**CHAPTER FOUR**

**TECHNICAL ANALYSIS OF PROJECT**

* 1. **Introduction**

According to the UNIDO project cycle model, pre-investment and investment phase involves Pre-Feasibility and Feasibility Studies it is a stage of project preparation, among others, is one of the most important, critical, costly, as well as complex part of the project cycle it involves assessment of key aspects of a project. In this regard, the two studies made in the preparation process are having the same structural framework; except that they differ in the scope or level of detail included in the assessment.

Major dimension of the feasibility study involves commercial (Market and demand analysis), Technical (production programming & plant capacity, input study, location & site study, engineering & technology study) institutional and managerial, financial and social cost benefit analysis (economic analysis).

Overestimating returns, optimistic projections, failure to consider the variability of climate, underestimating costs, omission of a necessary component & optimistic calendar for implementation are common mistakes during project preparation. Some of the consequences of poor project preparation are; Low capacity utilization, heavy costs overruns, deteriorated financial profitability and lingering illness or the sudden death syndrome on projects etc…

* 1. **Feasibility Studies**

Feasibility study involves two stages; Pre-feasibility study a general, not a detailed, assessment of the basic components of the project. It is a warrant for an in-depth investigation.

The basic objectives of pre-feasibility studies is to examine possible project alternatives, a basis for further study; to determine viability of initial screening. If pre feasibility study is promising plan for feasibility study if not terminate generated project idea.

Feasibility studyisdetailed analysis of a project undertaken if the preliminary screening suggests it is promising worthwhile. It provides a basis for the final investment decision.

The objective of the study is to define projects, in a more tangible form, the viability, quality, and dependability of the project. We should have a sharp eye on the aspects of a feasibility study, question the objectivity of the feasibility report and integrity of the participants b/c feasibility studies are not always free from vested interests.

**Considerations on feasibility study**

* Involvement of professionals in an interdisciplinary team process.
* Arrive at best conclusions after considering various alternatives.
* Define all project features as precisely as possible.
* Outcomes must be detail /for subsequent decisions.
* Project components should be well refined.
	1. **Technical Studies on project preparation phase**
		1. **Market and Demand study (commercial dimension)**

Market and demand analysis concerned with determining aggregate demand and market share for the product. Sales forecast and specific marketing strategy (a broader plan a company uses in order to achieve its marketing objectives) consists of marketing expenditures, marketing mix, and competitive strategy) is the final outcome of market and demand study.

The study of market and demand study, being the first step in project preparation, has the following main objectives:

* Systematically assess the market and its environment
* Collect, analyze, and report data about market situation;
* Obtain insights about the target market;
* Identify customers, their needs, and behaviors in the market;
* Designed the marketing mix
* Identify available distribution channels
* Identify competitors and their characteristics
* Determine the socio-economic aspects for project’s market strategy
* Identify strengths and weaknesses in the internal environment of the firm
* explain market opportunities and risks
* Project the level of demand expected and develop sales program

The rationales for conducting market & demand study is one, every part of the project preparation process depend on the information provided by the market & demand. Two, estimate of sales revenue is the basis for evaluation of alternatives and to make final decisions regarding: production program and plant capacity, materials and other inputs, location choice, financial evaluation, working capital needs and financial planning, ultimate marketing strategy, staffing the sales unit (marketing section), promotion and service department. Three, revision of market and demand analysis requires much time. Four, Market and demand analysis is more ambitious and risky. five, Market and demand study deal with the fundamental source of sales revenue.

**Major dimensions of the market and demand analysis**

1. **General economic and business conditions**:- economic welfare and dynamics of economic development, existing industry, production stricture and trends, foreign trade, GDP/GNP, inflation level, foreign exchange, balance of payment.
2. **Economic and business policy**:- general economic policy, investment policy, industrial policy, foreign trade policy and tax policy.
3. **Product:-** properties and characteristics of new product, advantages and disadvantages, types and qualities, substitutes and complementary.
4. **Demand:**- population & income level, development trends and projection, price level and tendencies, technology, buyers expectation.
5. **Supply:**- supply potential of competitors, amount of local production, import & export, competitors position.
6. **Marketing environment:**- marketing expenditure, competitive strategy and marketing mix.
7. **Legal and political environment:-** safety issues, branding , environmental and health issue.

For conducting marketing research data obtained from **field surveys** (interviews, tests, observation, etc), **secondary sources** such as national census, national sample survey reports, plan reports and documents, publications, economic survey reports, annual survey of industries etc…

**Projection of sales revenue**:- for forecasting of sales consider factors such as plant capacity and production program, marketing strategies, production technology, project life, market price of product and export/Import sales by competitors. Steps for sales projection;

1. Demand estimation
2. Supply estimation
3. Projects marketing strategy
4. Expect competitors strategy
5. Project sales
	* 1. **Production Program and Plant capacity study**

production program defines the level of output to be produced during specified period of time. Indicates the level/quantity of output and the timing of production over the life of the envisaged plant. It should be directly related to the specific sales forecasts (main basis of production program).

The objective of production program study is to determine the type and range of products to be produced over the life of the envisaged plant and to show the level of capacity utilization expected and the quantity of production.

**Factors considered in production program.**

* Capacity utilization ( in each stages of production),
* Production problems (machine breakdowns, tasks not properly assigned to series of workstations, or non- uniform cycle time between work stations shortage of materials Per given standard)
* Wastages and spoilages (abnormal or controllable & normal uncontrollable spoilage),
* Price and quantity sales (higher selling prices may be reflected in terms of lower sales volume/quantity, lower sales volume affects the production program.

**Plant capacity:**- is the output expectations from a production plant. The objective of such study is identify factors affecting capacity decisions, examine alternative capacity levels in view of sales, profitability, technology, etc, determine the feasible normal level of plant capacity and provide a basis for determining capacity costs (investment costs in capacity).

**Factors affecting capacity decisions**

* Technological requirements
* Input constraints
* Investment cost
* Anticipated market conditions (strong market strong capacity)
* Resources of the firm (managerial infrastructure, finance, skilled employees in the firm)
* Government policy

Optimum level of production (feasible normal capacity) is determined by the relative interaction of technology, availability of resource, investment and production costs. Technically feasible capacity (normal maximum capacity) is achievable through excessive overtime work.

* + 1. **Raw Materials and supplies study**

Close relationship between the study of raw material & supplies and other project formulation stages (definition of plant capacity, location, and selection of technology & equipment, demand analysis, production program, and plant capacity) all are the main basis for selection of materials & inputs.

The objective of such study is to determine the type, quantity, and quality of raw materials & supplies available for and needed by the project, determine availability of basic raw material suppliers, estimate the cost of raw materials & supplies needed and develop program & devise supply marketing schemes.

UNIDO 5 step approaches to study raw material and supplies;

1. **Classification of Raw Materials:** unprocessed & semi-processed, agricultural products , industrial Materials, marketable supplies, factory supplies , auxiliary materials and not auxiliary materials etc…
2. **Specification of Requirements**: Identify and specify the requirement of materials and supplies. It depends on type of production technology to be used and characteristics of the project.
3. **Check Availability and Supply of Inputs:** focus on Are the required materials & supplies available? Where? How materials & inputs required will be provided?
4. **Provide Marketing and Supply Program;** Its objective is to minimize costs/risks and Cultivate relationships with input suppliers.
5. **Estimate Costs of Raw Materials & Supplies:** involvesunit cost, over head cost and total costs of materials and supplies. For domestic materials current prices have to be viewed in the context of past trends and future projection of the elasticity of supply and consider the costs of alternative means of transport. Whereas, for Imported Materials: Use C.I.F prices (cost, insurance, and freight charges) consider loading & unloading costs, clearing charges (port charges, tariffs, etc), local insurance & taxes), and cost of internal transport to the plant.
	* 1. **Location, site, and environmental impact assessment**

Location refers to a fairly broad area like a city, an industrial zone, or a coastal area. Site refers to a specific place where the project could be set up. The objective of this study is to identify a location and site suitable to the industrial project. Location study focus on choice of location for the accessibility of market, raw material and infrastructure, level of urbanization, investment policy and incentives, population concentration, environmental impacts and pollution.

**Impacts and critical requirements to be assessed:**

* **Natural environment:**- It includes climate condition (consider temperature, rainfall, flooding, dust, fume (smoke), and other factors). Ecological Requirements (the relationship between the air, land, water, animals, plants, etc..).
* **Environment impact assessment;**- The objective of the assessment is to ensure the project under consideration is environmentally sound to pollution, flora, and fauna, to examine environmental consequences of the project, to incorporate in the project design any existing regulatory requirements, to identify measures for mitigating adverse environmental impacts, to enhance the likely beneficial impacts of the project and to determine environmental merits of alternative projects.
* **Socio-economic policies** :- it involves role of public policies (regarding concessions & incentives, direct subsidies), fiscal and legal aspects (define fiscal & legal issues (regulations), procedures applicable for alternative locations.
* **Infrastructure services, conditions, and requirements.** It includes technical infrastructure (such as reliability, quality, and physical aspects), transport and communications (Available rail, road, air, or water to transport inputs and marketing of products, good communication facilities telex, telephone, fax, internet, mobile networks, etc) telephone, fax, internet, mobile networks, etc) Factory Supplies (water, electricity, fuel, human resources, effluent and waste disposal facilities) should also be ascertained for alternative locations.

The optimal location is the one at which the total cost is minimized i.e Raw material + transportation cost + Production cost + Distribution cost of final products. A resource-based project like a cement plant or a steel mill should be located close to the source of basic material. A project that much depends on the use of imported materials may be located near a port. a perishable product should be close to the center of consumption or should be close to the center of consumption or should be located at some intermediate point.

**Site selection**

Assess alternative sites on the basis of key aspects and site specific requirements. Consider at least two or more alternative sites within a given location and evaluate the characteristics of the alternative sites identified within the specified location. Main considerations for site selection.

* Cost of land (Acquisition, Taxes, Legal expenses , Site preparation and development)
* Site preparation cost (Grading & leveling, Demolishing & removal, recovery of swamps & draining, Relocation of existing pipelines, cables, etc..)
* Cost of utility lines extension
* Environmental considerations
* Size and shape of the available area
* Suitability for future expansion
* Proximity of consumption centers (market)
* Infrastructure facilities (transport network, houses, power supply, etc)
* Availability of labor (skilled & unskilled)
* Socio-economic factors (waste disposal, taxes and duties, and public policies)
	+ 1. **Engineering and Technology Study**

Engineering involves accomplishing all necessary activities on the plant site and providing necessary infrastructure investment such as preparation of detailed plant layout, civil engineering works, maintenance & replacement requirements and estimation of associated investment costs.

TheObjectives of Engineering Study are: to design the functional and physical layouts in order to produce the defined outputs, to determine the corresponding investment expenditures, to determine the costs arising during the operational phase, to accomplish necessary work on the plant site and to provide necessary infrastructure investments.

**Plant layout and basic engineering**

The project layouts provide the basis for detailed project engineering and estimation of investment and production costs.

**Types of layouts**

1. **General functional layout:-** general relationships between equipment, buildings, and civil works.
2. **Material flow diagram**:- the flow of materials, utilities, intermediate products, final products, by- products, and emissions.
3. **Production Line Diagrams:-** Show how the production would progress along with the key information for the main equipment.
4. **Transport Layout:-** Shows the distance and means of transport outside the production line.
5. **Utility Consumption Layout**:- the principal consumption points of utilities (power, water, gas, compressed air, etc).
6. **Communication Layout:-** Shows how the various parts of the project will be connected with telephone, internet, etc.
7. **Organizational Layout:-** Shows the organizational set up of the project along with information on personnel required for various departments and their interrelationship. various departments and their interrelationship.
8. **Plant Layout:-** Concerned with the physical layout of factory.

**Civil engineering works and cost estimates**

**Civil engineering:-** A feasibility study should provide plans & estimates for civil engineering works related to the project site preparation & development, factory and other buildings, utilities, transport, emissions and effluent discharge, internal roads, fencing and security, other facilities & requirements of the plant. Plans & estimates for civil engineering works should be detailed for cost estimates and implementation scheduling.

**Technology Study**

Involves the selection of an appropriate technology, planning acquisition & absorption of the same, and the corresponding knowhow. Its objective is to select the technological alternative most suitable to the socio-economic conditions, investment strategy chosen, and ecological conditions in the context and to acquire and absorb the necessary technology and the corresponding know-how.

Technology or manufacturing technique is the sum patented and unpatented knowledge, know how, experience, and skills needed for the transformation of raw material into outputs. Technology study helps to identify necessary technologies and implications in terms of costs, use of local raw materials, environmental impacts, etc.

Factors considered in technology choice are**;** parked and marketing concepts;plant capacity;characteristics of the principal inputs;investment outlays and production costs; environmental impacts;use by other units;product mix;age of technology acquired (obsolescence issues);recent (latest) developments ;ease of absorption, etc…

Technology alternatives should be compared from capital investment and production cost point of view & fully proven/utilized/ in manufacturing process by others. In countries with a shortage of labor (or labor is expensive), capital-intensive techniques may be appropriate and economically justifiable. In countries with excess labor, labor saving techniques may prove unnecessarily expensive. technology utilizes local raw materials, local man power, goods & services produced cater the basic needs, technology protects ecological balance and technology is harmonious with social & cultural conditions, etc.

**Common mistakes in the choice of technology are;**

* Technology already or going to be obsolete in the near future.
* New versions of existing technology not sufficiently proved & tested.
* Heavily dependent on supply of special semi- products, sub-assemblies, or additives available from a monopoly supplier (or licensor).
* Technology incompatible with local conditions climate, special raw material properties, local personnel qualifications, etc.
* Under estimation of environmental hazards, etc.
	+ 1. **Human resource and organizational study**

Organizational study deals with the development & design of the organization needed to: control organizational activities, administer the flow & use of resources an ensure proper decision making. Human resource study focus on identification, recruitment, and training of professional and technical workers and managing the HR of the envisaged plant.

An “organization” is the means by which the operational functions and activities of the enterprise are structured and assigned to organizational units, represented by managerial staff, supervisors, and work force, with the objective of coordinating and controlling the performance of the enterprise and the achievement of its business targets. Organization of a company indicates delegation of responsibilities to various functional units.

The main objective of organizational design is to design the organizational set up needed to manage & control the project and the envisaged industrial establishment. Organizational design depends on internal and external project requirements and conditions.

**Steps in organizational design**

* State the goals and objectives of the business
* Identify major functions necessary to achieve goals
* Group (or relate) the necessary functions
* Design the organizational framework or structure
* Analyze, design, and describe all key jobs
* Prepare recruitment and training program

**Human resource study**

Successful operation of a well-designed industrial project ultimately depends on the skill, experience, and productivity of project personnel/team. Bad management or inadequately skilled & less – Bad management or inadequately skilled & less experienced personnel in key positions can easily jeopardize a promising and carefully planned project. A project with great risk & uncertainties may become successful due to good management & qualified labor. The main objective of HR study is to determine HR requirements for the project in terms of quality, quantity, type, and cost.

The feasibility study should Identify and describe HR requirements of the project, Assess the availability of HRs as well as the training needs and Give attention to the definition/description of skills and experiences. Therefore, define personnel requirements by category & function.

Socio-Economic and cultural environment and Legislation and labor terms (working hours and days, Labor norms, occupational Safety, health Care and social security) are factors affects human resource requirements.

**Project related requirements**

Requirements have to be planned for the implementation (pre--production) phase and start up

& operating phases. At pre production phase managerial staff, supervisors, foreman, and

specialized machine operators, foreign experts & technicians may be recruited. At operating phase Capacity utilization is usually improved gradually and additional shifts may be introduced, bringing about increased production and possibly additional requirements in certain personnel categories.

**Training plans**

Lack of experienced & skilled personnel is often a bottleneck for project implementation and

operation in developing countries. Extensive training program should be designed & carried out as part of the implementation process. Training may be organized during the pre- production stage at the plant site, the plant of joint venture partners, the plant of suppliers of technologies & equipment, similar factories in the country or abroad and specialized training institutes. Timing of training programs is of crucial important. Finally table prepared for each department for estimating labor costs.