

NIOEC-SP-00-88 (0)							
DOCUMENT CODE							NO. OF PAGES: 86
PLAN/PRJ/SUB	UNIT	PHASE	DISCIPLINE	DOCUMENT TYPE	SERIAL NO.	REV. NO.	DATE
NIOEC	000	EG	PR	SP	0088	A0	JULY, 2005



NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR RECOMMENDED PRACTICE FOR FEASIBILITY STUDIES

FIRST EDITION

JULY, 2005

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical standard specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such standard specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant standard specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the on going projects.

In response to the initiative of the Design Division of the Engineering and Construction Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design Division of the Engineering and Construction Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design Deputy of the Engineering and Construction Director of NIOEC for evaluation and consideration.

S. R. KASAEIZADEH



EXECUTIVE DIRECTOR

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) REMARKS RELATED TO EACH REVISION SHOW A BRIEF DESCRIPTION. THESE REMARKS SHALL BE INTERPRETED IN CONJUNCTION WITH THE REVISED TEXT MARKED BY REVISION NUMBERS.
- 3) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 4) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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0	JULY, 2005	M.A.A.SAJEDI		M.R.FARZAM	M.A.A.SAJEDI
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0. INTRODUCTION

The development of an industrial investment project from the stage of the initial idea until the plant is in operation can be shown in the form of a cycle comprising three distinct phases as; The Pre-Investment, the Investment, and the Operational Phases. The objective of this Recommended Practice is to explore a sound and well established procedure for carrying out the various studies required during the pre-investment phase in general and within which, the feasibility studies in particular.

1. SCOPE

This Recommended Practice which is mainly prepared in accordance with the requirements of part II of IPS-E-PR-150 set forth to explore the problems encountered in carrying out the various studies required during the feasibility studies of an industrial investment projects.

2. REFERENCES

Throughout this Specification, the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this Specification. For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date, shall mutually be agreed upon by the Company and the Vendor/Contractor.

"Manual for Preparation of Industrial Feasibility Studies",

By: W.BEHENSE & P.M. HAWRANEK, for Unido Publication, November 1991.

NIOEC-SP (NIOEC SPECIFICATIONS)

[NIOEC-SP-00-10](#) "NIOEC Specification for Units"

"Unido Guide to Industrial Purchasing, Unido Publication, 1989".

UBC (UNIFIED BUILDING CODE)

3. DEFINITIONS AND TERMINOLOGY

3.1 Administrative Expense

The overhead cost due to general direction of the Company, above the plant manager level. Generally includes top management salaries, and the costs of legal, central purchasing, traffic, accounting, and other staff functions.

3.2 Break-Even Point

The percentage of capacity at which incomes of a Company or facility just cover all fixed and variable costs. Depreciation is normally included.

3.3 Consultant Fee

The charge for the use of the Consultants (or Contractor's) organization for the period and to the extent specified in the contract.

3.4 Cost Index (Price Index)

A number which relates the cost of an item at a specific time to the corresponding cost at some arbitrarily specified time in the past.

3.5 Depreciation Costs

The allocation of the cost of fixed capital assets less salvage (if any), over the estimated useful life of the plant, in systematic and rational manner.

3.6 Direct Cost

The manufacturing expenses which may be affected by production rate. Direct costs are generally assignable to a specific product or process area usually including:

- Input material.
- Operating, supervision, clerical payroll.
- Fringe benefits.
- Maintenance.
- Utilities.
- Catalysts, chemicals, operating supplies.
- Miscellaneous.

3.7 Discounted Cash Flow (DCF)

The rate of compound interest at which the Company's outstanding investment is repaid by proceeds for project.

3.8 Expansion

Any increase in the capacity of a plant facility or Unit, usually by added investment. Scope of its possible application extends from the elimination of problem areas to the complete replacement of an existing facility with a larger one.

3.9 Indirect Cost

In a project, all costs other than direct costs, such as material, labor, which do not become a final part of the installation, but which are required for the orderly completion of the installation and may include, but not be limited to starting costs, Contractor fees, insurance, taxes etc.

3.10 Interest Rate

The rate earned by money expressed as a constant percentage of the unpaid balance at the end of the previous accounting period.

3.11 Labor Cost

The salary plus all fringe benefits of construction craftsmen and general labor on construct projects and labor crews in manufacturing or processing areas which can be definitely assigned to one product or process area or cost center.

3.12 Overhead Cost

A cost or expense inherent in the performing of an operation, i.e., engineering, construction,

operating or manufacturing, which can not be charged to or identified with a part of the work, product, or asset, and therefore, must be allocated on some arbitrary basis believed to be equitable, or handled as a business expense independent of the volume of production.

3.13 Present Value

The discounted value of a series of cash flows at any arbitrary point in time. Also, the system of comparing proposed investments which involves discounting at a known interest rate, in order to choose the alternative having the highest present value per unit of investment.

3.14 Profitability

A measure of the excess of income over expenditure during a given period of time.

3.15 Working Capital

The funds in addition to fixed capital and land investment which a company must contribute to the project (excluding start-up expense) to get the project started and meet subsequent obligations as they come due. Working capital is normally assumed recovered at the end of the project without loss.

4. SYMBOLS AND ABBREVIATIONS

Symbols and abbreviations referred to in the Standard are as follows:

<u>SYMBOL/ABBREVIATION</u>	<u>DESCRIPTION</u>
a	Discount Factor.
ARR	Annual Rate of Return.
CIF	Cost, Insurance and Freight.
CF_n	Nominal value of a future cash flow.
CTO	Coefficient of Turnover, (CTO = 360/MDC).
CF_p	The value at present time.
DCF	Discounted Cash Flow.
F	Found (or Capital), paid for a project.
FOB	Free On Board.
I	Increment of found in a definite time.
ir=IRR	Internal Rate of Return.
K	Total investment cost (fixed assets and working capital).
LPG	Liquefied Petroleum Gas.
MDC	Minimum Days of Coverage.
n	Number of years.
NCF_n	Annual Net Cash Flow of a Project.
NCU	National Currency Units.
NPV	Net Present Value.
NP	Net Profit (after deduction of taxes and interest).
NV	Negative NPV (at the highest discount rate).
OGP	Oil, Gas and Petrochemicals.
PV	Positive NPV (at lowest discount rate).
R	Interest rate.

R	Annual rate of return (in present).
SRI	Stanford Research Institution.
UBC	Unified Building Code.

5. UNITS

International System of Units (SI) in accordance with [NIOEC-SP-00-10](#) shall be used, unless otherwise specified.

6. FEASIBILITY STUDIES

6.1 General

The Pre-Investment Phase (see Fig. 1) comprises several stages as following:

- "Opportunity Studies" (The identification of investment opportunities).
- "Pre-Feasibility Studies" (Analysis of project alternatives and preliminary project selection as well as project preparation).
- "Feasibility Studies" (Final project selection and project appraisal investment decisions). and Appraisal Report"

6.2 Opportunity Studies

6.2.1 General

6.2.1.1 Identification of investment opportunities should be made at the starting-point in a series of investment-related activities as shown in Fig. 1. Information on the newly identified and viable investment opportunities should be obtained.

6.2.1.2 These information, data and required parameters should be generated, qualified and used as the main instrument to develop a project idea into a proposal. Compilation of necessary information, data and determining parameters followed with detailed analysis is termed as "Opportunity Study".

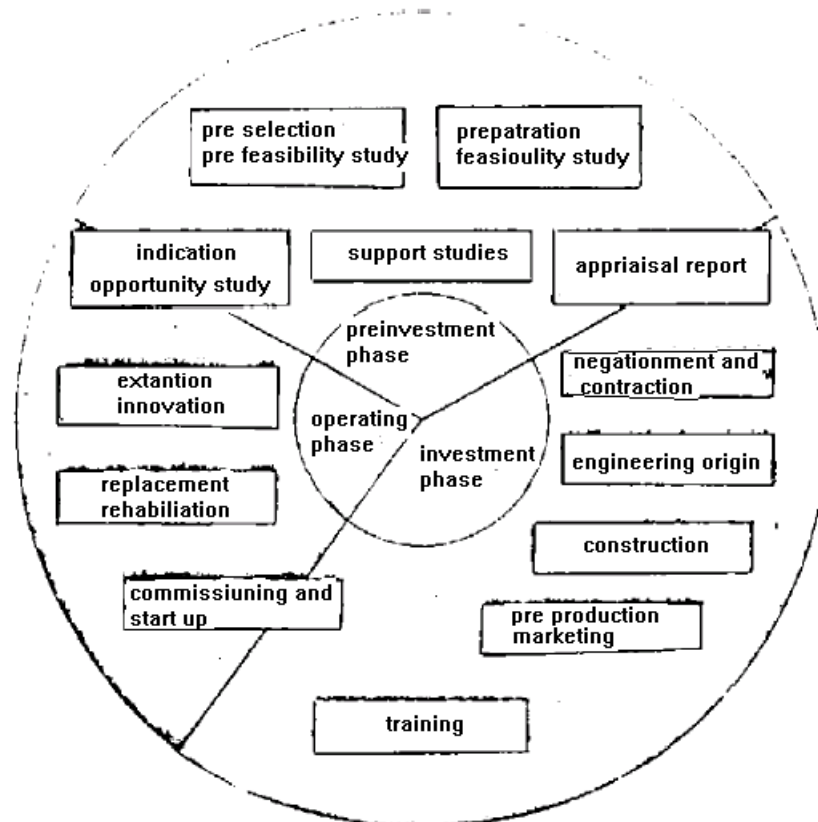
6.2.1.3 The following objective points should typically be analyzed together with an overall look to investment potential of the company, general interest of other governmental authorities domestic and foreign investors in investment and promotion of the project(s):

- Natural resources with potential for processing and manufacture such as hydrocarbon resources for chemical and petrochemical industries and crude oil for refinery processing.
- Possible resources of utilities such as air, steam, fuel, power, water, etc. and their transportation alternates for chemical and petrochemical or refinery plants.
- The existing industrial pattern that serves as a basis for the proposed new hydrocarbon-based industries.
- Future demand of the products that should have been potentially grown up as a result of increased population or purchasing power or for newly developed consuming goods.
- Imports, in order to identify areas for import substitution.
- Environmental impact.
- Manufacturing sectors successful in other countries with similar economic background and levels of development, capital, labor and natural resources.
- Possible inter-linkage with other industries, indigenous or transnational.
- Possible extension of existing production lines by backward or forward integration, linking for example, a downstream petrochemical industry with a refinery.
- Possibilities for diversification for example from a petrochemical complex into

ommercothercial product manufacturing.

- Possible expansion of existing industrial capacity to attain economies of scale.
- The general investment climate.
- Industrial policies.
- Availability and cost of production factors.
- Export possibilities.

6.2.4 Opportunity studies should be taken as a sketchy in nature relying more on aggregate estimates rather than on the detailed analysis. Cost data usually should be taken from comparable existing projects and not from quotations of sources such as Licensors, engineering companies or equipment suppliers.



**PRE-INVESTMENT, INVESTMENT AND
OPERATING PHASES OF THE PROJECT CYCLE**

Fig. 1

6.2.5 Outline of a general opportunity studies is given under Appendix A. These parameters may be integrated and/or cross checked with those already practiced in the Company's planning and investment promotion departments for the purpose of adequate stimulating of Company's (as investor) response.

6.2.6 It should be noted that, the information conveyed in a project opportunity study should not involve any substantial costs in its preparation, as it is intended primarily to highlight the principal investment aspects of a possible industrial proposition.

6.3 Pre-Feasibility Studies

6.3.1 General

6.3.1.1 The project idea should be elaborated in a more detailed studies. However, formulation of a feasibility study that enables a definite decision to be made on the project is a costly and time consuming task. Therefore before assigning larger funds for such study, a further assessment of the project idea should be made in a pre-feasibility study.

6.3.1.2 A pre-feasibility study should be viewed as an intermediate stage between a project opportunity study and a detailed feasibility study; the difference being in the degree of detail of the information obtained and the intensity with which project alternatives are discussed.

6.3.1.3 A detailed feasibility study.

6.3.1.4 A detailed review of available alternatives should take place at the stage of pre-feasibility study. In particular, the review should cover the various alternatives identified in the following main fields of study:

- Project or corporate strategies and scope of the project.
- Market and marketing concept.
- Raw materials and supplies.
- Location, site and environment.
- Engineering and technology.
- Organization and overhead costs.
- Human resources, in particular managerial staff, labor costs, and training requirements and costs.
- Project implementation schedule and budgeting.

6.3.1.5 The financial and economic impact of each of the above factors should be assessed. Occasionally, a well-prepared and comprehensive opportunity study justify by-passing the pre-feasibility study stage. A pre-feasibility study should however be conducted if the economics of the project are doubtful.

6.4 Feasibility Studies

6.4.1 General

6.4.1.1 A feasibility study should provide all data necessary for an investment decision (see Fig. 1). The commercial, technical, financial, economic and environmental prerequisites for an investment project should therefore be defined and critically examined on the basis of alternative solutions already re-viewed in pre-feasibility study.

6.4.1.2 A feasibility study should be carried out only if the necessary financing facilities, as determined by the studies, can be identified with a fair degree of accuracy. Possible project financing should be considered as early as the feasibility study stage, because financing conditions have a direct effect on total costs and thus on the financial feasibility of the project.

6.4.2 Main objectives

The main objectives to be considered, as the minimum requirement, in feasibility studies of projects are classified and covered in the following chapters:

Chapter I Executive Summary.

Chapter	II	Project Background and Basic Idea.
Chapter	III	Market Analysis and Marketing Concept.
Chapter	IV	Raw Materials and Supplies.
Chapter	V	Location, Site and Environment.
Chapter	VI	Engineering and Technology.
Chapter	VII	Organization and Overhead Costs.
Chapter	VIII	Human Resources.
Chapter	IX	Implementation Planning and Budgeting.
Chapter	X	Financial Analysis and Investment Appraisal.

Each of these chapters should separately be studied on the basis of specific procedure and guidelines given herein this Specification. For further detail studies of any and all of the scopes covered in these chapters, specific references are given at the end of each chapter.

CHAPTER I - EXECUTIVE SUMMARY

1. GENERAL

- 1.1 For convenience of preparation, the feasibility should begin with a brief executive summary, outlining the project data (assessed and assumed) and the conclusions and recommendations which would then be covered in detail in the body of the study.
- 1.2 The executive summary should concentrate on and cover all critical aspects of the study, such as the following: the degree of reliability of data on the business environment; project input and output; the margin of error (uncertainty, risk) in forecast of market; supply and technological trends; and project design.
- 1.3 The executive summary should have the same structure as the body of the feasibility study, and cover but must not be limited to the following areas:

a) Summary of the Project Background and History (Chapter II)

- Name and address of project promoter.
- Project background.
- Project (corporate) objective and outline of the proposed basic project strategy, including geographical area and market share (domestic, export), cost leadership, differentiation, market niche.
- Project location: orientation towards the market or towards resources (raw materials).
- Economic and industrial policies supporting the project.

b) Summary of Market Analysis and Marketing Concept (Chapter III)

- Summarize results of marketing research: business environment, target market and market segmentation (consumer and product groups), channels of distribution, competition, life cycles (sector, product).
- List annual data on demand (quantities, prices) and supplies (past, current and future demand and supplies).
- Explain and justify the marketing strategies for achieving the project objectives and outline the marketing concept.

- Indicate projected marketing costs, elements of the projected sales program and revenues (quantities, prices, market share etc.).
- Describe impacts on: raw materials and supplies, location, the environment, the production program, plant capacity and technology etc.

c) Raw Materials and Supplies (Chapter IV)

- Describe general availability of:
 - Raw materials
 - Processed industrial materials and components
 - Factory supplies
 - Spare parts
 - Supplies for social and external needs
- List annual supply requirements of material inputs.
- Summarize availability of critical inputs and possible strategies (supply marketing).

d) Location, Site and Environment (Chapter V)

- Identify and describe location and plant site selected, including:
 - Ecological and environmental impact
 - Socio-economic policies, incentives and constraints
 - Infrastructural conditions and environment
- Summarize critical aspects and justify choice of location and site.
- Outline significant costs relating to location and site.

e) Engineering and Technology (Chapter VI)

- Outline of production program and plant capacity
- Describe and justify the technology selected, reviewing its availability and possible significant advantages or disadvantages, as well as the life cycle, transfer (absorption) of technology, training, risk control, costs, legal aspects etc.
- Describe the layout and scope of the project
- Summarize main plant items (equipment etc.), their availability and costs
- Describe required major civil engineering works.

f) Organization and Overhead Costs (Chapter VII)

- Describe basic organizational design and management and measures required.

g) Human Resources (Chapter VIII)

- Describe the socio-economic and cultural environment as related to significant project requirements, as well as human resources availability, recruitment and training needs, and the reasons for the employment of foreign experts, to the extent required for the project.

- Indicate key persons (skills required) and total employment (numbers and costs).

h) Project Implementation Schedule (Chapter IX)

- Indicate duration of plant erection and installation
- Indicate duration of production start-up and running-in period
- Identify actions critical for timely implementation.

i) Financial Analysis and Investment Appraisal (Chapter X)

- Summary of criteria governing investment appraisal
- Total investment costs
- Major investment data, showing local and foreign components
- Land and site preparation
- Structures and civil engineering works
- Plant machinery and equipment
- auxiliary and service plant equipment
- Incorporated fixed assets
- Pre-production expenditures and capital costs
- Net working capital requirements
- Total costs of products sold
- Operating costs
- Depreciation charges
- Marketing costs
- Finance costs
- Project financing
- Source of finance
- Impact of cost of financing and dept service on project proposal
- Public policy on financing
- Investment appraisal: key data
- Discounted cash flow (internal rate of return, net present value)
- Pay-off period
- Yield generated on total capital invested and on equity capital
- Yield for parties involved, as in joint venture projects
- Significant financial and economic impact on the national economy and environmental implications
- Aspects of uncertainty, including critical variables, risks and possible strategies and means of risk management, probable future scenarios and possible impact on the financial feasibility of the investment project.
- National economic evaluation.

- Conclusions.
- Major advantages of the project.
- Major drawbacks of the projects.
- Chances of implementing the project.

Note:

For executive details if required refer to "Economic Evaluation of a Manufacturing Project in Chemical Engineering", December 1992 and other appropriate references.

CHAPTER II - PROJECT BACKGROUND AND BASIC IDEA**1. GENERAL**

- 1.1** To ensure the success of the feasibility study, it must be clearly understood, how the project idea fits into the framework of general conditions and industrial development of the country.
- 1.2** The project should be described in detail and the sponsors identified, together with a presentation of the reasons for their interest in the project.

2. PROJECT BACKGROUND AND BASIC IDEA**2.1** Description of the project idea as:

- List the major project parameters that served as the guiding principles during the preparation of the study.
- Project (corporate) objectives and description and analysis of proposed basic project strategy, including:
 - Geographical area and market share (domestic, export)
 - Cost leadership
 - Differentiation
 - Market niche.

2.2 Project promoter or initiator as:

- Names and addresses
- Financial possibilities
- Role within the project
- Other relevant information.

2.3 Project history as:

- Historical development of the project (titles, authors, completion dates)
- Studies and investigations already performed
- Conclusions arrived at and decisions taken on the basis of former studies.

2.4 Feasibility study as:

- Author, title
- Ordering party.

2.5 Cost of preparatory studies and related investigations as:

- Pre-investment studies.
- Opportunity studies.
- Pre-feasibility studies.
- Feasibility studies.
- Any other supporting studies.
- Expert, Consultant and Engineering Fees (if their services are utilized).
- Preparatory investigations such as:
 - Land surveys.
 - Quantity surveys (quantification of building materials).
 - Quality (laboratory) test.
 - Other investigations and tests (if performed).
- For calculation use Schedule II-1 of Appendix C, and insert in Schedule X-2 and X-5 of Appendix K.

2.6 COMFAR, is basically a typical standardized simulation model for financial and economic analysis of projects. The new COMFAR generation, developed for guiding the users through the data entry system by requesting exactly the input required for the computation of the system output as predefined by the users. The schedules contained in Appendices C through X of this Specification, constitute a format compatible with COMFAR for economic, cost-benefit analysis of the projects.

CHAPTER III - MARKET ANALYSIS AND MARKETING CONCEPT**1. GENERAL**

- 1.1** The basic objective of any industrial investment project is to benefit either from the utilization of available resources or from the satisfaction of existing or potential demand for the output of the project. Market analysis is the key activity for determining the scope of an investment, the possible production programs, the technology required and often also the choice of a location.
- 1.2** The marketing experts should communicate and cooperate with the other members of the feasibility study team from the very beginning of the work, so as to avoid isolated marketing or engineering solutions that could prove to be financially unsound.

2. MARKETING CONCEPT

2.1 When a project strategy has been defined, a suitable marketing concept should be designed in accordance with the phases described below:

a) Strategic Dimensions of Marketing

The marketing strategy to be considered involves;

- 1)** Identification of target groups and the products to win their favor.
- 2)** Determination of competition policies, that is, whether a low-price strategy or differentiation strategy should be pursued to defeat competitors.

b) Operative Dimensions of Marketing

Main marketing tools, namely product, price, promotion and place should be distinguished and the combination impact on marketing concept which is known as "Marketing Mix" should be specified. Table 1 hereunder lists the activities to be made relating the four components. Any of these components may be referred to as a sub-mix component.

TABLE 1 - MARKETING MIX

PRODUCT	PROMOTION
- Scope of product mix - Dept. of product mix - Quality - Design - Packaging - Maintenance - Service - Warranty service - Possibility of returning a purchase	- Advertising - Public relations - Personal sale - Sales promotion - Brand polity
PRICE	PLACE
- Price positioning - Rebates and conditions of payment - Financing conditions	- Channels of distribution - Distribution density - Lead time - Stock - Transport

3. MARKETING MEASURES AND MARKETING BUDGET

3.1 For the feasibility study, it is necessary to determine the marketing activities and to prepare a time schedule indicating the starting- point and duration of these activities.

3.2 For the development of the project strategy and marketing concept, a careful marketing research should be conducted.

The scope of marketing research required for a feasibility study should be covered to fulfill three principal aims as;

- Market-Project relations should be made clear for the management.
- Strategic constraints and problems should be identified.
- Strategic options for the project should be outlined.

3.3 The work on market analysis should be organized along the following lines:

- Assessment of the target market structure.
- Customer analysis and market segmentation.
- Analysis of the channels of distribution.
- Analysis of the competition.
- Analysis of the socio-economic environment.
- Corporate (internal) analysis.
- Projections of marketing data.
- Conclusions, prospects and risks.

- 3.4 The depth or degree of detail of the analysis should be determined according to the complexity of each problem and its importance for the project evaluation.

4. DATA ASSESSMENT

- 4.1 Two types of market information can be distinguished, namely "general market data" and "specific market data" for a particular market segment (consumer group or product group). General market data should be accomplished with studies on the following:

- General economic indicators relating to product demand, such as population level and growth rate, per capita income and consumption, gross domestic product per capita and annual growth rate, and income distribution.
- Government policies, practice and legislation, to the extent directly related to consumption, productions, imports and exports of the product(s) in question, standards, restrictions, duties, taxes, as well as subsidies or incentives, credit control and foreign regulations.
- Present level of domestic production, by volume and value, including production intended for internal consumption and not placed on the market.
- Present level of imports, by volume and value (CIF and local cost).
- Production and imports of substitute and near-substitutes.
- Critical imputes (see also Chapter IV).
- Production targets determined in national economic plans, where applicable for products in question, substitutes and complementary product.
- Present level of exports, by volume and value (FOB).
- Behavioral patterns, such as consumer habits and responses, individual and collective, and trade practice.

- 4.2 The specific demand and market data for a particular market segment should be identified and its availability for feasibility study should be ascertained. typically following items and similars should be studied in this regard:

- The demand for a product may have been suppressed by market imperfections due to trade policies, high import tariffs, which would not be portable on domestic products.
- Artificially high domestic prices may be imposed on certain products whose import are severely restricted, but the pattern of demand, and consequently of product pricing, would change materially once the product become available in large quantities.

- 4.3 It is however, necessary to identify the specific demand and market data required, the extent to which such data are available and could be utilized in the feasibility study.

- 4.4 the possibility of extending the market to other countries should be explored for most projects of any size, as export sales have to be taken into consideration in determining plant capacity.

- 4.5 International competition should be studied through economies of scale, for example, in production or marketing through comparative locational advantages, the development of international cooperation, access to technologies etc.

- 4.6 The geographical divisions of possible exports should be defined in content of a particular product.

Regarding export analysis, the feasibility study should therefore deal with the following questions:

- Will the enterprise gain strategic advantages by operating more internationally?.
- What advantages will it gain in particular (example: economies of scale in production)?.
- To what degree and in which fields does international competition pose a treat to the project?.

- What will be the future extent of the advantage of the enterprise operating on a geographically limited field?

5. OUTLINE OF THE PROJECT STRATEGY

5.1 Upon introduction of marketing and dimension for feasibility studies, the following main steps for defining the project strategy and corresponding marketing concept should essentially be studied:

- Geographical area of strategy;

On the basis of the assessment of the project situation, the feasibility study should consider different strategic alternatives with regard to the geographic limitations.

- Market share and basic strategy;

For an investment project it is necessary to define the long-term market position or market share and corresponding profitability of the project. Since each market has its individual characteristics, the feasibility study should analyze each profitability and market share relationship very carefully.

- Strategy of cost leadership;

The cost advantage attributable to the "learning and experience", provides protection against competition. In order to achieve cost leadership, the following assets required for this strategy should be evaluated:

- High investment capacity, i.e., access to capital.
- Process innovations and improvements.
- Thorough supervisions of labor force.
- Products designed for easy manufacturing.
- Low-cost distribution system.

- Differentiation strategy;

Differentiation strategy aims to protect against competition, in that binds the buyers to the brand or the firm and thus reducing price sensitivity. The following assets and similars should be subject to differentiation strategy:

- Powerful marketing potential.
- Strengths in research and development.
- Customer groups with higher purchasing power.
- Parts of the product line.
- Tradition in the industry.
- Cooperation with supply and distribution channels.

- Project strategy;

When a project strategy is selected, the feasibility study should always consider possible alternative strategies.

When assessing such alternatives, the following points should be considered.

- To what extent do the strategic alternatives fulfill the original aims of the feasibility studies.

- What is the financial impact of the alternatives (profitability, return on investment).
- What risks are linked with each alternatives (political, ecological, financial, etc.).
- For determining of project alternative strategies the following problems should be addressed:
 - What is the geographical area in which the project will operate?
 - What basic strategy should be chosen (cost leadership, differentiation or market niche)?
 - What market position (market share) is aimed at, and how much time is required to reach the target?
 - Which product-market relation should be basis for the marketing concept?
 - What will be the product range (products, price level)?
 - Which target group of consumers will be focused on?
 - Which strategy will be chosen (competition or market expansion)?
 - What core skills are required for success in respect of actual or potential competitors?
 - Will the project develop the market position exclusively by its own means or are there possibilities for cooperation?.

6. MARKETING COST

- 6.1** The projection of marketing costs comprises all costs components resulting from the marketing activities described in this section. Depending on the scope of study and the depth of analysis marketing costs should be projected for each product separately or for a group of products.
- 6.2** For detail analysis, the direct variable and direct fix unit costs as well as indirect marketing costs (marketing overhead costs) should be determined in line with check-list shown in Schedules III-1, III-2 and III-3 of Appendix D.

Note:

For detail studies on marketing and project strategy, see the Sections of Chapter III of "Manual for the Preparation of Industrial Feasibility Study", issued by UNIDO in 1991.

CHAPTER IV - RAW MATERIALS AND SUPPLIES CONCEPT

1. GENERAL

- 1.1** The selection of raw materials and supplies depends primarily on the technical requirements of the project and analysis of supply markets. Important determinant factors for selection of raw materials and factory supplies are environmental factors and criteria relating to project strategies, for example minimizing supply risks and cost of material inputs.
- 1.2** In order to keep the cost of feasibility studies at a reasonable level, key aspects should be identified and analyzed in terms of requirements, availability, cost and risk, which will be significant for feasibility of the project. the following approach should necessarily be taken to specify the requirements, check their ability and estimate their costs:
- a) Characteristics of raw materials, auxiliary materials and utilities.
 - b) Specification of requirements.
 - c) Availability and supply.

- d) Input alternatives.
- e) Supply marketing and supply program.
- f) Cost of raw materials and supplies:
 - f.1) The costs of materials and supplies used or kept in stock should be specified as per Schedule IV-1 of Appendix E. Cost estimates for materials and inputs can be expressed either as the cost per unit produced or in terms of a certain production level.
 - f.2) The following information should be presented in Schedule IV-1 of Appendix E:
 - Type of material and input.
 - Unit of measurement (barrels, tones, cubic meters, etc.)
 - Estimated costs per unit produced.
 - Estimated cost per input unit.
 - Number of input units consumed per unit produced.
 - Estimated cost per unit produced divided into direct (predominately variable) and indirect (predominantly fixed) cost components.
 - Direct cost per unit produced divided into foreign and local currency components (although expressed in one common currency).
 - Indirect cost per unit produced divided into foreign and local currency components.
 - f.3) When calculating indirect costs, the amounts resulting from environmental protection, pollution control measures, etc., should be established per unit of production, or per accounting period. Schedule IV-2 of Appendix E should be used to project the costs over the production period. The total per main category of inputs should be recorded in this schedule, and the grand totals, for direct and overhead costs (factory and administrative overheads) should then be inserted in Schedule X-3 of Appendix K.

Note:

For more information on marketing and supply see following recommended references:

- a) **Supply and Material Management by CROMPTON, H.K. 2nd ed., 1989.**
- b) **UNIDO Guide to Industrial Purchasing, Unido Publications, 1989.**

CHAPTER V - LOCATION, SITE AND ENVIRONMENT

1. LOCATION ANALYSIS

- 1.1 Feasibility study should identify locations suitable for an industrial project under consideration. The feasibility study should also indicate on what grounds alternative locations have been identified, and give reasons for leaving out other locations that were suitable but not selected.
- 1.2 The impacts and requirements to be identified should be classified as follows:
 - Natural environment, geophysical conditions and project requirements.
 - Ecological impact of the project, environmental impact assessment.
 - Socio-economic policies, incentives and restrictions, government plans and policies.

- Infrastructural services, such as existing industrial infrastructure, the economic and social infrastructure, the institutional framework, urbanization and literacy.

2. NATURAL ENVIRONMENT

- 2.1 Climatic conditions as an important locational factor should be specified in terms of air temperature, humidity, sunshine hours, winds, precipitation, hurricane risk etc. Each of these should be specified in detail such as maximum, minimum and average temperatures on an average day, in particular months or over a period of 10 years.
- 2.2 Geodesic aspects such as soil conditions, subsoil water levels and a number of special site hazards (earthquakes, susceptibility to flooding) should be studied.
- 2.3 Ecological requirements with specific regards to water supply with quality requirements, waste water disposal, pollution of area and health risks should be studied and demonstrated in the feasibility study.

3. ENVIRONMENTAL IMPACT ASSESSMENT

- 3.1 The feasibility study should include a thorough and realistic analysis of the environmental impact of industrial investment project. This impact is often of crucial importance for socio-economic, financial, and technical feasibility of the project.
- 3.2 The following specific objective of environmental impact assessment should be performed.
 - To promote a comprehensive, interdisciplinary investigation of environmental consequences of the project and its alternatives for the affected natural and cultural human habit.
 - To develop an understanding of the scope and magnitude of incremental environment impacts of the proposed project for each of alternative project design.
 - To incorporate in the designs any existing regulatory requirements.
 - To identify measures for mitigation of adverse environmental impacts and for possible enhancement of beneficial impacts.
 - To identify critical environmental problems requiring further investigation.
 - To assess environmental impacts qualitatively and quantitatively as required for the purpose of determining the overall environmental merit of each alternative.

4. SOCIO-ECONOMIC POLICIES (ROLE OF PUBLIC POLICIES)

- 4.1 Investments in export processing zones and other specified regions may sometimes be and are exempted from taxes or would benefit from other types of study. Such possibilities should be considered in the feasibility study.

5. INFRASTRUCTURAL CONDITIONS

- 5.1 The availability of a developed and diversified economic and social infrastructure is often of key importance for a project. The feasibility study should identify such key infrastructural requirements, because they are vital to the operation of a project.
- 5.2 In conformity with 5.1 above, technical infrastructure for the choice of location, and other characteristics such as reliability, quality and physical aspects should be studied. Transport

and communication facilities, utility requirements, labor, lands should be studied. Infrastructural services, effluent and waste disposal should also as a critical factor be studied and clearly monitored in the feasibility study report.

6. FINAL CHOICE OF LOCATION

- 6.1** The feasibility study should indicate, where the project in question shall be located, with specific concern to raw material, supplies (water, power, fuel, labor etc.), climate, social welfare facilities available (such as education, medical services, and recreation facilities), proximity to raw materials and downstream product consuming markets. etc.
- 6.2** As far as financial feasibility of alternative locations is concerned, the following data as well as data related to financial risks should be carefully assessed:
- Production costs (including environment protection cost).
 - Marketing costs.
 - Investment costs (including environmental protection).
 - Revenues.
 - Taxes, subsidies, and allowances.
 - Net cash flows.

7. SITE SELECTION

- 7.1** The feasibility study should analyze and assess alternative sites on the basis of key aspects and site specific requirements.

For sites available within the selected location, the following requirements and conditions should be assessed:

- Ecological conditions on site (soil, site hazards, climate etc.).
- Environmental impact (restrictions, standards, guidelines).
- Socio-Economic conditions (restrictions, incentives, guidelines).
- Local infrastructure at site location (existing industrial, infrastructure, availability of critical project inputs such as labor and factory supplies).
- Strategic aspects (corporate strategies, regarding possible future expansion, supply and marketing policies).
- Cost of land.
- Site preparation and development, requirements and costs.

8. COST ESTIMATES

- 8.1** Schedule V-1 of Appendix F should be used for the estimates of investment costs at site. Example of costs is acquisition of land, taxes, legal expenses, rights of way, site preparation and development. Different cost items are to be identified, quantified (if relevant), estimated and divided into components of foreign and local currency origin.

- 8.2 It should be carefully stated whether factory-external facilities, possibly judged as necessary (such as disposal and treatment of effluents, generation of electricity, water supply system, storage, housing and schools etc.) should be included in the cost estimate.
- 8.3 Schedule V-2 of Appendix F may be used for investment costs related to environmental protection.
- 8.4 Schedule V-3 and V-4 of Appendix F should be used for the presentation of annual costs related to the site and environmental protection costs respectively. This may comprise annual payments for rent and other costs.

CHAPTER VI - ENGINEERING AND TECHNOLOGY

1. GENERAL

- 1.1 An integral part of engineering at the feasibility stage is the selection of an appropriate technology and of the corresponding know-how. While the choice of technology defines the production processes to be utilized, the effective management of technology transfer requires that the technology and know-how are acquired on suitable terms and conditions and that the necessary skills are available or developed.
- 1.2 The required machinery and equipment should be determined in relation to the technology and processes to be utilized, the local conditions, the state of the art and human capabilities and training programs at various levels.
- 1.3 The analysis should also outline the specific requirements of each individual technology, if selected, and specify the need for technical documentation and maintenance procedures.
- 1.4 In particular the analysis should include a thorough survey of spare parts and the format of necessary lists of spare parts.

2. PRODUCTION PROGRAM AND PLANT CAPACITY

- 2.1 The detailed production program should be designed in a feasibility study when the required sales program is determined.

2.2 Determination of Production Program

- 2.2.1 Full production capacity should not be considered as practical in OGP process plants during the initial production operations. Owing to various technological, production and commercial difficulties, most projects experience initial problems that take the form of only a gradual growth of sales and market penetration, on the one hand, and a wide range of production problems on the other.
- 2.2.2 A production and sales target of 65 to 70 percent of overall capacity should be considered for the first year and 75 to 90 percent for the second year and full production capacity for third year and then after.

2.3 Input Requirements

2.3.1 Once the production program is defined, the nature and general requirements of materials, should be identified and the specific quantities needed for each stage of the production program and the costs that these entail should be determined. The costs should be assessed for: basic materials such as raw materials, semi-processed and bought-out items, major plant supplies (auxiliary materials and utilities), other supplies and labor requirements.

2.4 Determination of Plant Capacity

2.4.1 A feasible normal capacity should be specified in the study under normal operating conditions, taking into account not only the installed equipment and technical conditions of the plant such as normal stoppages, down time, holidays, maintenance, tool changes, desired shift patterns and management system applied.

2.4.2 A feasible nominal maximum capacity should also be specified which frequently corresponds to the installed capacity as guaranteed by the supplier of the plant. This capacity should entail overtime, excessive consumption of plant supplies, utilities, spare parts, wear-and-tear parts and de-proportionate production cost increases.

2.5 Minimum Economic Size and Equipment Constraints

2.5.1 When determining the minimum economic size of a project, experience gained elsewhere should be evaluated and used. There should be full treatment of the resulting higher production costs and prices and inability to compete with a cost leadership strategy in external market.

3. TECHNOLOGY CHOICE

3.1 The selection of appropriate technology and know-how is a critical element in any feasibility study. Such selection should be based on a detailed consideration and evaluation of technological alternatives and the selection of the most suitable alternative in relation to the project or investment strategy chosen and to socio-economic and ecological conditions.

3.2 Technology choice should be directly related to market, resource and environmental conditions and the corporate strategies recommended for a particular project. The form of foreign participation, national objectives and policies, industrial growth strategy, availability of local resources and skills and several other factors which can directly impinge on technology choice should be assessed.

3.3 Ecological and Environment Impact

3.3.1 Ecological and environmental impact and especially any possible hazards that may result from the use of particular technologies should be studied and used in technology selection.

3.4 Assessment of Technology Required

3.4.1 The primary goals of technology assessment are to determine and evaluate the impacts of different technologies on the society and national economy (cost-benefit analysis, employment and income effects, satisfaction of human needs etc.), impacts, on the environment, and techno-economic feasibility assessment from the Company's point of views should be made.

3.5 Technology Description and Project Layout

3.5.1 A preliminary project layout should be established in feasibility study report and should provide the overall framework of the project which can serve as a broad basis for: plant engineering, order-of-magnitude projections of civil works, machinery requirements and other investment elements and site development, plant and other buildings, transport facilities (road, railway, sidings etc.), utility linkages including electric power substations, water connections, sewage lines, gas and telephone links, storage and other facilities.

3.5.2 The preliminary project layout should include several charts and drawings (need not to be in scale). The functional charts and layout drawings at this stage should include the following:

- General functional layout, defining the principal physicals, or locational, features and flow relationships, civil works and constructions, various ancillary and service facilities.
- Basic characteristics of the technology.
- Material-flow diagrams indicating the flow of materials and utilities.
- Transport layout, indicating roads, railways, and other transport facilities up to their point of connection to public networks.
- Utility lines for electric power, water, gas, telephone, sewage and emissions (both internal and external up to the point connecting with public networks).
- Area for expansion and extension.

3.6 Technology Evaluation and Selection

3.6.1 Alternative techniques should be evaluated in the feasibility study to determine the most suitable technology for the plant. This evaluation should be related to plant capacity, and should commence with a quantitative assessment of output, production build-up and gestation period, a qualitative assessment of product quality and marketability.

3.6.2 The technology should have been proven and utilized in the manufacturing process, preferably in the company from which it came. While unproven, new and experimental techniques should not be considered appropriate. Obsolescent technology should be avoided.

4. TECHNOLOGY ACQUISITION AND TRANSFER

4.1 When a technology has to be obtained for a specific project, the means of acquisition should be determined. These can take the form of technology licensing, outright purchase of technology or a joint venture involving participation in ownership by the technology supplier. The implication of these methods should be analyzed.

4.2 The feasibility study should indicate the measures and action to be taken for technological absorption and adoption of the acquired technology to local conditions.

4.3 The feasibility study should identify the various categories of personnel to be recruited and the training programs they need to undergo.

4.4 Contract Terms and Conditions

4.4.1 The contractual terms and conditions for technology acquisition and transfer which are likely to be of particular significance to the project need to be highlighted in the feasibility study.

4.4.2 The negotiation strategy should also be indicated, and draft of the principal terms and conditions from the view point of the prospective Licensee should be prepared.

5. SELECTION OF MACHINERY AND EQUIPMENT

- 5.1** Equipment selection at feasibility study stage should broadly define the optimum group of machinery and equipment necessary for a specific production capacity.

5.2 Level of Automation

- 5.2.1** Degree of sophistication and automation as an important issue in OGP production plants should carefully be assessed, capital cost of automation trend, competitive nature of production should be evaluated. Thus the use of computer-aided designs for production or numerically controlled machine tools etc. should be specified in the feasibility stage of the project.

5.3 Categories of Equipment/Spare Parts

- 5.3.1** The equipment should be listed and categorized. The classification should be listed under; plant machinery, mechanical equipment, electrical equipment, instrumentation and controls, transport and conveying equipment, testing and research equipment and other machinery items with estimated prices.
- 5.3.2** A list should be prepared of required spare parts and tools with their estimated prices. Spare parts needs, should depend on the nature of the project, availability, import facilities. In common practice a stock of 2 years consumption is feasible for OGP industries.

6. CIVIL ENGINEERING WORKS

- 6.1** The feasibility study should provide plans and estimates for the civil works related to the project. This should cover site preparation and development, other buildings, civil engineering works relating to utilities, transport, emissions and effluent discharges, internal roads, fencing and security, and other facilities and requirements of the plant.

6.2 Building

- 6.2.1** Plans and estimates for buildings and structures should include: the main plant buildings; buildings for ancillary production facilities, ancillary building.

For maintenance and repair; testing and research and development; storage and warehouses for stock of raw material or finished products; non-factory or plant buildings; staff welfare facilities; residential buildings and such other buildings.

7. ESTIMATES OF OVERAL INVESTMENT COSTS (CAPITAL COST ESTIMATES)

- 7.1** On the basis of estimates for technology, machinery and equipment and civil engineering works, the feasibility study should provide an overall estimate of the capital costs of the project. Such an estimate should undergo modification in accordance with the bids and offers received from suppliers and Contractors, but should nevertheless provide a fairly realistic estimate of capital costs. These costs should be reflected in Schedules VI-1, VI-2, VI-3, and VI-4 of Appendix G.