & utilities maintenance and central works-shop (CWS).

Maintenance group in all the units is responsible to carry out maintenance activities in their respective areas. Central work shop (CWS) is a common place for all the maintenance groups to carry out repair works. It consists of all mechanical, electrical and instruments sections.

Maintenance planning and preventive maintenance are also included within CWS. CWS is basically supportive department of maintenance division.

BRPL is having well-equipped **quality control department**. This department monitors the products quality and certify finish products before despatching to customers. Oil movement and storage department is responsible for storing (intermediate and finish products), blending and despatching to customers. This department maintains close contact with quality control department in order to certify and delivery of products.

Tendering department involves in inviting and awarding tenders for the jobs related to plant operation like house keeping contracts, mechanical, electrical, instrument and civil maintenance contracts etc.

Technical services department is basically performing co-ordination job. This department is basically grouped into two. Planning and co-ordination section is responsible for preparation of production and product despatch planning. They are also responsible for collecting information relating to plant operation, production, maintenance, products movement etc. and to prepare MIS report for management appraisal. They are also responsible for correspondence with ministry and various organisations in regards to plant operation. Another section is process engineering. This section study the plant performance, conducted test run of production units in association with operation department. They are responsible for providing necessary technical suggestion in regards to operation of the plant. This section performs energy audit in the plant and prepared analytical reports on monthly basis.

Project division consists of project planning and monitoring, tendering, purchase, construction and central design department.

Project planning and monitoring department is responsible for development of project planning networks and monitoring the project. In addition to above they are responsible for preparation of annual project budget and help in indenting and procurement. Project planning department deals with the consultant firms in order to ensure schedule progress of the project. In order to appraise the project status, planning and monitoring department circulate monthly MIS report to the management. This department does all correspondence with ministry in regards to projects. The **Project tendering department** deals all tendering activities of the projects. **Purchase department** deals with the purchase activities relating project. **Project construction department** is sub-grouped to civil, mechanical, and electrical & instruments. All the construction activities of projects and maintenance of township are dealt by this department. **Central design department** (CDD) involves in designing of plant layout, modification etc. As such existing project set-up is not adequate for handing major or mega projects. Experience personnel from different departments are attached in the project division in case such a situation.

Marketing division of BRPL deals with only petrochemicals products. IOC markets petroleum products. The divisional marketing office is situated in at Dhaligaon, Assam along

with the corporate office. The company is operating its petrochemicals marketing business from the divisional office and regional offices at Delhi, Mumbai, Coimbatore.

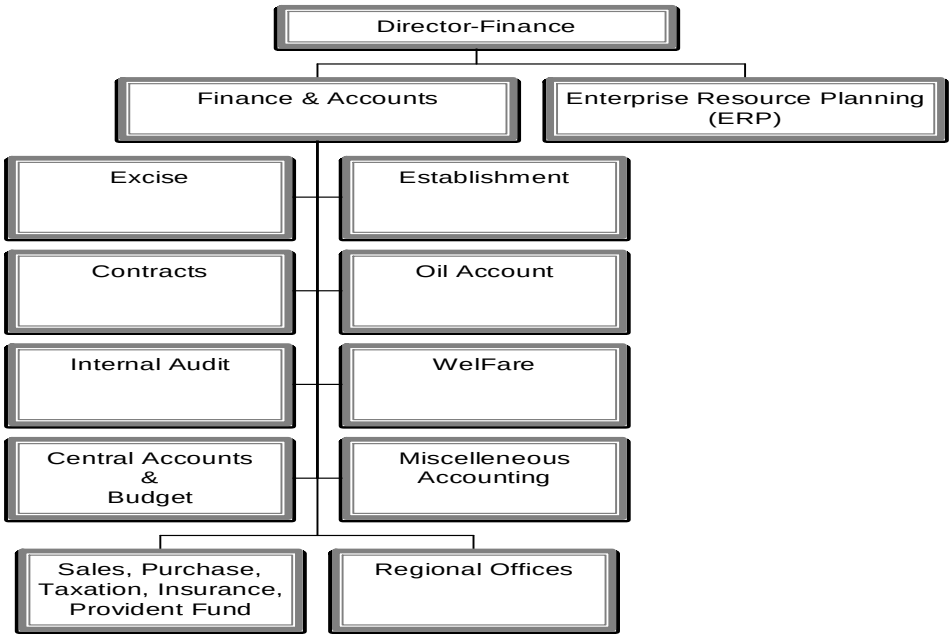
4.3.3.2 Functional areas under Director – Finance

Functional heads of finance and account and enterprise resources planning (ERP) are reporting to director-finance. Functional areas under director – finance is shown in the figure 4.5 below:

Finance and account division consists of excise, establishment, welfare, sales- purchase-taxation- insurance- provident fund, contract, oil account, internal audit, central account & budgeting, miscellaneous accounting and regional account offices.

Excise department deals with the excise and customs, government taxes related matter of the corporation. **Establishment department** deals with employee's salary, loan, provident fund gratuity, medical referral etc. **Welfare** deals with the welfare funds and expenses.

Figure 4.5 Functional areas under Director – Finance



Source: Author

Sales- purchase-taxation-insurance-provident fund department deals with the payment related to purchase and sales, statutory taxes, insurances and Provident Fund trust etc. **Contract department** deals with payment to work contract. **Oil account** department deals with calculation of crude oil supply and production. Based on the calculation of this department all financial transaction of crude oil and products are made. **Internal audit department** is authorised to conduct audit of all the accounts of the company. This department is responsible for reporting any un-eventualities, malpractices, and irregularities in accounting to the management. **Central account and budgeting department** is responsible compilation and allocation of budget to all the department/ division of the corporation. This

department prepared monthly MIS report regarding the company's expenditure in different heads. They are also responsible for co-ordinating with government audit team. **Miscellaneous account department** deals with the miscellaneous expenditure of the company like travelling expenses, medical bills, impress money etc. and the **regional account offices** deal with all the accounting activities connected to their regions.

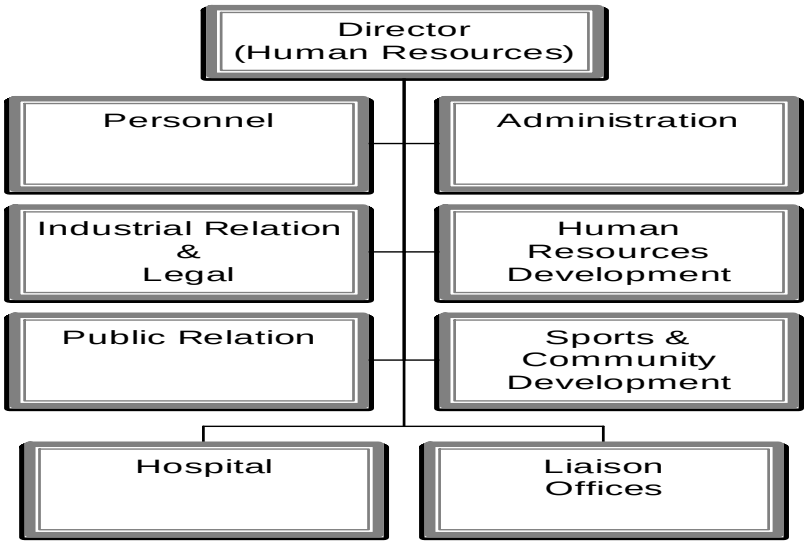
Enterprise resource planning (ERP) recently introduced and the ERP project activities are on going.

4.3.3.3 Functional areas under Director – Human Resources

Functional heads of human resources division is reporting to Director (Human Resources). The departments and their functional areas are shown in figure 4.6 below:

Personnel department deals with establishment, recruitment of manpower, employee's welfare, promotion transfer etc. This department is responsible for maintaining employees personal records, statistics, their performance records etc. Administration department deals with office and employees' accommodation, canteen, liveries transportation etc. Industrial relation and legal (IR & Legal) department deals with industrial relations/disputes, any legal and policy matter of the company. Human resources development department (HRD) conducts training, symposium, workshops etc., and public relation department liaisons with public. This department is responsible for releasing company's journals, bulletins and activities related to protocols and ceremonies and ceremonies of national importance.

Figure 4.6 Functional areas under Director – Human Resources



Source: Author

Sports and community development deals with the employee's sports, entertainment and activities related to grand of funds to various organisations for the development of the community as a social welfare measure. BRPL is having its hospital to take care of the health

of the employees and their family. Company's liaison offices are situated at Guwahati, New Delhi, Kolkata and Mumbai.

Considering the nature of the organisation and its business function, the existing organisational structure is adequate for smooth functioning.

4.3.4 Analysis of organisation culture

BRPL provides a stable environment in which employees can develop and exercise their skills. The company has provided township to all the employees adjacent to the factory premises. All essential infrastructure facilities like schools, hospitals, clubs, play ground, parks, communication facilities, electricity, water etc. are available in the township. Celebrating various festivals within the township by employees along with family with the support of management is a distinctive feature of BRPL, Which help in building good inter-personal relationship. People as an individual are rational and supportive to each other. Most of the employees are working in the company for more than ten to fifteen years. The company annually conducts long service award ceremony as a recognition and honour to employees for their distinctive and loyal services to the company. Employees are skilled to their jobs due to the fact that they are experience for long period and also the company recruits on the basis of requirement in the jobs. Employees normally tend to stay in the organization due to stable environment.

Management is concerned about the development in the business environment and always adaptable to change. This may causes resentment among employees. Inter-departmental relationship of the company is not very much applicable. **Most often their rivalry affects the performance of a department as well as individuals.** This not only delays the whole process but also damage the working environment. For example, most often plant operation suffers due to different in opinion of operation and maintenance group. This may happen due to various reasons but ultimately it may cause many problems such as equipment damages, energy loss, and fire in the plant, product quality deterioration or even emergency shutdown of the plant. In all are contribute to the losses.

4.3.5 Organisational processes

Planning and decision-making process of BRPL can be broadly divided into corporate and business function level. Corporate planning and decision making process is strategic based on the study of environment and the strength and weakness of the organisation however in functional level it is tactical and operational. Management is basically following MBO for organising, leading and controlling the organisation.

BRPL being an industry with more than thirty years of experience is well **organised**. However, the company still need to improve in certain areas like performance evaluation of individuals and comparing with another of same level is difficult task. Even though there are criteria of evaluation but it depends on person-to-person, who does the evaluation. Different departments perform different activities, similarly different individuals perform different

activities within the department and all the activities are important for different purposes, therefore judging the performance of individuals become more complicated. So unless there is a standard tool for measuring each and every activity and some how make it comparable to each other, it is not possible to measure the performance of individuals. Measurement of individual performance is important in order to maintain sound promotion policy, carrier development or even for justify reward and punishment of individuals etc**.** Imperfect or wrong performance judgment affects the work culture of the company therefore bringing improvement in those areas is necessary.

It is some time seen un-uniform work distribution within the departments as well as individuals in BRPL. Within the company, from one department to another or even person to person in the same department, it is seen that someone is over loaded with his works and some one is sitting idle. **This is a cause for de-motivation and frustration.** It can happen due to unhealthy management practice i.e. manager may not know how to managed the situation or his is least bordered. But such a situation easily destroys the work culture of the company and its long run affect is serious.

The company is **leading** with no significant growth during last few years. The employee's strength of the company is 1800. Fresh recruitment of personal during last few years was insignificant. In fact, The Company made a manpower assessment, which shows that the existing manpower strength is higher compared to size of the company. In order to retrench manpower, company has implemented voluntary retirement scheme (VRS) and it is partially successful. Due to its location in the remote part of the country, have many disadvantages especially in transportation of goods and products. However, the attitude of state and central government as well as the public towards the company is good and the company enjoys the status of one of the biggest public enterprise in the region. In fact, considering socio-economical need of the region, the government of India relaxed the excise duty to the tune of 50% on petroleum fuel products to all the North Eastern refineries as a temporary arrangement in order to keep the refineries operating and BRPL is one of the beneficiaries of this government scheme.

The company has infrastructure for communication network, however the system is under utilized or not properly utilized. For instance, to have an idea of day-to-day business operations, all divisions/departments can be circulated MIS report in the standard formats, identifying all the critical activities and critical issues. **This can make the communication system faster and helps in taking faster decision-making process** and also reduces paper consumption drastically. However, the reasons for under utilization of communication network may be due to traditional, individual departments or managers have owned application system and data lock in them causing **islands of information** in the organization. Inadequate knowledge on computer operation in certain level of employees and lack of effort in developing centralized information sharing system are also another reasons for under utilization of this system.

Production units of BRPL are manned with long experienced executives and operators. From the viewpoint sufficient operation and plant safety deployment of experienced personal is desired. However, they are less exposed to other business function of the company and their long period working in operation becomes the cause of monotony due to having no innovation and newness. Existing maintenance groups are set-up based on separate operation plants. Since the maintenance activities of plants are not uniform all the times, therefore the resources allocated in some area remain un-utilized at the same time some area face shortage of resources. This affects overall maintenance performance.

For measuring and to bring improvement in each of the activities, BRPL try to follow standard method and bench marking. **Standardization and benchmarking** is done based on comparison with some data like global or country average or with the industry that has excellent performance records. If such data is not available, it is done based on in-house analysis of time and resources utilization. However, there is not centralized effort to follow the above system in BRPL and therefore most of the time the system is by-passed as a result, performance and efficiency could not be judged properly and scope for further improvement remains un-noticed.

CHAPTER 5

OIL INDUSTRY SCENARIO

5.1 GLOBAL OIL INDUSTRY SCENARIO

As at the end 1999, the world had proven oil reserves of a little over 1,055 million barrels (about 140,900 MMT) while that of gas, a little less than 140 trillion cubic meters. At the current rate of production, oil reserves are likely to last for about 40 years and natural gas reserves for about 65 years. The reserves are however unevenly distributed with the Middle East countries together holding 65% of oil and 34% of the gas reserves. Oil & Gas constitute a significant 63% of the primary energy consumption. The situation in Asia/ Australia is different with coal still remaining the primary source of energy. However, the scenario is rapidly changing, for instance in the last decade, oil & gas consumption has grown at more than 70% in the Asia-Pacific region vis-à-vis 15% in the rest of the world (excluding the former Soviet Union, where the growth rate has been negative). **The Asia pacific region is thus gaining importance in the oil & gas map, with India and China together accounting for 47.50% of the total demand in this region**. **A**verage per capita consumption of energy vis-à-vis hydrocarbons (kgOE) in the world and the Asia Pacific region and some of the important European countries are shown in the table 5.1

Table 5.1: The Average per capita consumption of energy vis-à-vis hydrocarbons (kgOE)

Country /Region	Primary Energy	Hydro-Carbons
World	1454	927
India	285	113
China	688	169
Pakistan	264	231
Bangladesh	81	80
Japan	3962	2520
U.K.	3856	2719
Germany	4102	2539

Source: British Petroleum Statistics -1998

In the last decade, natural gas has taken the lead in growth and in the emerging energy scenario, it is seen as an environment-friendly substitute for relatively scarcer oil. Consumption of natural gas has grown by more than 26% vis-à-vis 15% in consumption of oil. Considering the fact that oil & gas would be available in the foreseeable future without any constraint, oil & gas would continue to be the most widely traded energy source. World oil trade is estimated to be 38 million barrels a day. The inherent advantages of oil & gas in

terms of versatility ease in handling & transport and adaptability to new environmental standards would make it the most preferred fuel. As of 1999, the world's total refining capacity was close to 82,861 thousand barrels a day. The refinery throughput in the year 1999 stood at 71,126 thousand barrels a day, representing an average capacity utilization of about 85%. Oil and gas prices are closely linked to the policies and capacity utilization of OPEC. Oil prices, which were reasonably flat at about USD 3 per bbl, till early seventies spiked to more than USD10 per bbl in 1973-74 and again to more than USD 25 per bbl in 1979-80. The prices have thereafter hovered between USD 15-25 per bbl but for a short blip in 1990 due to Iraqi invasion Kuwait. In 1998, oil prices crashed once again to a decade low of USD 11 per bbl due to excess capacity, poor off-take and an overall slowdown in world economies. Subsequently OPEC reduced crude output, which escalated prices from USD 11 per bbl in 1998 to USD 32 per bbl in June 2000. Later though OPEC increased production twice (by 1.45mbpd in September '99 and 0.7mbpd in June'00), the quantum was insufficient to tame prices. The world market now banks on increased supply from non-OPEC countries namely Mexico, Oman and Norway. Natural gas prices on the other hand have also increased from USD1.5-2.5 per mbtu in 1998 to USD 4.36 per mbtu in June 2000. Huge disparities exist in the price of natural gas not only between countries but also within a country.

5.2 OIL INDUSTRY SCENARIO IN INDIA

Excluding the non-commercial energy sources like wood and animal waste, the primary energy consumption in India was 285 kgOE in 1998 as against 5800 kgOE in North America. Coal continues to be most important source of energy, constituting more than 56% of the total energy consumption though there is a conscious shift towards oil as alternate fuel. The over all demand for oil products increased from 74 MMTPA in 1996 to 90 MMTPA in 2000. At current levels the estimated demand by 2005 is expected to be around 114 MTPA while the refining capacity would be around 155 MMTPA. The Indian downstream (refining and marketing) oil industry promises to be one of the most attractive growth markets in the world, in the coming decades**. It is emphasized that investment of Rs. 2500 billion in the refining, Rs. 210 billion for pipelines and Rs. 1350 billion in the marketing infrastructure would be required by 2025.** The Hydrocarbon vision 2025 formulated by the Ministry of Petroleum & Natural Gas in 1999 emphasized 90% self-sufficiency in middle distillate (Diesel/kerosene group) in the sector with an appropriate mix of national oil companies, foreign players and private Indian players so as to develop a globally competitive industry. According to this report, the country would require 277 MMTPA petroleum products and 358 MMT refining capacity is to be build up in order to achieve 90 % self-sufficiency. Corresponding increase in pipeline and marketing infrastructure would also be required. There are 26 sedimentary basins in India covering an area of 1.78 million sq km, of which 1.46 million sq km are onshore and 0.32 million sq km are offshore in water with up to 200 meters in depth. The total prognosticated reserves are estimated at 20 bbl of oil, but till date only 27% of this has been discovered. A total of 5.4 bbl of oil (about 732 million metric tonne) has thus been discovered, with the annual production in the region accounting to 35-40

MMTPA. These reserves are likely to last for the next 20 years. **However, the current production level of 35 MMTPA would be highly inadequate,** especially once the planned refining capacities come on stream a large portion of the crude would need to be imported. As of 1995, the proved gas reserves were about 660 billion cubic meters (BCM) while production as of 1999 was 27 BCM. At current production levels these reserves are likely to last for about 30 years.

Prior to April 2002, the price of petroleum products was controlled under the Administered Price Mechanism (APM). Since abolition of the APM, subsidies on these products are being progressively reduced thus exposing Indian companies to global market forces. National oil companies are divesting equity to the private sector in a phased manner.

5.2.1 Refining capacities

The refining capacity of the country has increased from 69.14 MMTPA in financial year 1999 to 109 MMTPA as of January 2000 i.e about 2.7% of the world refining capacity. Currently there are about 18 refineries are in operation with total refining capacity of about 112.34 MMTPA in India. Refineries and their processing capacities as shown in table 5.2 below;

Table 5.2 Refineries and their processing capacity of India (Year 2003)

Refinery	Refining capacity (MMTPA)
(a) Public/ Joint Sector	
IOC, Guwahati	1.00
IOC, Barauni	4.20
IOC, Gujarat	13.70
IOC Haldia	4.60
IOC, Mathura	8.00
IOC, Digboi	0.65
IOC, Panipat	6.00
HPCL, Mumbai	5.50
HPCL, Visakh	4.50
BPCL, Mumbai	6.90
MRL, Chennai	6.50
CRL, Cochin	7.50
BRPL, Assam	2.35
MRL, Narimanam	0.50
NRL, Numaligarh	3.00
ONGC, Tatipaka	0.08
MRPL, Mangalore	9.69
Total (a)	**85.42**
(b) Private sector	
RPL, Jamnagar	27.00
Total (a+b)	**112.34**

Source: http://petroleum.nic.in/psinst.htm

Refineries with lower processing capacities are facing problem in competing with the refineries of higher processing capacities. Moreover, these refineries are older and still operating on comparatively older technology. Refining capacity of BRPL is 2.35 MMTPA, which is only 2.09 percent on the existing total refining capacity in India. Accept few, most of the refineries are bigger compared to BRPL. Recent refineries are built with latest technology and they are bigger in size. Reliance Petrochemicals Limited (RPL), a private sector concern has set up refinery with 27.0 MMTPA capacity with latest state of art technology. Competing with such giant private competitor is become a major concern to Indian public sector refineries now.

5.2.2 Consumption pattern of petroleum products

Petroleum products play a vital role in every industry in the world. The present consumption pattern of important petroleum products in India is shown in the tables 5.3 below.

5.2.2.1 Liquefied Petroleum Gas (LPG) consumption pattern in India

Consumption of LPG for using as domestic cooking fuel is increasing due to strict government restriction for cutting woods and scarcity of other non-commercial fuel to use as a domestic cooking fuel. Table 5.3 shows the LPG consumption pattern in India

Table 5.3 LPG consumption pattern in India (Basis: Year 2000)

Particulars	Quantity in '000 tonnes	% consumption
Domestic	2762	80.4
Commercial	654	19.1
Others	18	0.5
Total Consumption	**3434**	**100**

Source: CMIE

Domestic consumption of LPG is 80% of the total consumption. The population of the country is about one billion and only 38 million people are using LPG. This indicates that the consumption of LPG in the domestic front is likely to be increased in near future.

5.2.2.2 Naphtha consumption pattern in India

Naphtha consists of paraffin, naphthanic and aromatic hydrocarbons. High aromatic naphtha are generally used by fertilizer industries and low aromatic by petrochemical industries. The consumption pattern of naphtha in India is shown in the table 5.4 below:

Table 5.4 Naphtha consumption pattern in India (Basis: Year 2000)

Particulars	Quantity in '000 tonnes	% consumption
Petrochemicals	831	24.4
Fertilizers	2495	73.4
Others	74	2.2
Total Consumption	**3400**	**100**

Source: CMIE

Use of naphtha in the fertiliser sector is very high compared to other sectors due to high demand of fertilizer in the agriculture sector.

5.2.2.3 High Speed Diesel (HSD) consumption pattern in India

The consumption pattern of HSD in India is shown in the table 5.5 below:

Table 5.5 HSD consumption pattern in India (Basis: Year 2000)

Particulars	Quantity in '000 tonnes	% consumption
Transport	24742	47.5
Roads	2156	4.1
Railways	1398	2.7
Other transports	21188	40.7
Plantation	621	1.2
Power	229	0.4
Mining & Quarry	585	1.1
Iron& steel	106	0.2
Textile	227	0.5
Engineering	172	0.3
Others	693	1.3
Total Consumption	**52117**	**100**

Source: CMIE

Consumption pattern shows that HSD is basically used as a fuel for different transports (Rail, road, water transport). Use in other sector is negligible. Transport industry in India is growing faster and accordingly consumption of HSD is also increasing.

5.2.2.4 Light Diesel Oil (LDO) consumption pattern in India

LDO is relatively cheaper petroleum product compared to HSD. Consumption pattern of LDO in India is shown in the table 5.6 below

Table 5.6 LDO consumption pattern in India (Basis: Year 2000)

Particulars	Quantity in '000 tonnes	% consumption
Transport	83	7.4
Shipping	62	5.5
Other transports	21	1.9
Plantation	35	3.1
Power	165	14.7
Misc. services	441	39.1
Chemicals	144	12.8
Engineering	124	11.0
Ceramics	34	3.0
Cement	17	1.5
Total Consumption	1126	**100**

Source: CMIE

LDO is used as fuel in almost every industrial sector. However, power, chemical and engineering industries are the major user of LDO. Because of comparatively lower price to HSD its use for miscellaneous services is high.

5.2.2.5 Low Sulphur Heavy Stock (LSHS) consumption pattern in India

HSLS is heavier and comparatively relaxed quality petroleum product. Price of LSHS is generally lower compared to HSD and LDO. Use of LSHS in the thermal power plants and similar other small power generating plant is popular in India particularly due to its lower price compared to other fuels. With the growth of power requirement the consumption of LSHS is also increasing in the power sector. Fertilizer is another sector where LSHS is extensively used in the country due to the same reason. Fertilizer is also a growing sector in India and therefore consumption of LSHS in this sector is increasing .Use of LSHS in other sectors like chemicals and textile are also significant. Other use of LSHS is in plantation, iron and steel industries and various miscellaneous services

The consumption pattern of LSHS in India is shown in the table 5.7 below.

Table 5.7 LSHS consumption pattern in India (Basis: Year 2000)

Particulars	Quantity in '000 tonnes	% consumption
Transport	2	0
Plantation	27	0.7
Power	1624	40.1
Misc. services	141	3.5
Fertilizers	1001	24.7
Chemicals	483	11.9
Textile	276	6.8
Iron& steel	102	2.5
Others	396	9.8
Total Consumption	**4052**	**100**

Source: CMIE

5.2.2.6 Furnace Oil (FO) consumption pattern in India

FO is used in various sectors. However fertilizer sector is the major user of FO. The consumption pattern of FO in India is shown in the table 5.8 below

Table 5.8 FO consumption pattern in India (Basis: Year 2000)

Particulars	Quantity in '000 tonnes	% consumption
Transport	440	8.5
Shipping	323	6.2
Other transport	117	2.3
Plantation	188	3.6
Power	580	11.2
Misc. services	685	13.2
Fertilizers	1507	29.0
Chemicals	563	10.9
Textile	375	7.2
Iron& steel	409	7.9
Total Consumption	**5187**	**100**

Source: CMIE

FO and LSHS are heavy petroleum products relatively similar it their quality. They can be used as replacement to one another. However FO is widely used in different sectors but most predominantly in fertilizers, power and chemicals industries.

5.2.2.7 Year-wise consumption of petroleum products in India

Overall consumption of petroleum products (light distillate, middle distillate and heavy distillate) is increasing steadily at a steady rate (CAGR 5 %) during 1996 to 2000. Similar trend is continuing. Looking at this trend Indian petroleum market is promising. Year-wise consumption of petroleum products (Light, middle and heavy distillate) in India during 1996 to 2000 is shown in the table 5.9 below. For detail product-wise consumption of petroleum products in India refer annexure 1.

Table 5.9 Year-wise consumption of petroleum products in India

('000 Tonnes)

Year to 31 March	1996	1997	1998	1999	2000	CAGR (%)
Light distillates	13144	14384	15742	17958	20473	11.7
Middle distillates	45459	48544	49716	51686	54259	4.5
Heavy distillates	13915	14296	14380	15122	15919	3.4
Imports by Private Party	0	1944	4452	5796	5639	30.5
Total demand	72518	79168	84290	90562	96290	5.0

Source: Ministry of Petroleum & Natural Gas

The table 5.9 indicates that the consumption average growth rate (CAGR) of **light distillate** is 11.7 % annually. Trend shows constant and steady increase of consumption during the year 1996 to 2000. The most prominent growth in consumption is naphtha (21.4 %) and LPG (11.9%), while it is 6% in case of MS.

CAGR of **middle distillate** is 4.5 % annually. Trend shows constant and steady increase of consumption during the year 1996 to 2000. All middle distillate products consumption are increasing, however most prominent growth in consumption is SKO (3.6%), HSD (5.1%) and LDO (3.6%).

CAGR of **heavy distillate** is 3.4 % annually. Trend shows constant and steady increase of consumption of all heavy distillate products. Most prominent growth in consumption is bitumen (9.5 %), lubes (6.5 %) and LSHS (3.3 %).

5.2.3 Year-wise imports of crude oil and petroleum products in India

Country's demand for crude oil and petroleum oil and lubricant (POL) products are more than production. Crude oil import trend of India shows overall annual growth of 13.54 during the years 1995 to 2000, however, the import of POL in the decreasing trend. Reason for higher demand of crude oil is due to increase in consumption of petroleum products, however, reduction in import of POL products is due to increase in overall refining capacity in the country during recent years. This indicates that overall demand of the petroleum products in

the country is increasing. Simultaneously refining capacity of the of the country is also increasing but still it has to be increased. Table 5.10 shows year-wise import of crude oil and POL (Light, middle and heavy distillate) products from different countries during 1995 to 2000.

Table 5.10 Year-wise imports of crude oil and petroleum products in India

('000 tonnes)

Year to 31 March	1995-96	1996-97	1997-98	1998-99	1999-00
(A) Crude Oil	27342	33906	34494	39808	44989
POL Products					
Light Distillates	1117	1490	1422	1947	1618
Middle Distillates	17950	18037	17942	16308	10900
Heavy Distillates	1267	738	166	525	549
(B) Total POL Products	20334	20265	19530	18780	13067
Total (A+B)	47676	54171	54024	58588	58056

Source*:* Ministry of Petroleum & natural Gas

Import of crude oil was ever increasing, however overall import was low during 1999-00 compared to 1998-99 due to reduction in import quantity of light and middle distillate products. For detail imports of POL products (product-wise) refer annexure 2.

5.2.4 Year-wise export of crude oil and petroleum products

Table 5.11 below shows year-wise export of crude oil and finished petroleum products to different countries. India never was exported crude oil. Export of light distillate and heavy distillate products is in decreasing trend due to increase of domestic market demand. Export of middle distillate products fairly remains constant. The trend also indicative of present and future exports potential of POL products from India.

Table 5.11 Year-wise exports of crude oil and petroleum products in India

('000 tonnes)

Item ('000 tonnes)	1995-96	1996-97	1997-98	1998-99	1999-00
(A) Crude Oil	0	0	0	0	0
POL Products					
Light. Distillates	3017	2643	2098	779	284
Middle. Distillates	396	437	491	531	586
Heavy. Distillates	22	82	361	91	29
(B) Total POL Products	3435	3162	2950	1401	899
Total (A+B)	3435	3162	2950	1401	899

Source*:* Ministry of Petroleum &Natural Gas

CHAPTER 6

SWOT ANALYSIS OF BRPL

6.1 BRIEF ON SWOT ANALYSIS

BRPL being associated with the oil refining business, there are certain common factors that are influencing in the overall business performance to all the players. Crude oil is non-renewable natural resources found in the earth crust on which all refineries are dependable. World crude oil reserve is limited and it is predictable that with the present pace of consumption pattern it may last for about another 40/50 years. Although the price of crude oil is internationally standardized but due to its limited availability and having no other alternative, price fluctuated frequently base on supply and demand characteristics. Subsequently price of products also fluctuating based on supply and demand characteristics.

The upstream industries i.e. the suppliers always enjoy advantage of market in terms of pricing and quality of crude oil. **Refinery products are generally standardized and there is not much scope for product innovation and differentiation from the viewpoint of its quality and patterns.** However, demand of petroleum products is all the time high, because of having no alternative to customers. Petroleum refining business involves huge capital investment therefore any decision for investment cannot be taken in short term basis even though changing business environment is quite visible.

In chapter 4, business and organization analysis of BRPL has been made in detail. Business analysis includes analysis of purchasing, production, and sales, financing and personal. Analysis of purchasing includes the various practices adopted in BRPL and advantages and disadvantages of existing practices. Analysis of production covers physical performance and yield pattern of refinery during the year 1998 to 2003. The analysis covers various reasons for capacity under utilization, technological bottleneck and effect of fuel and loss in the profitability of the refinery. Analysis of sales covers trends of products sales during 1998 to 2003 and its contribution in the profit and loss of the company. The analysis also includes demand and supply trend in India. Financial analysis covers current, debt-equity and equity assets analysis for the years 1998 to 2003 to find out the liquidity, assets-liability and financial stability position of the company. Analysis of personals includes analysis of personal their behavior, structure and relationship with the organization.

Analysis of profitability of BRPL during 1998 to 2003 includes analysis of ROR and ROA to find out the return of assets of the company. In the process analysis of net profit ratio and inventory turnover analysis is also made to find out the net earnings on net sales and operating efficiency of the company.

In the chapter, analysis of organization is made which includes analysis of organizational structure, culture and process. In the organizational structure corporate governance and formation of divisions and department and their functions are discussed. Under organizational culture, prevailing organizational cultural environment, their positive and negative impacts on organization are discussed. Under organizational process such as planning, organizing, leading and controlling of BRPL have been discussed.

In chapter 5, we are trying to analysis the external environment in connection with oil industries. This includes global oil industry scenario and its present trend. Finally, discussion on present oil industry scenario in India has been made. Under oil industries in India, discussion has been made on refining capacity of the country, technology, supply-demand and export-import of crude oil and POL products.

Considering all the above factors SWOT matrix of BRPL is prepared.

6.2 SWOT MATRIX OF BRPL

Strengths are the following:

- Infrastructure facilities available for receiving crude oil from Upper Assam oil field, Krishna - Godavari basin and imported crude oil from Haldia Port.
- Developed adequate infrastructure facilities for delivery of products by road, rail and pipeline
- Developed infrastructure for internal and external communication
- Own power generation to cater the requirement and not dependent on external power suppliers
- Work force of the company are skilled to their jobs
- Employees are co-operative and rational
- Employees resides in well developed township, which is just near by the factory
- Present financial condition of the company is in improving trend
- Holding ISO 9000 certificate for its quality products
- Holding ISO 14001 certificate for maintaining better environment management practices.
- Own well-developed quality control department for quality testing and certifying of products
- Management is committed for brining improvement

Weaknesses as a result of our analysis:

- The company has relatively lower crude processing capacity
- Technology is relatively older compared to new entrants
- Lower capacity utilisation due to lower crude allocation from upper Assam oil fields and Krishna Godavari basin, product containment problem or forced plants shutdown due to technical reasons

- Crude oil and products pipelines are owned by other companies
- High cost involvement in transportation of crude oil due to its distance from the oil fields.
- Petroleum oil marketing is dependable to Indian Oil
- Geographical location of the plant is not favourable for transportation of raw materials and products
- Inter departmental rivalry
- Improper maintenance planning and resources mobilisation affect the performance of maintenance activities
- Employees do not consider energy conservation/optimisation activities as a part of their jobs.
- Method of standardisation or system of bench marking of activities is not always based on time and manpower evaluation resulting un-uniform work distribution to individuals, which affects the work culture and also affecting overall company's performance
- No standardise tools applied for measuring performance of individuals
- System does not take care of reward and punishment
- Majority of middle management personals are computer illiterate
- Existing online information system is incapable of timely communication of important business information to the management. Management has to depend on delayed information of furnished by divisional/ departmental heads leading to delay in decision-making process
- Employees' strength is higher compared to size of the company
- Annual performance appraisal system most often does not reflect actual performance of individuals.

Opportunities are the following:

- High potential for market growth in India
- High potential for importing products as the refinery is situated at the close vicinity of Bhutan, Bangladesh and Nepal
- Marketing tie-up for petroleum products with Indian Oil
- Company is a subsidiary to Indian Oil Corporation, which is holding major market share in refining as well as in marketing sectors of petroleum products.
- Public image to the company is good.
- Company is one of the biggest public enterprises in the region.
- Cheap labour force available
- Attitude of central as well as state government towards the company is favourable. Government of India relaxed excise duty on petroleum fuel products to the tune of 50% as a temporary arrangement in order to keep the refinery operating.

Major threats are the following:

- Competitors are giants

- Refinery is located in flood-ridden area.
- On and off political disturbance in the region
- Threat from new entrants
- Stringent environmental regulation
- New technology adapted by the competitors
- Market driven pricing mechanism

SWOT analysis of BRPL reveals that the company has adequate infrastructure facilities for supply of crude oil and dispatch of finish petroleum products by all available modes of transport (rail, road and pipeline). Even though the company does not have its own marketing network for selling or distribution of petroleum products but marketing tie-up with Indian Oil, which is enjoying biggest market share in petroleum refining and marketing business in INDA, is providing the company a great advantage. In fact BRPL being the subsidiary to Indian Oil, marketing tie-up is a good deal. The company has qualified long experienced skilled and rational work force. As a welfare measure of employees, the company provided well-developed township facilities with hospital and other recreational facilities like clubs, canteen, parks, playgrounds etc. The company's medical policy for the employees and their family is attractive. All these facilities hold good for retaining experience work force of the company.

Petroleum refining is a continuous process and any interruption in the operation causes serious loss to the company. Uninterrupted and stable supply of electricity is essential for continuous refinery operation. To avoid such situation, the company has developed own captive power plant (CPP), which is adequate to cater the power and steam requirement for entire refinery and township. The company is holding ISO-9000 and ISO-14001 certificate for its products' quality and environment friendly industry. Attitude of state and central government as well as the public towards the company is good and enjoy the status of one of the biggest public enterprise in the region. However, the refining capacity of the company is 2.35 MMPTA only, which is 2.09 percent of total existing refining capacity of the country. The company has never processed oil in full capacity. The basic cause for capacity under-utilization was due to shortage of crude oil and forced shut down of the plants due to products containment problem or technical reasons. Further no significant growth/expansion in the business during last few years and resulting stagnation in promotion and employees' personal development. Processing cost of the refinery is higher compared to new refineries with higher processing capacity and new technology. Even though infrastructure facilities for supply of crude oil is available but the transportation cost of crude oil is still higher due its distance from the supply points. Transportation of others goods and supply of finished products also time to time interrupted due to flood and on and off political disturbance in the region. Geographical location of the industry is not favorable for transportation of goods. Stringent environmental standards are another threat on which company has already invested a huge sum of money and still need to be invested more in order to comply with the continual upgraded environmental standards.

BRPL has never been achieved full capacity utilization in the history. Past records shows that the basic reasons for lower capacity utilization were primarily due to shortage of crude oil and forced shut down of the plants on account of products containment problem or due to technical failure.

Energy conservation and optimization in consumption is one of the most important aspects, which has direct impact to profit, and loss of the company. BRPL has put many efforts to make most energy efficient plant by way of optimization and brining awareness among the employees. A considerable amount has already invested but still there is scope for improvement.

The company has infrastructure for communication network, however the system is under utilized or not properly utilized. For instance, to have an idea of day-to-day business operations, all divisions/departments can be circulated MIS report in the standard formats, identifying all the critical activities and critical issues. This can make the communication system faster and helps in taking faster decision-making process and also reduces paper consumption drastically. However, the reasons for under utilization of communication network may be inadequate knowledge on computer operation in certain level of employees and also may be due to lack of centralized effort to develop a system.

Within the maintenance groups, due to improper planning or may be due to existing set-up of separate maintenance groups for separate operation plants, resources utilization is not uniform. In some area resources remain un-utilized but at the same time some area face shortage of resources. This affects overall maintenance performance.

For measuring and to bring improvement in each of the activities, one must follow standard method and bench marking. Standardization and bench marking should be done based on comparison with some data like global or country average or with the industry that has excellent performance records. If such data is not available, it should be done based on in-house analysis of time and resources utilization. However, most of the time BRPL does not follow such system, as a result, performance and efficiency could not be judged properly and scope for further improvement remains un-noticed.

Un-uniform work distribution to individuals harms the company in many ways. Within the same company, from one department to another or even person to person in the same department, it is seen that someone is over loaded with his works and some one is sitting idle. This is a cause for de-motivation of the employees those who are really hard working. It can happen due to unhealthy management practice i.e. manager may not know how to managed the situation or his is least bordered. But such a situation easily destroys the work culture of the company and its long run affect is serious.

Performance evaluation of individuals and comparing with another of same level is difficult task. Even though there are criteria of evaluation but it depends on person-to-person, who does the evaluation. Different departments perform different activities, similarly different

individuals perform different activities within the department and all the activities are important for different purposes, therefore judging the performance of individuals become more complicated. So unless there is a standard tool for measuring each and every activity and some how make it comparable to each other, it is not possible to measure the performance of individuals. Measurement of individual performance is important in order to maintain sound promotion policy, carrier development or even for justify reward and punishment of individuals etc. Imperfect or wrong performance judgment affects the work culture of the company. BRPL still to think and bring improvement in this area.

Most of the problem is related to system improvement, which can be handled by proper management practices. However, some investment in restructuring and system atomization also involve in certain areas. Based on the above analysis, the measures that need to be taken to bring overall improvement in the profitability of the company are discussed in chapter 7.

CHAPTER 7

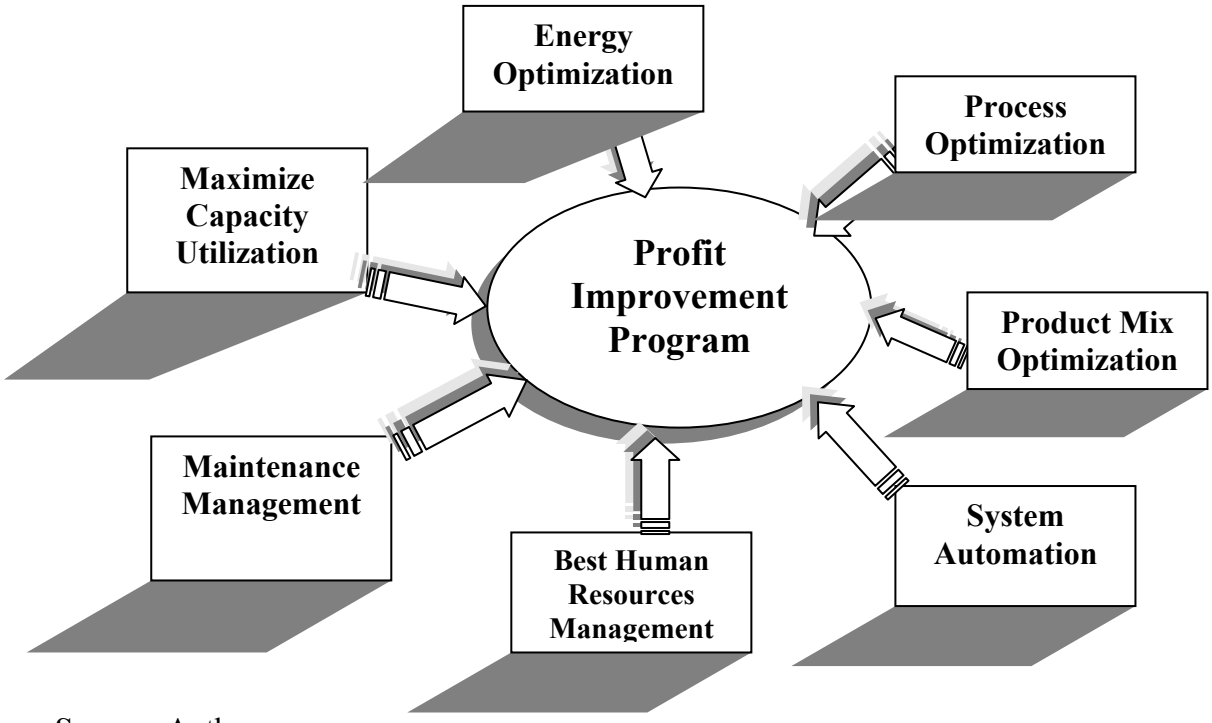
PROPOSED PROFIT IMPROVEMENT MEASURES IN BRPL

In chapter 6, we have determined and analyzed about the strength, weakness, opportunity and threats (SWOT analysis) of BRPL. The analysis shows many interesting areas where company can bring improvement by adopting various approaches in the business function. In this chapter, I will try to discuss about how to bring improvement on the issues discussed in the previous chapter by developing methodology, which can help in eliminating the problems and improve profitability of BRPL. Best on the analysis, profit improvement program of BRPL should involve the following:

- Maximization of capacity utilization
- Energy optimization,
- Process optimization
- Product optimization
- Maintenance Management
- System automation
- Best human resources management.

A model of profit improvement program of BRPL is derived as shown in figure 7.1 below:

Figure 7.1 Model of profit improvement programme in BRPL



Source: Author

Correct and systematic approach on profitability improvement programs can help in achieving desired goal. An approach to profitability improvement programs and their possible implementation in BRPL is discussed below. In these areas we can expect most benefits in a shorter period of time.

7.1 MAXIMIZATION OF CAPACITY UTILIZATION

Lower capacity utilization is directly affecting the profitability of the company. BRPL has never been achieved full capacity utilization in the history. Past records shows that the basic reasons for lower capacity utilization was primarily due to shortage of crude oil on account of lower allocation from Upper Assam oil fields as well as from Krishna Godavari basin. BRPL stopped importing crude oil due to comparatively higher costs also one of the reasons for capacity under-utilization. Forced shut down of the plants due to products containment problem or technical reasons also another reasons. To achieve full capacity utilization of the plants, BRPL has to emphasize on the following three points:

- Ensure availability of crude oil
- Products containment problem should be avoided
- Emergency plant shutdown should be avoided

In order to cater the problems and to maximize the capacity utilization of the plants, BRPL can take the following measures:

- Supply of crude oil from all possible sources i.e. Upper Assam oil fields, Krishna Godavari basin and imported crude oil should be explored in order to bring maximum crude oil, limiting to its capacity of 2.35 MMTPA.
- Adequate fund should be kept reserved against crude oil so that supply is not interrupted in any eventuality.
- A realistic annual production and dispatch plan with month wise breakup should be prepared in line with the existing capacity of the plants. While preparing annual production and dispatch plan the following points should be considered:
    - Study the past history of Indian petroleum market
    - Make a projection of future market demand (product-wise) based on the previous years' annual market growth rate
    - Study the seasonal fluctuation of products demand in India; monthly processing plan should be made accordingly.
    - Production and dispatches should be planned in such a manner, so that product containment problem can be avoided. Try to maintain optimum inventory build-up.
- Deviation from planning should be analyzed and necessary corrective action should be taken to minimize it.

- Focus on maintaining good condition of the plants by best operation and maintenance practices in order to avoid forced shutdown due to technical reasons.
- Condition monitoring of the plant should be improved in order to maintain sound condition of the plant and to take all precautionary measures before the situation of force shutdown arises.

Best operational practice and products and process optimization process are synonymous, which will be discussed under this heading on and off. However, best maintenance practices will be discussed subsequently under improvements of maintenance management in this chapter.

7.2 ENERGY OPTIMISATION

Refinery is an energy intensive industry, where electricity, steam, fuel oil & gas are used as the main sources of energy. In BRPL, fuel oil & gas are produced as by products in the refinery. Fuel oil and gas are used as a heating medium of boilers in the captive power plant (CPP) to generate steam and in the furnaces of process plant to heat the hydrocarbon to accomplish the distillation process. Steam generated in the boiler is used to run steam turbine of CPP to produce electricity. Part of the generated steam is used to meet the requirement in different process plants and utility areas. Electricity is used for lighting, Air conditioning, running of motors, pumps, compressors etc. As the basic source of energy is hydrocarbon (petroleum oil) only, saving in energy directly contributes to reduction of operational costs and minimize fuel and loss (OFL) and thereby improve profitability of the company. **An assessment made in BRPL shows that one percent reduction in OFL contributes rupees 40 millions to the company**.

Implementation of energy optimization program needs systematic approach, which involves the following steps:

- Identification of areas of main energy consumption
- Identification of areas of main energy losses
- Analysis of causes of energy losses
- Estimate of the losses
- Find measures for eliminating energy losses
- Estimate cost involvement
- Design a program for continual improvement
- Take decision for implementation

Unless persons have knowledge about the area where the energy is consumed, what is consumption pattern, whether it is as per normal compared to national or international standard or not. What are areas where excess energy is consumed, what might be the causes and what is the quantum of losses? It is not possible to find out a solution for eliminating the

loss and to design a continual improvement program. Energy optimization programs should be easily understandable and can bring improvement by best operational, maintenance and human resources management practices within the existing costs of business operation.

The approach that needs to be taken to find out the area and causes of energy losses and the action to be taken for elimination is shown in figure 7.2 below. However, this approach is exclusively designed for BRPL and may not fit to other refineries.

Figure 7.2 Systematic energy optimization approach

Energy	Area of consumption	Causes of excess energy consumption	Measures for elimination losses
Electricity	Lighting, fan, etc.	• Use of high energy intensive lighting accessories • Use of light and fan carelessly • Improper fittings and connection	• Use energy efficient electric accessories, equipments at home and offices etc. • Replace improper fittings and loose electrical connection • Conduct awareness program on energy conservation
	Running of motor/ compressor	• Use of energy intensive pumps, motors, compressors etc. • Improper maintenance of pumps, motors and compressors • Running of pumps, motors, compressors etc. during non-productive hours	• Replace energy intensive pumps, motors, compressors etc. • Proper lubrication of pumps, motors and compressors' bearings • Stop non-productive running of pumps, motors, compressors etc.
	Running of Air Conditioning systems	• Use of air conditioning system in non-air tied room	• Make air condition room air tied.
	Running of computers, other home appliances, office equipments, etc.	• Running of computers, office equipments etc. during non-productive hours.	• Conduct awareness program and try to Cultivate habit of energy saving among employees

Continuation of figure 7.2

	Electric heating systems (geyser, heater etc.)	• Running heating system during non-productive hour	• Avoid running of heating systems during non- productive hour. • Conduct awareness program
	Running of other electrical equipments / tools etc	• Improper maintenance of equipments/ tools • Running equipments during non-productive hour	• Maintenance of equipments/ tools as per recommendation. • Avoid running of equipments/ tools during non- productive hour.
Steam	Process plant	• Steam leakage inside process plant • Un economized use of steam for equipment heating, oily surface cleaning etc. • Improper steam line insulation • Use of excess steams in the burner of furnaces and boilers. • Excessive use of steam in other process areas • Improper condensate draining system	• Inspection and timely maintenance for arresting steam leakage. • Equipment heating with steam should be constantly monitored • While cleaning oily surfaces, steam line should not be kept open unattended. • Use of proper insulation materials during construction and during repairs. • Proper atomization of burners in boilers and furnaces • Use steam optimally in the production processes. • Use proper and efficient steam traps. Non-functioned steam traps should be replaced immediately.

Continuation of figure 7.2

	Running of Steam Turbine in power plant	• Steam leakage inside power plant • Excess use of steam in the Turbine • Improper steam line insulation	• Inspection and timely maintenance for arresting steam leakage. • Optimize use of steam in the Turbine • Steam lines should be insulated properly during construction and during repairs.
	Crude and products heating in the tanks	• Line loss • Leakage in steam lines • Improper insulation • Improper condensate draining system	• Design optimal size and lengths of steam lines during construction phase • Inspection and timely maintenance for arresting steam leakage. • Use of proper insulation materials during construction and during repairs. • Use proper and efficient steam traps. Non-functioned steam traps should be replaced immediately.

Continuation of figure 7.2

Fuel oil & gas	Boiler and Furnace	• Scaling inside heating coils • Improper insulation of heaters • Excessive soot deposition in the chimney • Poor maintenance of burners • Improper atomization of burners	• Scaling inside the heating coils of boilers and furnaces should be removed periodically during maintenance. • Insulation inside the boilers and furnaces should be maintained as per industrial standard. • Prepare schedule for blown off deposited soot from the chimney of boilers and furnaces and implement strictly. • Make a schedule for burner cleaning and implement strictly. • Atomized burners properly.
		• Water and salt content in hydrocarbon causes excess consumption of fuel oil & gas in the furnaces	• Water and salts content in the hydrocarbon should be minimized to the extend possible.

For effective energy optimization, the role of the manager is to identify critical areas of energy losses, analysis them and bring improvement. In order to bring improvement, detail estimates of losses and potential saving need to be carried out for which manager has to affix responsibility to a person competent to perform the jobs. Responsible person has to carry out his assigned job and suggest for measures. Based on that manager will draw action plan for implementing the measures. The measures may be system improvement within the department or by other means like conducting awareness among the employees. Implementation of the schemes may require investment. In such a case manager has to prepare a realistic cost estimate based on the feedback and get it approved for implementation. Person responsible has to follow-up and takes necessary controlling measures after implementation of the scheme/ measures. He has to report to managers on the outcome after detail analysis of actual and estimates and tries to find out the cause of deviation if any, based on which manger takes decision. The process should be continued for continual improvement in energy saving.

7.3 PRODUCTION PROCESS OPTIMISATION

Process optimization is another way of bringing improvement in plants operation, maximization of high value products by minimizing low value products, energy input and reduce hydrocarbon losses. Process optimizations can be done by systematic study of the process involved in the operation. Effort for process optimizations process should be a continuous as a profit improvement measures.

In BRPL, study has been made in different areas; some of them have already been implemented. One of such most successful schemes implemented in BRPL is desalter in CDU. By installing **desalter in both CDU-I & II**, water content in Assam crude, which is usually fluctuating from 2 % to even 8% and causing serious unstable condition in the main fractionation column of CDU and resulting products quality problem has been reduced to the level of 0.2%. Salt content in the crude oil also reduced significantly. This has stabilized the operation of the main fractionation column, which has helped in achieving desired product yield and quality. Besides, due to lower salt content, corrosion level in the DCU furnace reduced thereby increased the run length DCU and also reduced the maintenance cost. Another successful scheme implemented in BRPL was **low-level heat recovery (LLHR).** By installing LLHR in CDU-I, considerable amount of waste heat is recovered from the products rundown streams and utilized to preheat crude oil. This has saved considerable amount of energy in the form of heat and contributed in improvement of profitability of the company.

There are still many such scopes for improvement in BRPL, which can be achieved by process optimizations. In my opinion, these can be explored and implement by systematic study and action. Implementation of production process optimization programme needs systematic approach, which involves the following steps:

- Identify areas where process optimization is possible
- Study about the technical and economical viability
- Study about environmental impacts
- Make projection of likely benefits
- Estimate cost involvement
- Take decision for implementation based on the above analysis
- Implementation of measures
- Analysis of results

Some of the areas where process optimization program can be implemented in BRPL are highlighted below:

7.3.1 Maximization of hot RCO feed to DCU

DCU feed can be supplied to the unit directly from CDU as hot RCO (temperature about 120

^{o}C) and also from the RCO storage tank as cold RCO (80 ^{o}C). Feeding cold RCO to the DCU plant has two implications with respect to energy consumption.

- Pumping cost of RCO from the storage tank
- Additional energy consumption in the furnace to raise the temperature from 80 ^{o}C to 120 ^{o}C. This is besides the cooling water consumption for cooling the hot RCO to 80 ^{o}C for sending the same to storage tank.

An in-house estimation has been made by BRPL to find out the energy saving by maximizing hot RCO feed to DCU. Crude throughput basis was taken only 1.6 MMTPA in spite of having design capacity of 2.35 MMTPA in order to find out minimum energy saving by implementing this scheme. Estimate shows 65 SRFT of energy equivalent of power saving on account of pumping cold RCO from the tanks and 435 SRFT of energy equivalent of fuel for raising cold RCO (detail calculation shown in annexure 4). Corresponds saving on this account is about rupees 4.0 million per annum without any additional cost involvement. The above estimation is exclusive of cooling water cost for cooling the hot RCO before transporting to the RCO storage tanks.

Above saving is possible by effective production process optimization for which a standard guideline has to be framed, giving all the technical details and the method of implementation. Technical information can be generated after conducting necessary trail-run in the units. The role of the manager is to ensure implementation by fixing responsibilities to competent person and monitor the key parameters involved in the process. He is also responsible for analyzing result, estimating benefit from the scheme and giving decision as a when needed.

7.3.2 Minimization of yields of RCO in CDU and that of heavy ends in DCU

A study on minimization of RCO yield in CDU and its effects in the distillate yield in DCU has been carried out in BRPL. RCO being the feed to DCU unit, minimization of RCO yield in CDU significantly affects the distillate yield in DCU. Study shows net gain of Rs 56.27 per MT of crude by reducing RCO yield and higher end, which equivalent to total annual net gain of Rs.90.03 Million. Detail calculation is shown in annexure 5.

Above saving is possible by effective production process optimization in CDU and DCU units for which a standard guideline has to be framed, giving all the technical details and the method of implementation. Technical information can be generated after conducting necessary trail-run in the units. The role of the manager is to ensure implementation by fixing responsibilities to competent person and monitor the key parameters involved in the process. He is also responsible for analyzing result, estimating benefit from the scheme and giving decision as a when needed.

7.3.3 HSD yield improvement

HSD constitutes primarily of two components, viz. Straight Run Gas Oil (SRGO) and Coker Kerosene. Earlier, the yield of Coker Kerosene was about 26% on DCU throughput having an end point of about 320 ^{o}C. However, there was a complaint from customers on HSD quality w.r.t. total sediments. For improvement of HSD quality, BRPL reduced the end point of Coker Kerosene to about 270-280 ^{o}C resulting in a reduction in yield of Coker Kerosene by about 4% and corresponding reduction in HSD production.

In order to improve the quality as well as the quantity of HSD, rigorous study has been made in laboratory and identified few stabilizer additives that are effective in reducing the total sediment in HSD even for Coker Kerosene with end point greater than 300 ^{o}C. This would enable to increase the yield of Coker Kerosene to the earlier level of 26% thereby increasing the production of HSD without compromising its quality w.r.t. total sediment.

Other ways of maximizing HSD production by process optimization as mentioned below:

- Optimization of gas oil yield from atmospheric distillation column of CDU. This not only increases HSD yield, but also reduces RCO generation thereby reducing DCU throughput and resultant increase in distillate products.

Stringent cut of SRGO and Coker kerosene and continuous doping of additives in the rundown need constant monitoring of production process. The role of the manager is to discuss with the concern technical personals of CDU and DCU units to find out the best way of implementing scheme and ensure implementation by fixing responsibility to competent persons and coordinate with them. He has to monitor the key parameter as a controlling measure Another responsibility of the manager is to ensure availability of the additive in order to maintain continuity of doping for which timely action of procurement need to be taken with the purchase department. He is also responsible for analyzing result, estimating benefit from the scheme and giving decision as a when needed.

7.3.4 LPG maximization

At present market scenario, demand of LPG is very high. Its price is also higher than the Naphtha price. Therefore, maximization of LPG production is very essential to increase the profit of the company.

At BRPL, the LPG recovery facilities have been provided in CDU and DCU units. In CDU, LPG is recovered from unstabilisaed Naphtha and DCU plant, LPG is recovered from Coker Off gas & unstabilised naphtha.

In CDU, the basic process for recovery of LPG from unstabilised naphtha is to separate C_3 / C_4 components in naphtha stabiliser column under control operating pressure and temperature.

Hence, in order to maximise LPG recovery from CDU the following operating parameters of stabiliser need to be monitored on regular basis:

- Top and bottom temperatures of stabiliser.
- Stabiliser column pressure. Low pressure in the column will cause higher amount of hydrocarbons (propane and butane) to escape into fuel gas system and reduce LPG make.

In DCU, the basic process for recovering of LPG from coker off gases are to absorb heavier components of compressed coker gas with lean stabilized naphtha in a rectified absorber and separation of LPG components from unstabilised naphtha in a debutaniser. Hence, in order to maximise LPG recovery from DCU the following operating parameters of the absorber and debutaniser column need to be monitored on regular basis:

- Top pressure and temperature of absorber column.
- Tray 3 temperature of absorber column.
- Top and bottom temperature of debuatniser column
- Debutaniser column pressure.

Yield of LPG needs strict maintenance of operating parameter in CDU and DCU units. The role of the manager is to discuss with the concern technical personals to find out the best way of implementing scheme and ensure its implementation by fixing responsibilities to competent persons in CDU and DCU units. He has to coordinate with the persons responsible for the job and monitor the key parameters involved in the process. He is also responsible for analyzing results, estimating benefit from the scheme and decision making in order to explore possibilities of further improvement measures.

7.4 PRODUCT MIX OPTIMIZATION

In order to achieve maximum Refinery profit, it is essential to optimize the product mix considering the crude / product prices fluctuations and process changes. Due to volatility in the international market, there is always crude / product prices fluctuations and this necessitates process changes and optimization of product mix. In view of this, it is always necessary to plan refinery operation in such a way considering all available opportunities can derive that maximum profit and alternatives in the refinery configuration to arrive at optimum product mix.

- Maximization of high value products like LPG, MS, ATF, HSD etc.
- Production of high value specialty products
- Routing of intermediates streams to various finished products based on feasible alternate routings to different products and economics thereof.

- Optimization of severity of operations in units like Reformer unit to maintain better product mix and profitability.
- Optimization of secondary units throughputs
- Optimum product mix and profitability calculation
- Minimization of yields of RCO in CDU and that of heavy ends in DCU
- Supply – demand scenario
- Blending and optimization of product quality
- Minimization or elimination of quality give way

Implementation of products mix optimization in BRPL needs systematic approach, which involves the following steps:

- Study market value and demand of the products
- Estimate benefits out of product mix optimization of products
- Identify, production of which products are to be optimized by product mixture
- Identify possible innovation of new value added products
- Study, production of which products can be optimized
- Estimate the quantity
- Find methodology for implementation
- Study adequacy of infrastructures
- Estimate financial involvement
- Take decision for implementation based on the above analysis
- Implementation
- Analysis of results

Recent years the company has conducted study in various areas and their outcomes are as below:

7.4.1 MS maximization

MS maximization should be done based on the market demand. Price of MS is normally higher than Naphtha. In view of that MS production needs to be maximized to improve profitability.

At BRPL, MS production is maximized by processing wide cut Naphtha (105^0C to 150^0C) in the Catalytic Reformer in the Xylene plant in the MS mode of operation to produce C_5^+ reformate, which is then blended with Cracked Naphtha from DCU and SRN in a definite proportion to meet the MS quality with respect to octane number (RON 88) and Benzene content (3% by volume in Metros and 5% by volume in local). MS is produced with above blending component in the following ratio:

C_5^+ Reformate	: 55 % by wt.
Coker Naphtha	: 25 % by wt

SRN : 20 % by wt

The economics for MS maximization is shown below:

MS price = Rs 19,997 / MT (**Basis**: August 2002)
Naphtha price = Rs 11,330 / MT (-do-)

- 1 MT of Reformer feed Naphtha gives 0.9 MT of C_5^+ Reformate, which goes to MS pool.
- Gross value addition : Rs. (19997*0.9 – 11330)
  : Rs 6667 / MT Naphtha
  Fuel requirement : 0.13 MT / MT Naphtha
  i.e. 0.13 * 9440 = Rs 1227
  Net value addition: Rs (6667 – 1227) = Rs 5440 / MT Naphtha

  a. 0.9 MT of C_5^+ reformate can upgrade 0.74 MT of Coker Naphtha / SRN (0.9 / 0.55 * 0.45 = 0.74) in view of the blend ratio mentioned above.
  b. Value addition for upgrading CN / SRN : 0.74
  0.74*(19997 – 11330) = Rs 6414
  c. Total value addition: Rs (5440 + 6414) = Rs 11854 / MT Naphtha

The role of the manager is to monitor the price of naphtha, MS and calculate the benefit, which can be derived out of blending the above products with out compromising with the quality of the product. For which he has to discuss with concerned personals of the units, appraise them about the benefit, fixed responsibility to competent person and give decision for implementation. For controlling, manager has monitor key parameter, analyze results, estimate benefit and giving decision as a when needed.

7.4.2 HSD maximization

HSD maximization process helps in improving distillates yield and refinery profitability. At BRPL, HSD has the following blending components:

a) Straight run Gas oil (SRGO) fro CDU
b) Coker Kero from DCU
c) Kerosene feed (Kero-I /Kero-II) from CDU

HSD price (August'2002) with 50 % excise duty benefit will always be higher than Naphtha, SKO, ATF, LDO as shown below:

Price differential between HSD and Naphtha, SKO, ATF & LDO:

HSD – Naphtha : Rs/MT 3200.32 (**Basis:** August 2002)
HSD – SKO : Rs/MT 1563.10 (-do-)
HSD – ATF : Rs /MT 309.26 (-do-)
HSD – LDO : Rs/MT 3385.92 (-do-)

In view of the above price differential existing between HSD and other refinery products, it is essential to maximize the HSD production for refinery profitability improvement.

There are various ways to maximize HSD production as mentioned below: BRPL should study and take necessary step for implementation in order to improve the profitability of the company.

- Kerosene feed blending to HSD after meeting SKO & ATF production up to required level.

The role of the manager is to monitor the price differential of various products, which can be used for maximizing production of HSD and calculate the benefit, which can be derived out of blending the above products with out compromising with the quality of the product. For which he has to discuss with concerned personals of the units, appraise them about the benefit, fixed responsibilities to competent person and give decision for implementation. For controlling, manager has monitor key parameter, analyze results, estimate benefit and giving decision as a when needed.

7.4.3 LSHS up-gradation to LDO by pour point depressant (PPD)

A study has been conducted in laboratory to find a suitable blend for upgrading LSHS components to maximize LDO production by doping suitable pour point depressant (PPD). Four PPDs were tried in nine different blends. The study conclusively established that two of the PPDs were effective in certain blend of LDO in upgrading LSHS component (CFO). About 30% LSHS (in total LDO pool) can be upgraded by doping the above PPD.

Implementation of this scheme will improved the LDO yield and contributes in the profitability of the company with minimum additional costs. The role of manager is to ensure availability of the PPD in order to maintain continuity of doping for which timely action for procurement need to be taken with the purchase department and follow up the results.

7.4.4 Routing of intermediate streams to finish products

There are some low value intermediate products like Coker Fuel Oil (CFO), Coker Naphtha, Coker Kerosene in BRPL, which can be blended with high value products to improve profit. Routing of intermediate streams to different products is depends on factors like refinery economics i.e. how much the company can gain financially. What is the quality requirement of finished products and what is the requirement for blending the product, whether the company has the capability to do so?

Decision on proper disposal of streams is required to be taken based price difference between products, quality requirement and product demand in the market.

In general, there is flexibility in optimizing the product mix by selective routing of various streams depending on the profit margin linked with products and their respective demand so that overall profitability can be increased. This is however a short time measures. The role of the manager is to collect information on price of products, market supply-demand and formulate plan for implementation and take decision. He has to provide necessary resources, coordinate with the concern persons, fixed responsibilities to competent persons, monitor the activities, evaluate benefit out of implementation of the schemes and make decision.

7.5 IMPROVEMENTS IN MAINTENANCE MANAGEMENT

Maintenance is an associated supportive function of plant operation. Unless there is support from maintenance, operation of plant is not possible. Condition of the plant's health depends how properly it has been maintained.

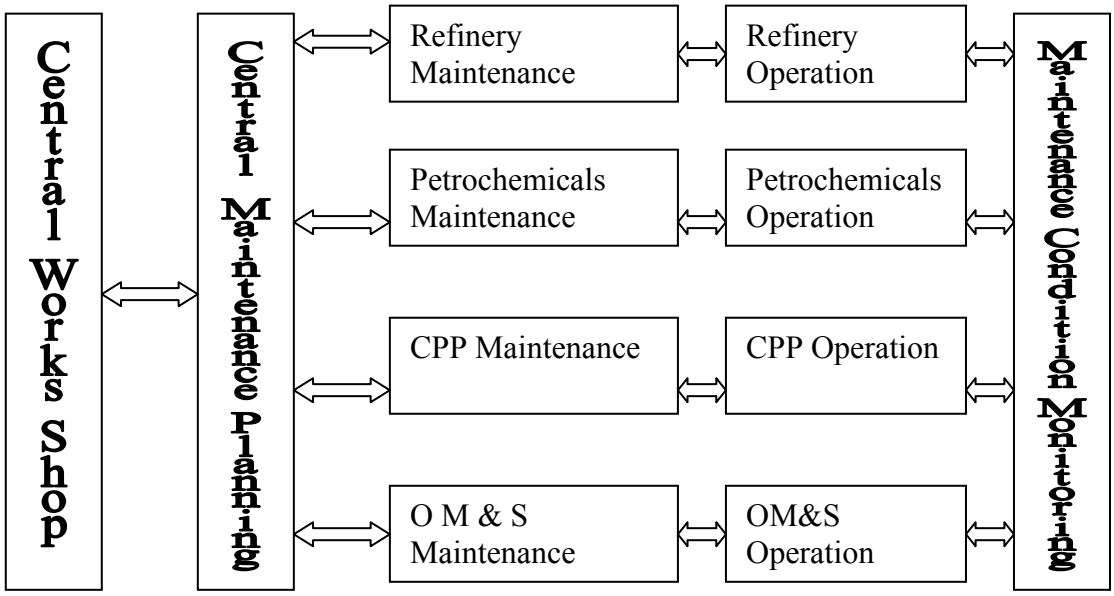
In BRPL existing maintenance division is grouped based on their disciplines (mechanical, electrical, instruments and civil) and except civil maintenance, others are regrouped based on area of operation. Existing maintenance-planning department of BRPL is just keeping records without much control over the system. As a result the divisional maintenance head overburdened with scattered information and activities of different areas and the possibility wrong decision-making increases. With the existing maintenance of BRPL, it is not possible to utilise resources uniformly. Because maintenance activities are unpredictable, it depends on the condition of the plants at that particular moment, so distribution of resources especially manpower to an area in a permanent nature is often wasteful or some times it is not adequate. The chances of equipment failure in the existing maintenance set up are more due to the above problem. In order to bring overall improvement in the total maintenance activities of BRPL, the following measures are suggested which will help in better organisation and control of maintenance activities by assigning responsibilities and optimised utilisation of resources.

The proposed maintenance management system to bring improvement by way of fulfilling the following purposes:

- To maximise utilisation of available resources
- To avoid unnecessary wastage of man-hours
- On-the job training to update job knowledge and personal development
- Bring uniformity in job distribution by mutual supporting system
- Faster maintenance approach
- New system will help in centralising the maintenance activities

- Improve information system
- Documentation system streamlined

Figure 7.3: Proposed model of maintenance management



Source: Author

To systematise the maintenance function in BRPL and to improve their effectiveness, a model of maintenance structure, their function and responsibility is proposed as shown in figure 7.3 above:

7.5.1 Proposed central maintenance planning (CMP) department

Proposed CMP will function directly under maintenance divisional head and senior or chief manager will assist him. The proposed central maintenance planning department (CMP) is to be structured as below:

- Senior or chief manager and his group will be officiating in general shift. Size and composition of the group will be determined based on the assessment of workload.
- CMP department will be the custodian of all the maintenance resources (work force and maintenance equipments etc.). They will maintain centralised resource pool.
- CMP department will allocate resources to field maintenance group from the centralised resources pool.
- One shift maintenance manager along with two supervisors (engineer /senior engineer) will be associated in each shift. Shift maintenance manager will report to senior/ chief manager.
- Work forces from the resources pool will be maintained separately for general shift and special shifts (morning, evening and night)

- Resources pool and resources under field maintenance groups will be under shift maintenance manager during special shift hours.
- Responsibility and authority of managers of deferent maintenance groups are well defined and the same will be determined by CMP. Based on that managers of different groups will organise maintenance functions of the areas assigned under him by sharing and fixing responsibilities with the persons under him. He will coordinate and use feedback system for controlling the activities and give decision.

The basic idea of central maintenance planning is to centralise maintenance function and to improve its effectiveness. Maintaining centralised resource pool can help in efficient utilisation of resources. Since people will have to work in different areas, they can gathering more experience and develop skill. Plant operation is a continuous process and therefore maintenance function has to run on shift basis in order to carry out the same at any point of time as and when needed. For overall improvement, CMP department should be given the following functions and responsibilities:

- Service of CMP department will be twenty-four hour basis.
- Maintain centralised resource pool and from the pool, work force and maintenance equipments etc. will be supplied to different field maintenance groups as per demand
- Co-ordination and providing assistance to field maintenance groups
- Co-ordination with central works shop for providing assistance to field maintenance groups.
- Prioritisation of maintenance activities
- CMP department will maintain on-line communication networks, which will be accessible to all the groups on twenty-four hour basis.
- Special shift group will be responsible for all the maintenance activities during the shift hours.
- General shift group will be responsible for:

    - Daily planning,
    - Brief daily situation to divisional head and take advise
    - Holding discussion with field maintenance groups
    - Resources allocation during general shift hours
    - Prepare shift-rota
    - Prepared MIS report
    - Conduct on the job-training program to general shift maintenance personals.
    - Documentation and record keeping
    - Arrangement for on the job training to maintenance personals
    - Development of methodology for measurement and standardisation of maintenance activities and its implementation
    - Maintain minimum stocks of spares

- Resources allocation from centralised resources pool or even from other field maintenance groups to different areas based on need basis during general shift hours.

7.5.2 Proposed central works shop (CWS) department

Proposed CWS consists of maintenance groups of mechanical, electrical and instrumentation disciplines. They are performing repair works of equipments and machineries and plays as a supportive department to the field maintenance groups. Even though different disciplines are involved but the department will run under single head of senior manager or chief manager level. The department will be responsible to carry out the following activities:

- Carry out all repair works
- Priority of the jobs will be given based on the instruction of CMP department
- Maintain and feed all the information in one line communication network
- Keeping all equipments of CWS properly and healthy condition
- Co-ordination with CMP and field maintenance groups

7.5.3 Proposed maintenance condition monitoring (MCM) department

Proposed MCM department will look after the condition of all equipment and machineries of the plants and will run under functional head of senior manager or chief manager level. The department will be responsible to carry out the following activities:

- Prepare schedule for condition monitoring of equipments (plant-wise)
- Carry out condition monitoring activities as per the schedule
- Maintain close co-ordination with the operation groups
- Maintain close co-ordination with CMP
- Frequency of monitoring of equipment and machineries will be determined based on the condition of the equipments.
- Keep maintenance records of all equipments
- Monitoring report of equipments should be feed in the communication networks along with their recommendations.
- Analysis the behaviour of equipments and placed findings as and when required

7.5.4 Field maintenance groups (Refinery, Petrochemicals, CPP and OM&S)

Proposed field maintenance groups (Refinery, Petrochemicals, CPP and OM&S) will run under separate functional head of senior manager or chief manager level. These departments are grouped with minimum manpower and resources in order to meet the immediate maintenance support in the respective plants. Size and composition of the groups will be formed based on the practical assessment of normal work volume and the same will be determined by CMP. Even though different disciplines are involved but the department will run under single head of senior manager or chief manager level. The department will be responsible to carry out the following activities:

- Collect work order from the plant
- Carry out maintenance activities in the plant
- Place demand for additional resources from CMP in case needed
- Isolation and transportation of equipments from plant to CWS and taking back to plant and re installation after repair
- Coordination with CMP and operation department
- Keeping records and feed all information in the communication networks

7.6 SYSTEM AUTOMATION

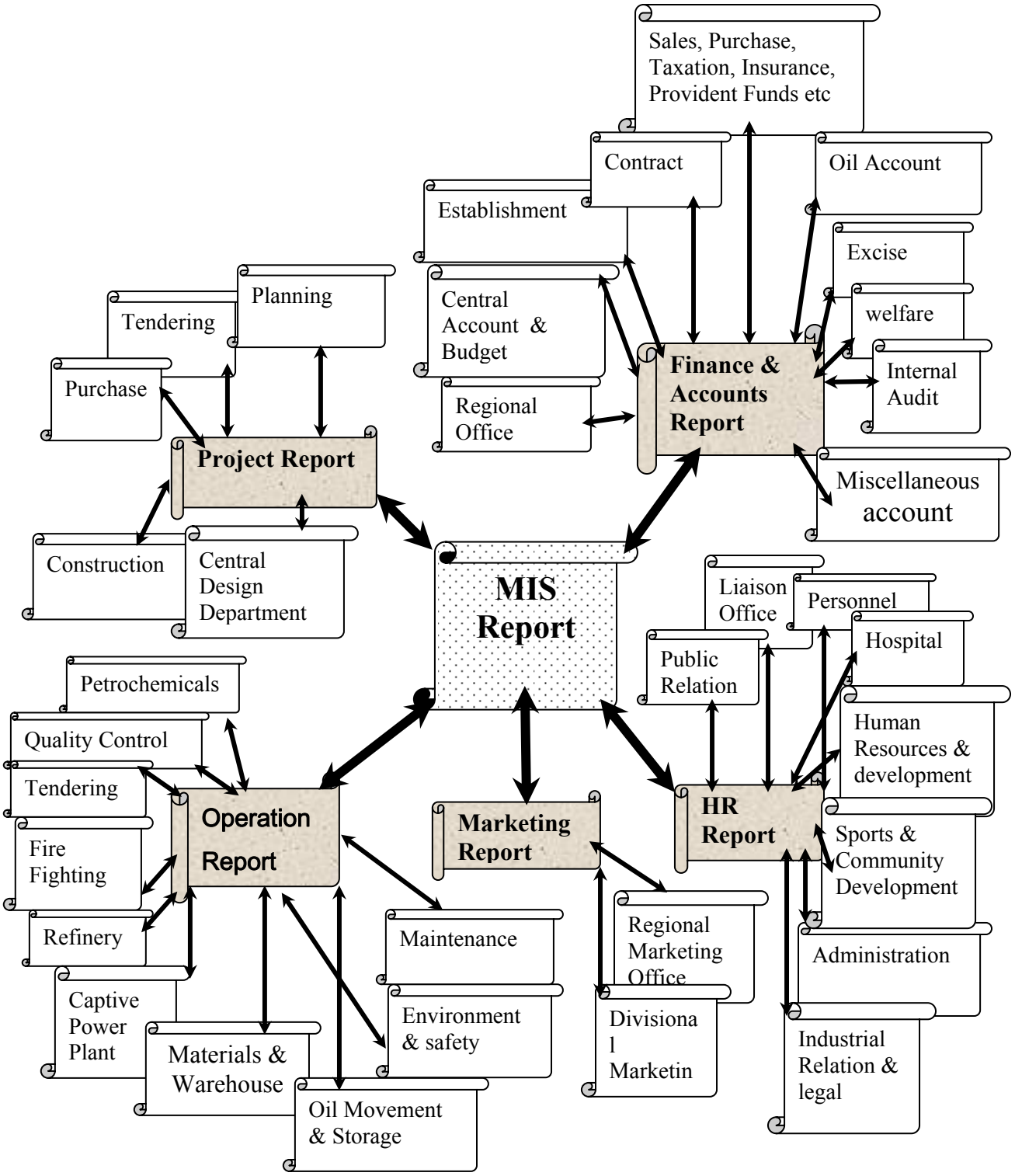
System automation is the mechanisation or computerisation of a system by which the working system can be made faster, simple and accurate. In refinery there are scope for system automation in various fields. BRPL has recently introduced **tank firm automation system** in all the crude and product tanks. This system replaced earlier tedious and time-consuming manual tank information collection system. BRPL is operating more than hundred crude and product tanks. Keeping information for all these tanks was very difficult and operator often did mistake. Most often products were overflowed or drained out along with water from the tanks, causing considerable losses to the company. With the system automation, it is now possible to get all-important information such as capacity of the tanks, products availability in the tank, water content, tank temperature, safe filing height, whether tank is in operation or in idle condition etc. on-line. This has reduced the operational workloads, improve tank monitoring, system become more accurate and reliable and eliminate considerable amount of losses. Similarly, System automation in **material management system (MMS)** has been introduced, which enable to collect on-line information about availability of materials such as spare parts, chemicals etc. MMS system also provides facility for on line indenting, rising purchase order etc. The system helps in efficient inventory management and control electronically and eliminated earlier kardex system. After introduction of this system the company could considerably reduced the inventory level.

7.6.1 Integrated management information system (IMIS)

In my opinion, automation of information system in BRPL is very important at this moment. Although BRPL has infrastructures for information networking system but it is not effective to take care of the total information system of the company. At present the communication system of BRPL is localised which can be described as Islands of information. Such system scattered information and create more complication. More of the time information are repeated in different form and create more confusion. Moreover, the information flow system is become very slow and erroneous. Such information are often misleading and affect the decision making process. Slower decision making often miss the opportunity, while taking wrong decision generate problem. **In order to avoid such situation, integrated communication system is essential in BRPL to make information flow faster and more accurate, which only can the decision making process accurate and faster.** To caters the

need, Automation in information system necessary. Considering the above facts, a customised integrated management information system **(IMIS)** is designed shown as figure 7.4 below, which may be suitable for BRPL:

Figure 7.4 Proposed integrated management information system (IMIS) Network



Source: author

Proposed IMIS is designed to incorporate the following:

- Identify the important user points in different operational areas and extend the existing communication network to all the points
- Develop customised software suitable for BRPL
- On the job training to each individual to familiarise with the system operation.
- System should be design for on-line information flow.
- All information should be accessible to all users.
- Management Information System (MIS) report will contain highlight of important events of all the areas.
- Every divisions and departments will use standard format for floating on-line information. Format may very division-to-division or department-to-department based on their requirement.
- Information will be updated immediately after completion of every event.
- Entry of information will be at the first point, which will be act as data collecting sources.
- On-line information will covers all plan and program for day-to-day business activities of all the divisions and departments.

7.7 PROPOSED HUMAN RESOURCES MANAGEMENT IN BRPL

SWOT analysis of BRPL in chapter 6, highlight problems related to human resources management such as inter-departmental rivalry, lack of awareness in the areas like energy conservation/optimization activities, lack of motivation due to improper performance measurement of individuals, un-uniform work distribution and unspecific reward and punishment system. All the above have long run negative impact in organizational culture and affect overall company's performance. In order to improve the performance of the organization as well as the individuals and to harmonize the organizational culture to the extend possible, the following measures are proposed to adopt in BRPL.

7.7.1 Cohesive team building

BRPL should emphasize on cohesive team building based on the organizational structure, which may confine within departments or divisions. Following approach should be taken to build a cohesive team.

- Form the team with skilled work force who can don the job.
- Team size should be optimum
- Create working environment by providing assistance
- Clarify the objectives and goals of the team
- Working process and procedure should be standardized
- Keep team morale high by frequent meeting and close association

- No discrimination among the team member
- Help in building good personal relationship among the members
- Establish two way communication
- Motivation by making the people feel that the task performing by them is significant to the organization.
- System should be developed for performance evaluation and improvement measures
- Leadership should be participative

7.7.2 Improve inter-group relationship

To improve inter-group relationship, BRPL should focuses on the following:

- Sharing overall business goal and results information
- Develop organizational culture of treating every body with respect
- Cultivate loyalty to the organization by informing about the influence of the organization to the society and their families
- Job boundary are clearly defined to the extend possible
- Fixed responsibility
- Develop discipline and progressive systems
- Develop system for improvement of inter personal relationship
- Interdepartmental discussion on related issues

7.7.3 Create continuous learning environment

In order to survive and to grow in the present business scenario an organization has to create continuous learning environment within the organization. There are various methods of creating continuous learning environment in an organization however; the following are suitable to BRPL.

- Extensive communication by various method of communication
- Adopt job rotational program
- Training
    - On the job training (Job related training)
    - Training related to personal development
    - Training out side the factory premises (in country or abroad) as a means of motivation
- Conduct awareness program on various fields like energy conservation/ optimization, environmental issue, corporate culture etc.

7.7.4 Motivation

The job of a manager in the work place is to get things done through employees. To do this the manager should be able to motivate employees. Human nature can be very simple, yet

very complex too. An understanding and appreciation of this is prerequisite to effective employees motivation. Motivation is the key to performance improvement because well-motivated employees overcome all the deficiencies of poor structure and process. There are many ways of motivation however the following are suitable to BRPL.

- Clear promotion policy
- Career planning entails matching an individual's skills and aspirations with opportunities
- Motivate by making the people feel that the task performing by him is significant to the organization.
- Value on skills of individuals
- Reasonable compensation package
- Introduce reward system for best performers
- No discrimination

7.7.5 Performance management system

BRPL should emphasized on the following points in order to improve the performance of individuals in order to improve the overall performance of the company.
Individuals often under performed due to his placement to a job, which is not of his interest or as per his qualification. In such situation individual get frustrated and also work suffered. Such incident is not rare in BRPL. To improve the performance of individuals and also to avoid wastage of man-hours, **selection of right man for the right job** is necessary.

Within BRPL, distribution of workload is not uniform; it is observed that from one department to another or even person to person in the same department, someone is over loaded with his works and some one is sitting idle. This is a cause for de-motivation of the employees those who are really hard working. On the other hand person sitting idle frustrated. This has serious affect to the work culture of the company. To avoid such situation, **job distribution and responsibility sharing** should be made uniform to the entire individual and at all levels as per as practicable. Uniformity in job distribution can be brought by job standardization and measurement and individual performance recording system.

For individual performance recording, a model chart shown as figure 7.5 below can be introduced in BRPL.

Figure 7.5 Model chart for performance record

Date	Job no.	Job Code	Job weightage	Time		Performed by		Check-ed By	Remarks
				Start	Finish	Name	Signature		

Source: Author

For measurement of jobs, BRPL can adopt method of standardization of jobs/activities. A model chart along with example for standardization of jobs is shown as figure 7.6 below:

Figure 7.6: Model chart for standardisation of jobs

Job Code	Job Description	Activities	Man-hour			Company Average Man hour (Weightage)	Industry Average Man hour
			Minimum	Maximum	Average		
001	Mechanical Seal replacement of a pump	Dismantling of pump	2	3	2.5	16	12
		Cleaning	1	2	1.5		
		Fixation of mechanical seal	6	8	7		
		Re-assembling	4	6	5		
002							

Source: Author

7.8 ORGANISATION OF PROFIT IMPROVEMENT PROGRAMME (PIP)

Profit Improvement Programme (PIP) is a management function, which needs continuous effort to achieve the goal of the organization. Since the survival and growth of an organization is depending on the profitability, therefore PIP is one of the top most priority functions of an organization and it should be permanent in nature. It is also a decision-making process and often financing is required, therefore involvement of highest authority is important in the process. To implement this programme in BRPL a systematic and organized approach (team) has to be taken which allow management to focus on achievable goals and to attain the best possible results from available resources based on management by objective (MBO) practices. The management has to focus on the result, not the activity and delegate tasks by "negotiating a contract of goals" with the subordinates without dictating a detailed roadmap for implementation. For implementing PIP in BRPL with continuous efforts, it is necessary to form issue base task forces comprising members from different strategic areas. It may be possible that some area might yield more result or need more deep analysis to enhance profit than the other; the task force will discuss all these issues and affixed responsibility to a person. The responsible person has to suggest the appropriate measures and implement the same. He should also be made responsible for follow-up and controlling of the measures.

C&MD and other functional directors are the part and partial of the profit improvement programme. However, their involvement in full time basis is not possible therefore person of General Manager level is to be assigned in a formal way with responsibility and authority. He will be responsible for assisting management in formulating strategies and decision-making process for implementation. He also involves in negotiating a contract of goals to divisional heads and assigned responsibilities with authorities. Responsibility of the divisional heads is to implement the programme and fulfill their goals by engaging competent personal to achieve negotiated goals.

PIP becomes a part of management therefore no separate budget is needed. Plan figures from the budget become goal or objective of this programme. The best idea is that the analysis of business and environment is conducted within the annual planning and budgeting.

CHAPTER 8

CONCLUSION

BRPL had been making profits under APM due to assured return on net-worth in addition to reimbursement of actual operating cost. However, after abolition of APM by the government of India, the profitability of BRPL became inconsistent. The company-incurred losses during the financial year 2000-01 and 2001-02 are indicative of fluctuating financial performance and it is difficult to predict future performance due to market driven pricing mechanism. The profitability of BRPL is at stake due to the following perceive threats:

- Lower crude availability in the region
- Fluctuating crude and products prices
- Stringent environmental and safety regulations
- Fast changing technology
- Increased competition from other refineries

Due to lower crude availability in the region (Upper Assam Oil Fields), infrastructure facilities has been developed to supply crude oil from Krishna Godavari basin of Southern India and for importing crude oil, therefore shortage of crude oil may not be a hindrance in full capacity utilization as long as the company can effort to buy crude oil from all these sources. But further enhancement of refining capacity may not be feasible due to its locational disadvantages for transporting crude oil and products. As such transportation cost of crude oil is high due to its distance from the sources. Existing crude oil supply pipelines are partly owned by IOC and partly by Oil India Limited (OIL) and they are used in shared basis with other Indian Oil refineries. Similarly IOC owns products pipeline and the same is also used as shared basis. Therefore supply of crude oil as well as dispatch of products by pipelines stand as a major bottleneck in capacity enhancement of BRPL. Viability of the refinery is a question at the present highly competitive environment due to its lower capacity. However, the company has already invested a huge amount in infrastructure development. Moreover, as a public enterprise to the government of India, BRPL has socio-economical obligation to the region. Therefore closure of BRPL cannot be a solution. The option available at this juncture is to continue petroleum-refining business by taking internal improvement measures by best utilizing existing strength of the company and removing weaknesses to the extend possible. Study has been undertaken with the goal to find out main areas of improvement in refinery and to help in making better decisions within the selected areas, which will lead to improvement of profitability in BRPL.
The above goal can be achieved in the following ways:

- Systematic study of energy consumption and find out the critical areas where consumption of energy can be optimised in order to minimise fuel and loss (OFL) of the company. This also includes recovery of energy from various area of potential.

- Maximize capacity utilization by exploring all possible ways to bring crude oil from different sources viz. Upper Assam oil fields, Krishna Godavari basin and imported crude oil to a maximum, limiting to its capacity of 2.35 MMTPA. Simultaneous action for movement of products is to be made well in advance in order to avoid products containment problem. Action for unplanned shutdown of the plant due to technical failure, which is also a major cause of capacity under utilization, needs to be taken by adopting best operational and maintenance practices.

- Systematic study of different process and find out critical areas where process optimization is possible in order to improve the product yields or to minimize consumption of energy.

- Systematic study of product mix blending/optimization in order to maximize production of high value products by utilizing low value products based on the market value study.

- Systematic study on maintenance functions and finding out their short comings and to adopt necessary measures in order to bring improvement, which ensure better plant maintenance by optimum and effective utilization of available resources.

- System automation in the critical areas as per as practicable in order to minimize manual operation and to make the system more faster and reliable.

- Adopting best human resources management practices by cohesive team building, bringing improvement inter-group relationship, create continuous learning environment in the organization, motivation people and adopting appropriate performance management system.

It has been observed that world over small capacity refineries is not viable from the techno-economical point of view. Suitable strategic decision may be taken in order to capacity enhancement and technology up gradation based on the projection of future market demand and supply. However short-term measures can be taken to improve and to sustain profitability by taking various improvement measures in different critical areas.

Refinery is an energy intensive industry, where electricity, steam, fuel oil & gas are used as the main sources of energy. Basic source of above forms of energy is hydrocarbon (petroleum oil) therefore optimization of energy is basically conservation of hydrocarbon, which in turn contributes in minimizing fuel and loss (OFL) and thereby improves profitability of the company. Most of energy optimization schemes need only systematic study and continuous effort of improvement without or with little cost involvement. There fore it is recommended to implement energy optimization schemes in BRPL in order to bring improvement in the profitability.

Maximizing sells of products can increase profit; of course, the selling price must be higher than the production costs. However maximizing capacity utilization of the plants can maximize volumes of products. Therefore, to maximize capacity utilization vis-à-vis maximizing production, it is suggested to explore all possible ways to bring crude oil from different sources viz. Upper Assam oil fields, Krishna Godavari basin and imported crude oil to a maximum, limiting to its design capacity (2.35 MMTPA). Simultaneous action plan for movement of products is to be drawn well in advance to avoid products containment problem and unplanned plant shutdown due to technical failure is to be contented.

Study reveals that process optimisation in different critical areas contribute considerably in improvement of profitability without or with little investment. Therefore it is recommended to implement the following process optimisation programme in BRPL.

- Maximization of hot RCO feed to DCU directly from CDU units recovers substantial amount of heat energy from RCO rundown and thereby reduce fuel consumption in DCU furnaces.
- Minimisation of RCO yields and that of heavy ends in DCU and upgrading the same to high value products.
- Improvement of HSD yields in CDU and DCU plants by doping stabilizer additives
- Maximisation of LPG yields from CDU by diverting part of naphtha ex CDU to LPG pool and also recovering LPG from coker off gas of DCU.

Optimising product mix can bring improvement in the profitability of BRPL without or with little investment. Therefore, it is recommended to implement the following product mix optimisation programme in BRPL.

- Maximisation of MS yield by diverting part of naphtha ex CDU and by processing wide cut Naphtha (105^0C to 150^0C) in the Catalytic Reformer in the MS mode of operation and optimum blending with cracked naphtha from DCU and SRN.

- Maximisation of HSD yields by optimum blending of SRGO ex. CDU, Coker Kero ex DCU and Kerosene feed (Kero-I /Kero-II).

- Up-grading LSHS to LDO by doping pour point depressant (PPD).

- Routing of intermediate low value product streams directly to finished products with out incurring processing

Maintenance is an associated supportive function of plant operation. Unless there is support from maintenance, operation of plant is not possible. Condition of the plant's health depends how properly it has been maintained. Failure in maintenance may leads to unplanned plant shut down; equipment damages etc. which can increase the cost of production and affect the

profitability of the company. Therefore it is recommended to modify the existing maintenance structure of BRPL in order to ensure its effectiveness in proper maintenance of plants and machineries and optimum utilisation of existing resources.

Automation of information system in BRPL is important from the view point of faster and correct information flow and thereby improve communication system, which enable the company to improve decision making process on day-to-day business operation. Duplication of information often misleading and it is unnecessary waste of time. Delay in decision making due to delayed information flow often miss the opportunity. Similarly wrong decision based on wrong information can cause more problems to the organisation. In all the cases company is affected. Therefore it is recommended to implement automation of information system in BRPL in order to improve the communication system and to help in improvement of decision-making process.

Human is the most precious resources of any organisation. All the above discussions do not bear fruits unless human resources are well managed. In order to get best possible out put it is important to adopt best human resources management practices which is most suitable to an organisation. Therefore it is recommended to adopt best human resources management practices in BRPL giving more focus in the following areas:

- Cohesive team building
- Improve inter-group relationship
- Create continuous learning environment
- Motivation of employees
- Performance Management System

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Annexure 1

Year-wise consumption of petroleum products in India

('000 tonnes)

Year to 31 March	1996	1997	1998	1999	2000	CAGR (%)
LPG	3849	4184	4581	5041	6029	11.9
MS	4679	4955	5182	5507	5909	6.0
Naphtha	3669	4015	4716	6652	7970	21.4
NGL	475	682	768	330	91	-33.8
Others	472	548	495	428	474	0.1
Light distillates	**13144**	**14384**	**15742**	**17958**	**20473**	**11.7**
ATF	2082	2158	2108	2112	2197	1.4
SKO	9317	9646	9878	10599	10731	3.6
HSD	32254	35019	36071	37217	39287	5.1
LDO	1311	1223	1235	1278	1512	3.6
Others	495	498	424	480	532	1.8
Middle distillates	**45459**	**48544**	**49716**	**51686**	**54259**	**4.5**
Lubes	711	705	835	885	915	6.5
FO	6496	6534	6651	6767	6816	1.2
LSHS	4189	4313	4323	4537	4763	3.3
Bitumen	2005	2273	2178	2412	2879	9.5
Petroleum coke	319	276	227	315	328	0.7
Others	195	195	166	206	218	2.8
Heavy distillates	**13915**	**14296**	**14380**	**15122**	**15919**	**3.4**
Imports by Private Party	0	1944	4452	5796	5639	30.5
Total demand	**72518**	**79168**	**84290**	**90562**	**96290**	5.0

Source: Ministry of Petroleum & Natural Gas

Annexure 2

Year-wise imports of crude oil and petroleum products ('000 Tonnes) in India

('000 tonnes)

Year to 31 March	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**1999-00**
Crude Oil	**27342**	**33906**	**34494**	**39808**	**44989**
POL Products					
1. LPG	678	1035	1087	1525	1377
2. Others	439	455	335	422	241
Light. Distillates	**1117**	**1490**	**1422**	**1947**	**1618**
1. ATF	97	150	55	0	1
2. SKO	5001	4279	3812	5823	5491
3. HSD	12852	13608	14075	10485	5408
Middle. Distillates	**17950**	**18037**	**17942**	**16308**	**10900**
1. Furnace Oil	1209	694	141	514	483
2. Lubes	58	44	25	11	66
Heavy. Distillates	**1267**	**738**	**166**	**525**	**549**
Total POL Products	**20334**	**20265**	**19530**	**18780**	**13067**
Total (A+B)	**47676**	**54171**	**54024**	**58588**	**58056**

Source*:* Ministry of Petroleum &Natural Gas

Annexure 3

Year-wise exports of crude oil and petroleum products in India

('000 tonnes)

Item ('000 tonnes)	1995-96	1996-97	1997-98	1998-99	1999-00
Crude Oil	**0**	**0**	**0**	**0**	**0**
POL Products					
1. Naphtha	2461	2184	1407	643	214
2. LPG	17	22	21	23	31
3. Others	539	437	670	113	39
Light. Distillates	**3017**	**2643**	**2098**	**779**	**284**
1. HSD/LDO	209	216	237	260	278
2. Others	187	221	254	271	308
Middle. Distillates	**396**	**437**	**491**	**531**	**586**
1. Furnace Oil / LSHS	22	82	360	91	29
2. Others	0	0	1	0	0
Heavy. Distillates	**22**	**82**	**361**	**91**	**29**
Total POL Products	**3435**	**3162**	**2950**	**1401**	**899**
Total (A+B)	**3435**	**3162**	**2950**	**1401**	**899**

Source*:* Ministry of Petroleum &Natural Gas

Annexure 4

Calculation of energy saving by maximizing hot RCO feed to DCU:

Basis: Crude throughput = 1.6 MMTPA

(Crude throughput basis is taken only 1.6 MMTPA in spite of having design capacity of 2.35 MMTPA in order to find out minimum energy saving by implementing this scheme)

Assumptions:

Desired hot RCO feed to DCU : 85%
Consider: hot RCO feed to DCU : 50%
(It may be noted that during July 2000 hot RCO feed was as low as only 29%)

Hot RCO temperature : 120 ^{o}C
Cold RCO temperature : 80 ^{o}C
RCO generation @41% on crude throughput : 656 TMT
Cold RCO @35% : 230 TMT

Energy loss:

(ii) Power required for pumping cold RCO : 210MWH (230000/82*75/1000)
= 65 SRFT

(ii) Fuel required for raising cold RCO temperature from 80 ^{o}C to 120 ^{o}C : 4350 MKCal
= 435 SRFT
(230000*0.473*40/1000)

Thus, the total energy loss by feeding 35% lower (85% - 50%) hot RCO would be about 500 SRFT per annum at a crude throughput of 1.6 MMTPA. This corresponds about Rupees 4.0 million per annum. This is excluding the cooling water cost for cooling the hot RCO before transporting to the RCO storage tanks.

Annexure 5

Minimization of yields of RCO in CDU and that of heavy ends in DCU

A study on minimization of RCO yield in CDU and its effects in the distillate yield in DCU has been carried out in BRPL. RCO being the feed to DCU unit, minimization of RCO yield in CDU significantly affects the distillate yield in DCU. The study and outcome is shown as below:

A) RCO yield in CDU can be reduced through following means:

- Main Fractionation Column should be operated at low pressure at about 1.2 Kg/cm^2
- Adequate stripping steam at column bottom to strip off light ends from RCO
- Furnace COT is to be maintained steady at about 358^0C
- Maximization of SRGO draw off from the column by maintaining its recovery at 370^0C

B) Heavy ends in DCU can be reduced through following means:

- Coker kero yield is to be maximized by maintaining to end point above 300^0C
- LGO and HGO draw off to be maximized
- Furnace COT to be maintained steady at $498 – 499^0C$

C) Impact of 1% RCO yield reduction in CDU and 1% heavy end reduction in DCU on profitability:

Basis: 100 MT Crude

(a) Impact of lower RCO yield in CDU:

	Base Case	Improved case
SRGO yield	22.70	23.70
RCO yield	41.50	40.50

Gain in SRGO yield: 1 MT

Impact of higher SRGO yield: 1 * Rs 14530 = Rs 14530

i.e. Rs 145.30 / MT Crude……(A)

Impact of DCU yield pattern

Streams	Yield	Base Case	Improved case	Delta	Price	Impact
	%	MT	MT	MT	Rs./MT	Rs.
RCO		41.5	40.5	-1.00		
LPG	2.5	1.04	1.01	-0.03	15030	-452
CN	5.8	2.41	2.35	-0.06	11330	-689
CK	26	10.79	10.53	-0.26	12967	-3371
LGO/HGO	18	7.47	7.29	-0.18	11144	-2006
CFO/CR	23.9	9.92	9.68	-0.24	9440	-2266
RPC	14.3	5.93	5.79	-0.14	5963	-835
Total impact						- 9619

Impact of DCU yield pattern: - 96.19 Rs/ MT of Crude…… (B)

(b) Impact of Higher end reduction in DCU (1 % reduction in CFO/CR):

1 % reduction in CFO / CR will result corresponding increase in LGO/HGO yield.
With 41.5 MT RCO feed, incremental increase in LGO/HGO will be 0.42 MT.
Impact of reduction in higher end in DCU: 0.42 * (11144 – 9440) = Rs 716

Impact of reduction in higher end in DCU, Rs / MT Crude = Rs 7.16 …(C)

Net gain by reducing RCO yield & Higher end = (A + B + C) = Rs 56.27 / MT Crude

Total annual net gain by reducing RCO yield & Higher end = Rs.90.03 Million

Assumption:
Crude throughput 1.6 MMPTA
Product prices basis: August 2002