Unit-1

production and operation management:-

1) operations System:-

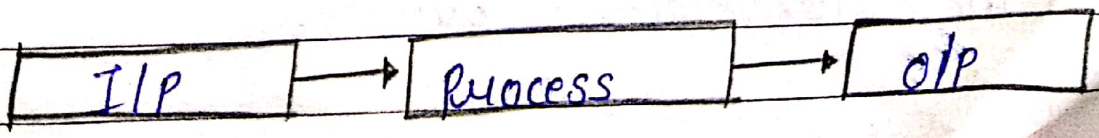
The operations system (function) of an organization is the part that produces the organization's products.

In some organizations the product is a physical good, while in others it is a service.

what do such diverse organizations as manufacturing companies, financial institutions, and health care facilities all have in common within their operations system?

★ Conversion process:-

Conversion process the process of changing inputs of labor, capital, land and management into outputs of goods and services.



Page
Date

✱ operations functions :-

1) Value-added :- Value-added when blending inputs into a product or service, the increased value of outputs compared to the sum of the values of inputs.

2) Random-fluctuations :- Random-fluctuations Unplanned or uncontrollable environmental influences (strikes, floods, etc). that cause planned and actual output to differ.

3) Feedback :- Feedback information in the control process that allows management to decide whether organizational activities need adjustment.

4) Technology :- Technology The level of scientific sophistication in plant, equipment, and skills in the conversion process.

* Distinguishing Between manufacturing and service operations

→ Distinguishing between manufacturing and service operations can be difficult. Generally, we consider characteristics such as:

1) Tangible / intangible nature of output
2) Consumption of output
3) Nature of work (jobs)
4) Degree of customer contact
5) customer participation in conversion
6) measurement of performance.

* Define Throughputs:-

Throughputs items going through the conversion process, contrasted with outputs coming out of the conversion process.

* System:- In a very general sense, a system is a collection of objects related by regular interaction and interdependence.

System can vary from the large- Nationwide communications networks, for example- to the small - a system for processing paperwork in a office, for example. To help people communicate about a system.

* Sub- System :- System can be viewed as collection of sub- system.

→ e.g:- business farm may contain sub- system department wise like finince, marketing, sales, purchese, production, hr. inventory management.

* operations management :- [6m] m.Imp

operations management of the conversion process, which converts land, Labor, capital, and management inputs into desired outputs of goods and services.

→ The operations manager's job is to manage the process of converting inputs into desired outputs.

* Following cine different views of operations management:-

1) classical management:-

classical management one of three primary theories of management, emphasizing efficiency at the production core, the separation of planning and doing work, and management principles and functions.

2) Scientific management:-

Scientific management one of several theories of classical management, emphasizing economic efficiency at the production core through management rationality, the economic motivation of workers and the separation of planning and doing work.

→ classical management:- productivity assignment management output / input = 100%.

$$\text{Efficiency (\%)} = \frac{\text{output}}{\text{Input}} \times 100\%$$

3) * Process management:-

process management one of several theories of classical management, emphasizing management as a continuous process of planning, organizing, and controlling to influence the others' actions.

⇒ 1) planning:- planning includes all activities that establish a course of action. these activities guide future decision making.

2) organizing:- organizing includes all activities that establish a structure of tasks and authority.

3) Controlling:- Controlling includes all activities that ensure that actual performance is in accordance with planned performance.

4) * Behavioral management:-

Behavioral management one of the primary theories of management, emphasizing human relations and the behavioral sciences.

⇒ 1) Human relations:-

Human relations phenomenon recognized by behavioral scientists that people are complex and have multiple needs and that the subordinate-supervisor relationship directly effects productivity.

2) Behavioral Science:-

A science that explores how human behavior is effected by leadership, motivation, communication, interpersonal relationships, and attitude change.

5) * modeling management:-

modeling management one of the primary theories of management, emphasizing decision-making, systems,

and mathematical modeling.

⇒ 1) mathematical modeling :-

mathematical modeling creating and using mathematical representations of management problems and organizations to predict outcomes of proposed courses of action.

* A FRAMEWORK FOR MANAGING OPERATIONS:

1) planning :-

The operations manager defines the objectives for the operations subsystem of the organization, and the policies, programs, and procedures for achieving the objectives.

→ This stage includes clarifying the role and focus of operations in the organization's overall strategy.

→ It also involves product planning, facilities designing, and using the conversion process.

2) Organizing:-

operations managers establish a structure of roles and the flow of information within the operations subsystem.

→ They determine the activities required to achieve the operations subsystem's goals and assign authority and responsibility for carrying them out.

3) Controlling:-

To ensure that the plans for the operations subsystem are accomplished, the operations manager must also exercise control by measuring actual outputs and comparing them to planned outputs.

→ Controlling costs, quality, and schedules is at the very heart of operations management.

4) Behaviar:-

Operations managers are concerned with how their efforts to plan, organize, and control affect human behaviar.

→ They also want to know how the behaviar of subordinates can affect management's planning, organizing, and controlling actions.

→ In operations we are interested in the behaviar of managers as well, especially their decision-making behaviar.

5) models:- As operations managers plan, organize, and control the conversion process, they encounter many problems and must make many decisions.

→ They can frequently simplify these difficulties by using models.

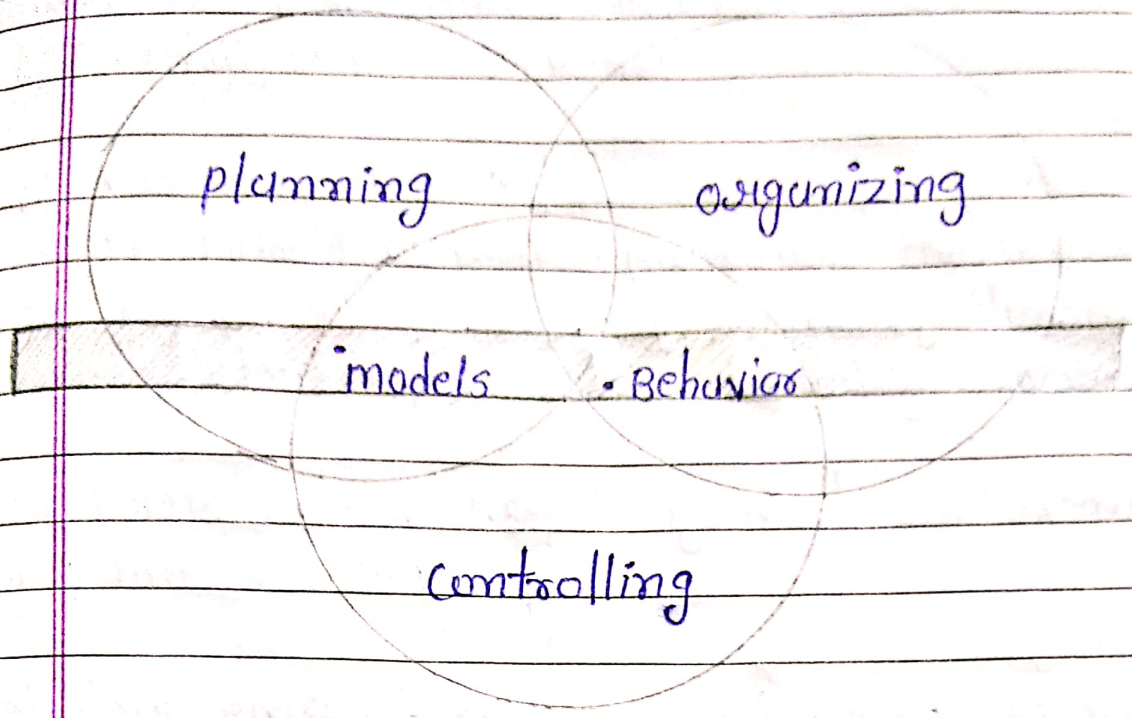


Fig:- 1.5. management themes in operations.

★ PROBLEMS OF THE OPERATIONS MANAGER:-

operations managers are concerned with many different problem areas: cost control in brokerage houses, quality of services in hospitals, and rates of production output in furniture factories.

Page
Date

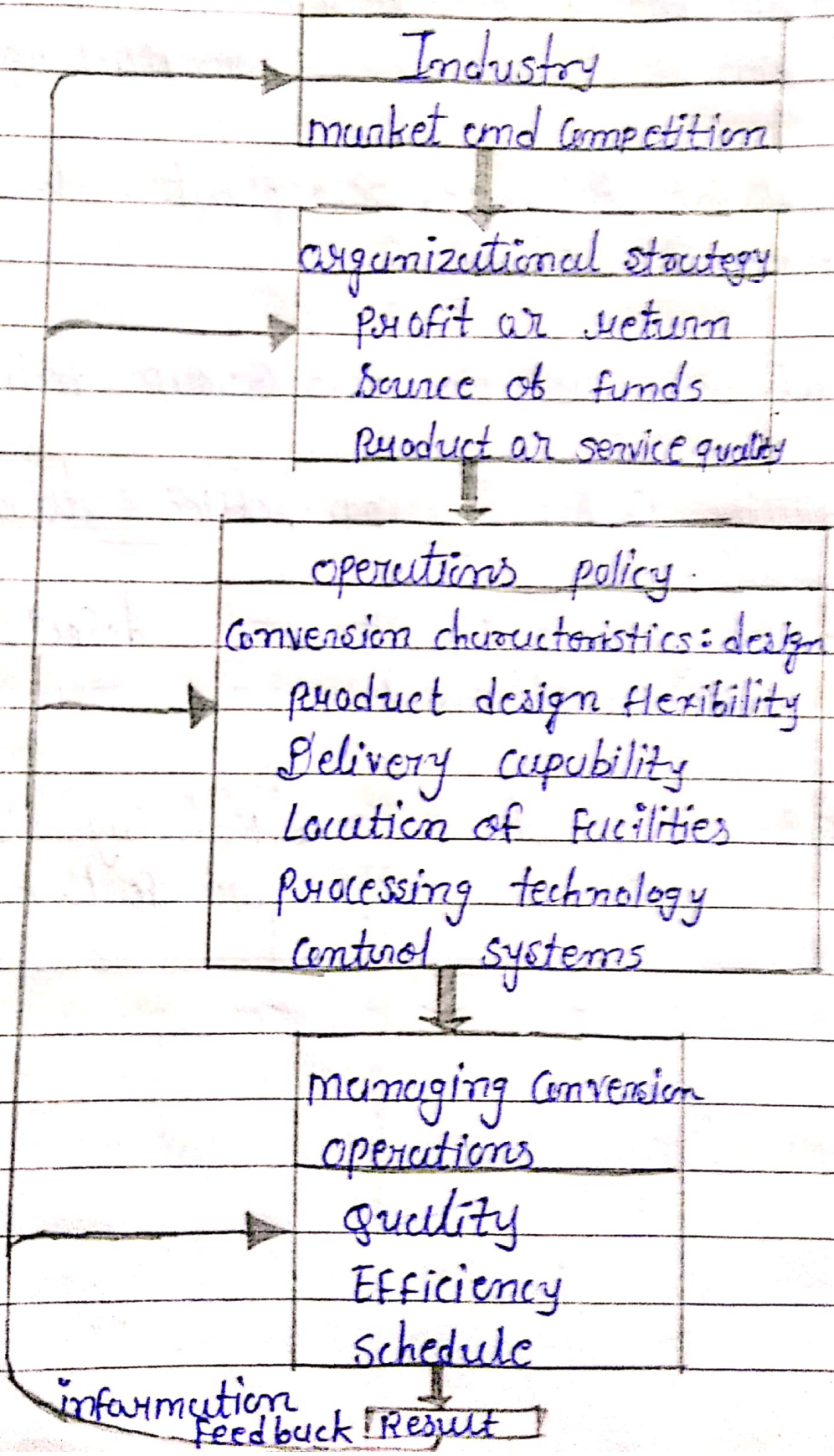
TABLE:-1.3. Activities emphasized by organizations to improve operations.

% a	Activity	% a	Activity.
90.6	Production planning, scheduling / inventory control systems.	44.4	Developing new processes for new products.
76.9	Supervisor training	43.1	vendor relations, procurement procedures.
66.3	Capacity expansion	42.5	Focusing factories
63.1	worker safety programs	41.3	Narrowing product line; standardizing
58.8	Defining a manufactu -ring strategy	39.4	making existing systems work better.
57.5	motivating direct labor employees.	35.0	Giving workers a broader range of tasks to perform.
55.0	value analysis - product redesign.	33.1	CAD (Computer - aided design)

54.4	Improved maintenance practices.	31.9	Giving workers more responsibility for planning and organizing work
53.1	changing the manufacturing argumi -zation.	29.4	CAM (computer-aided manufacture)
50.0	Developing integrated information systems	26.9	plant relocation
48.1	Lead-time reduction	25.0	Group technology
47.5	Quality circles	21.3	office automation
46.9	Developing new processes for old products	20.0	zero defects programs
46.3	Automating jobs	20.6	Reducing size of manufacturing units.

★ THE STRATEGIC ROLE OF OPERATIONS:-

Fig:- 1.6 operations as a strategic element in accomplishing organizational goals.



* Following are characteristics of organizational strategy:-

1) quality (product performance)
2) cost efficiency (low product price).
3) Dependability (reliable, timely delivery of orders to customers)
4) Flexibility (responding rapidly with new products or changes in output volume).

* OPERATIONS OBJECTIVES:-

- The overall objective of the operations subsystem is to provide conversion capabilities for meeting the organization's goals and strategy.

- The subgoals of the operations subsystem, then, must specify the following:

1. product / service characteristics
2. process characteristics.
3. product / service quality
4. Efficiency
   (a) Effective employee relations and cost control of Labor.

(b) Cost control of material
(c) Cost control in facility utilization

5. Customer Service (Schedule)
(a) Producing quantities to meet expected demand
(b) meeting the required delivery date for goods or services

6. Adaptability for future survival

★ STRATEGIC PLANNING :-

⇒ Strategic planning A process of thinking through the organization's current mission and environment and then setting forth a guide for tomorrow's decisions and results.

1) **planning for operations** Establishing a program of action for converting resources into goods or services.

2) planning the conversion systems Establishing a program of action for

acquiring the necessary physical facilities to be used in the conversion process.

⇒ Strategic planning Approaches for production / operations:- one specialist on strategic planning suggests three contrasting modes of strategic planning:

→ The entrepreneurial, the adaptive, and the planning modes. In the entrepreneurial mode, one strong, bold leader takes planning action on behalf of the production / operations.

⇒ A strategic planning Forced choice model:-

one of many planning models that has been used in strategic planning is a forced choice model,

- In group sessions or individually, analysts assess environmental considerations together with the organization's current production / operations position.

Date

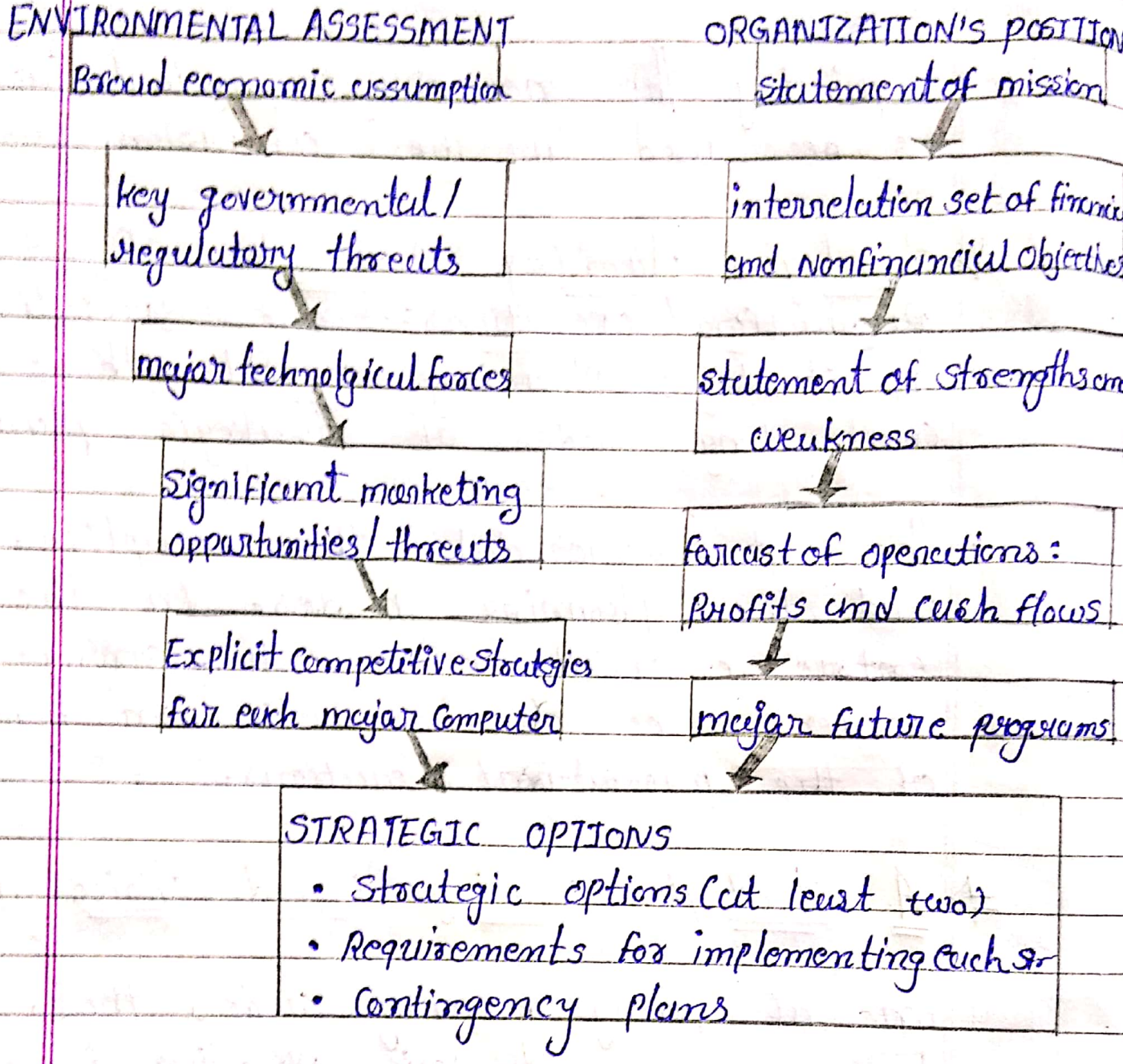


FIG:-2.1 A forced choice model of Strategic planning for operations.

3) A strategic planning operations model:-

Professor Chris A. Voss of the London Business School, England, has set forth

a Framework for strategy and policy development in manufacturing, which we have modified for Services as well.

- His Concept is that manufacturing Strategy tries to link the policy decisions associated with operations to the marketplace, the environment and the Company's overall Goal.

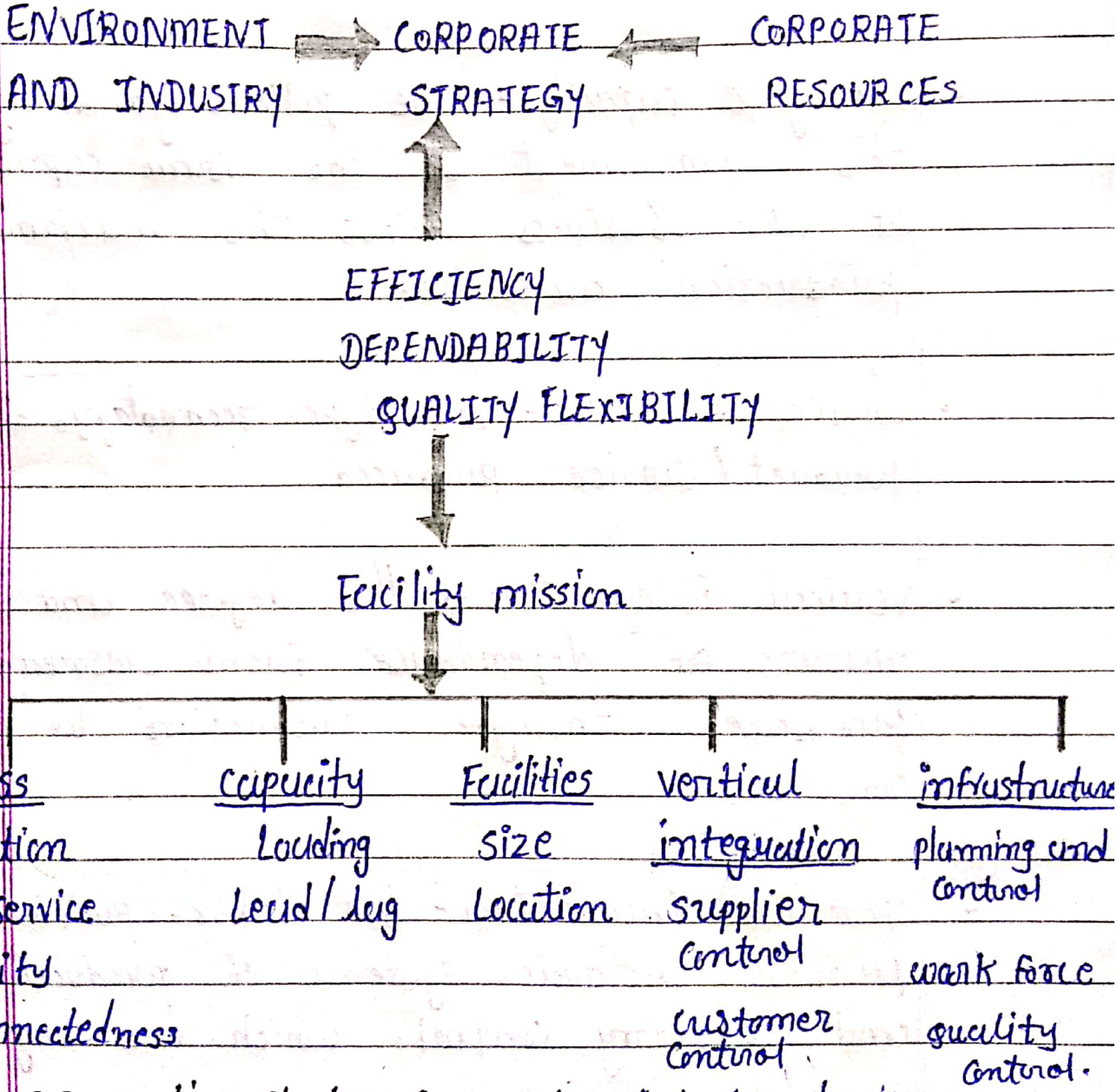


Fig:-2.2 operations strategy framework.

- A low-cost, high productivity operation makes efficiency possible.

- minimum use of scarce resources - labor, management, materials, equipment / facilities, and energy - while sustaining high outputs in the key to productivity.

- Facilities - for example, the scale, location, and focus of the facilities

- Aggregate capacity - the policies governing the management of the sum capability of all business units; the maximum production available.

- choice of process - the type, technology, and product / service produced

- Vertical integration - the degree and nature of dependence from resources purchased through production to the consumer.

- operations integration - the labor, policies, payment methods, systems of production and inventory control, which are key

elements for management control.

MARKET - BASED CRITERIA FOR SUCCESS

EFFICIENCY
- Low price
- Low cost
- High productivity
  - Labor
  - material
  - Energy

EFFECTIVENESS
- Delivery
  - Reliable
  - Rapid
- Availability (from stock)
- Design Competence
- Technical capability

QUALITY
- High
- Consistent

FLEXIBILITY
- Fast introduction of new products and services wide product/service range.

FIG:- 2.3 market - based criteria for success.

- operations interface with other functions:-
The mechanisms for Communicating with other functions.

* Productivity and quality:-

- Efficiency and productivity refer to a ratio of outputs to input.

- performance actually is a broader term incorporating efficiency and productivity in overall achievement.

- Formula:-

$$\text{productivity (\%)} = \frac{\text{O/P}}{\text{I/P}} \times 100$$

$$\text{productivity (\%)} = \frac{\text{O/P}}{(\text{labor} + \text{capital} + \text{material} + \text{management})}$$

different types of Inputs

* Types of productivity:-

1) Total factor productivity:-

Consider all types of I/P element and (Parts)
it is the ratio of output to the total inputs of labour, capital, material and energy.

2) partial factor productivity:-

it is the ratio of output to one, two or three (few) of all includes.

Eg:- 1) 250 customer served
3 workers to serve customer
8 Hours / day.

$$\text{Productivity} = \frac{250}{3 \times 8}$$

$$= \frac{250}{24} = \frac{10}{1}$$

2) 200 customer served on monday 3 workes time.
(2 X 8 Hrs & 1 X 4 Hrs)

$$\text{Productivity} = \frac{200}{16+4}$$

$$= \frac{200}{20}$$

$$= \boxed{10}$$

⇒ Labar efficiency:- The ratio of outputs to labor inputs the labar actually work to achieve that outputs.

- It is a partial factar productivity measure.

⇒ Quality:- The degree to which the design specifications for a product ar services are appropriate to its functions and use, and the degree to which a product ar services conforms to its design specifications.

⇒ quality - productivity strategy:-

Improving quality is well important aspect to maintain competivite position in today's market.

* Forecasting:- use of past data to determine future events

- it is for an objective computation.
  {Goals, purpose, success}

Page
Date

* Predictions:- it is an estimate of a future events achive without refering past data.

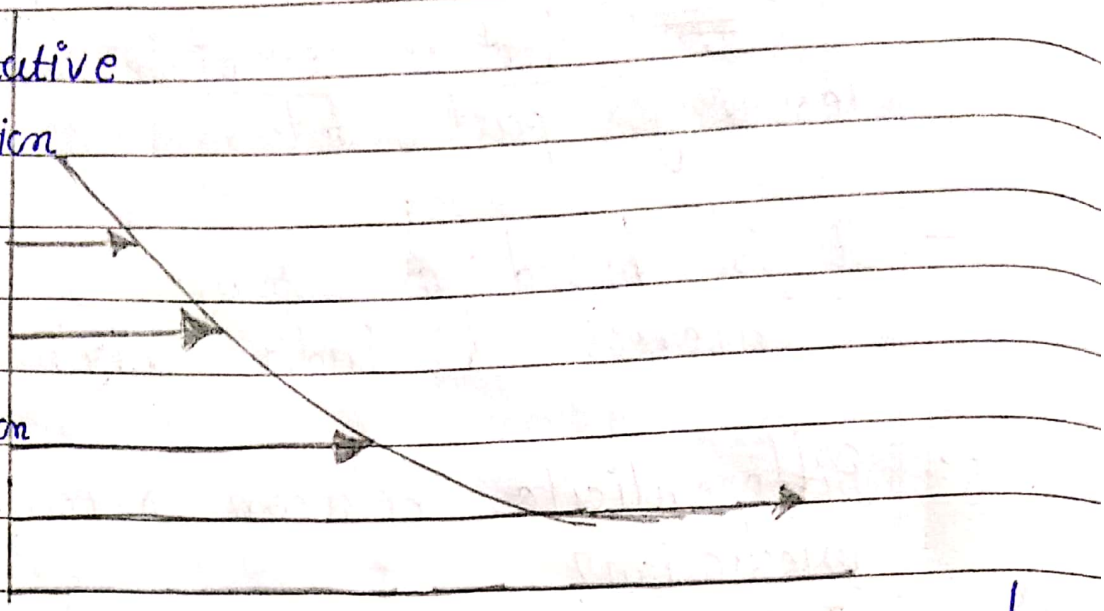
- It is based on subjective consideration. { interest of individually }

Q:- Differentiate between forecasting and prediction?

Ans:-

FORECASTING	PREDICTION
1) it is based on objective computation	1) it is based on subjective consideration.
2) Historical data for past transaction.	2) NO
3) Predetrmine way of analysis	3) NO method.
4) Guarenty of success	4) NO.

Types of Decision.	Representative information needs.
short-run planning decision	→ specification demands



Aggregates presents — Five years hence
demands

Strategies and facilities.

Long run planning decision.

fig:- Forcasting Time Durations.

* Forcasting and operations subsystem:-

1) planning (Designing) the system:-

- In planning the system managers needs to forcast aggregates demands so they can design or redesign process necessary to meet demand.

once process design, product design and equipment investment decision have been made for an anticipated volume, managers are locked into a facility of specifies capacity.

- There after wide variations between anticipated demand and actual demand can result in excessive production and operating costs.

- Capacity planning that makes use of long-run forecasts in one of the areas in production / operation is both critical and not well understood or developed.

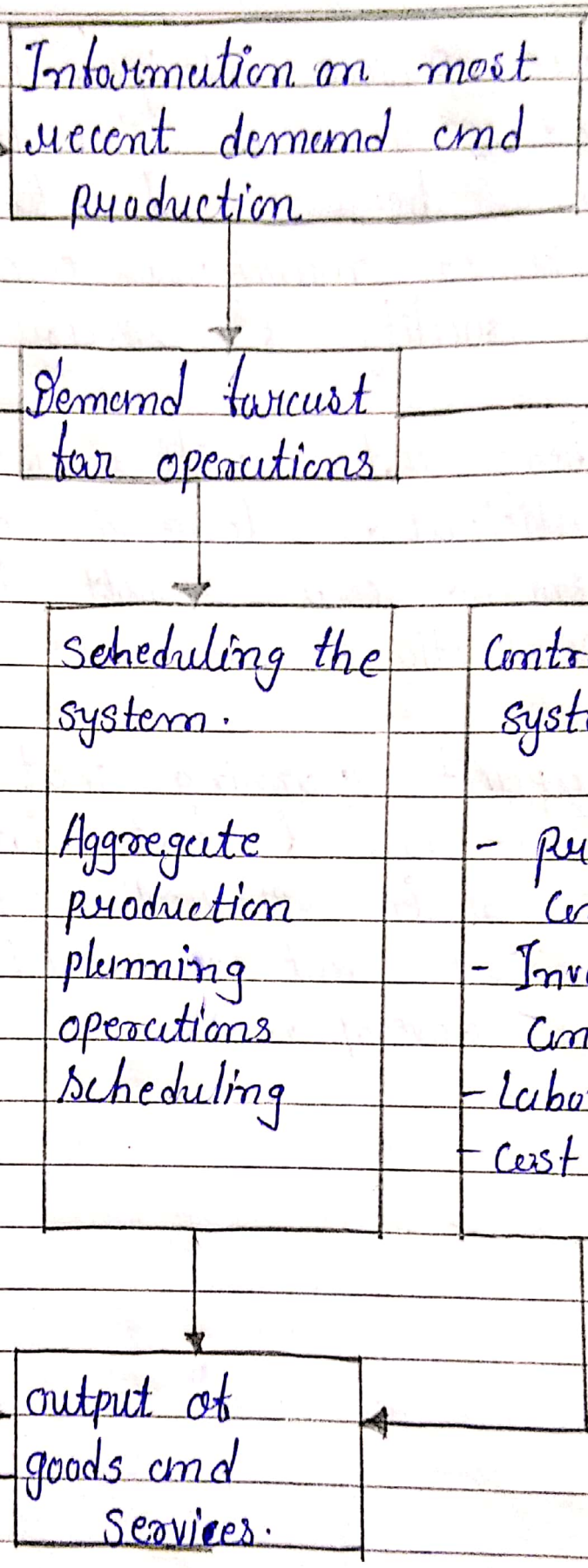


fig:- Using demand forcasting & productional operations Sub-systems.

Date

2) Scheduling the system:-

- when deciding how best to use the existing conversation system, accurate demand forecasts are very important. Managers need intermediate - run demand forecasts for three months, six months, and a year into the future.

- Both current and future work force levels and productions rates must be established from these forecasts.

- Job scheduling in intermitent and continuous operations is more stable if demand forcasts are accurate.

3) Controlling the system:-

- managers need forecasts of demands to make decisions about controlling inventary, production, labor and overall costs.

- Accurate forecasts are needed for the immediate future - hours, days, and weeks ahead. no longer

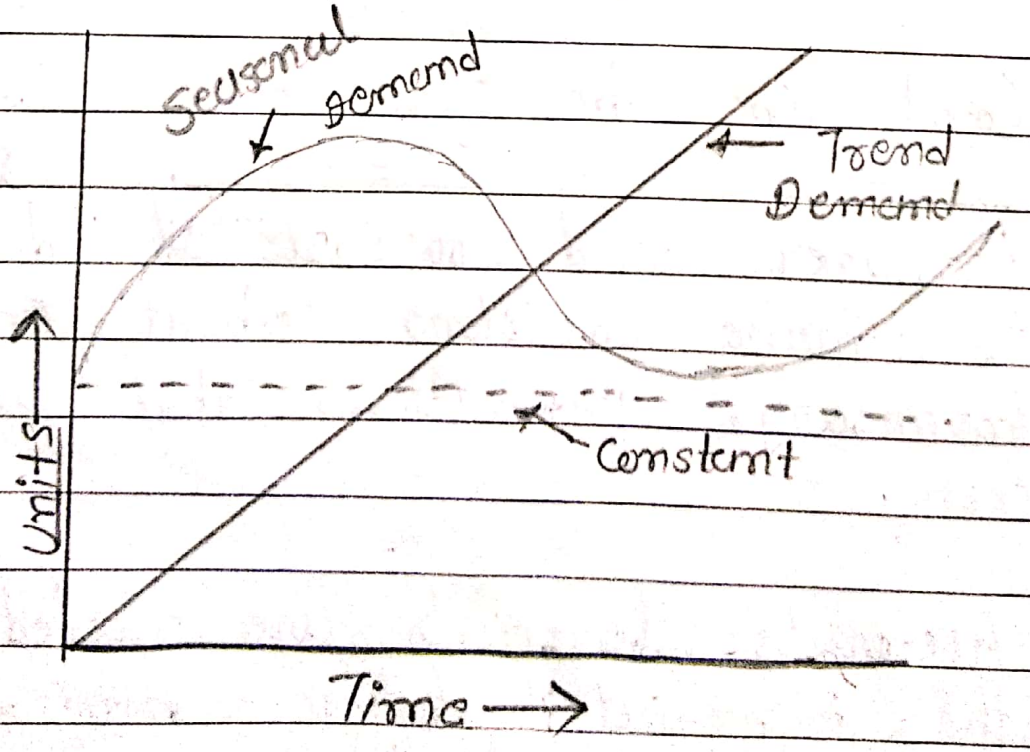
Page
Date

acceptable is an earlier generation's assumption that "any services that is offered will be purchased." or that "all that is produced can be sold."

* Time series Analysis:-

→ statistical Term
→ set Time
→ Fix Time Duration and then Analyze
→ Attribute Analysis is possible.

- In Forcasting problem, analysis of demand data located on time scale to present patterns on demand.



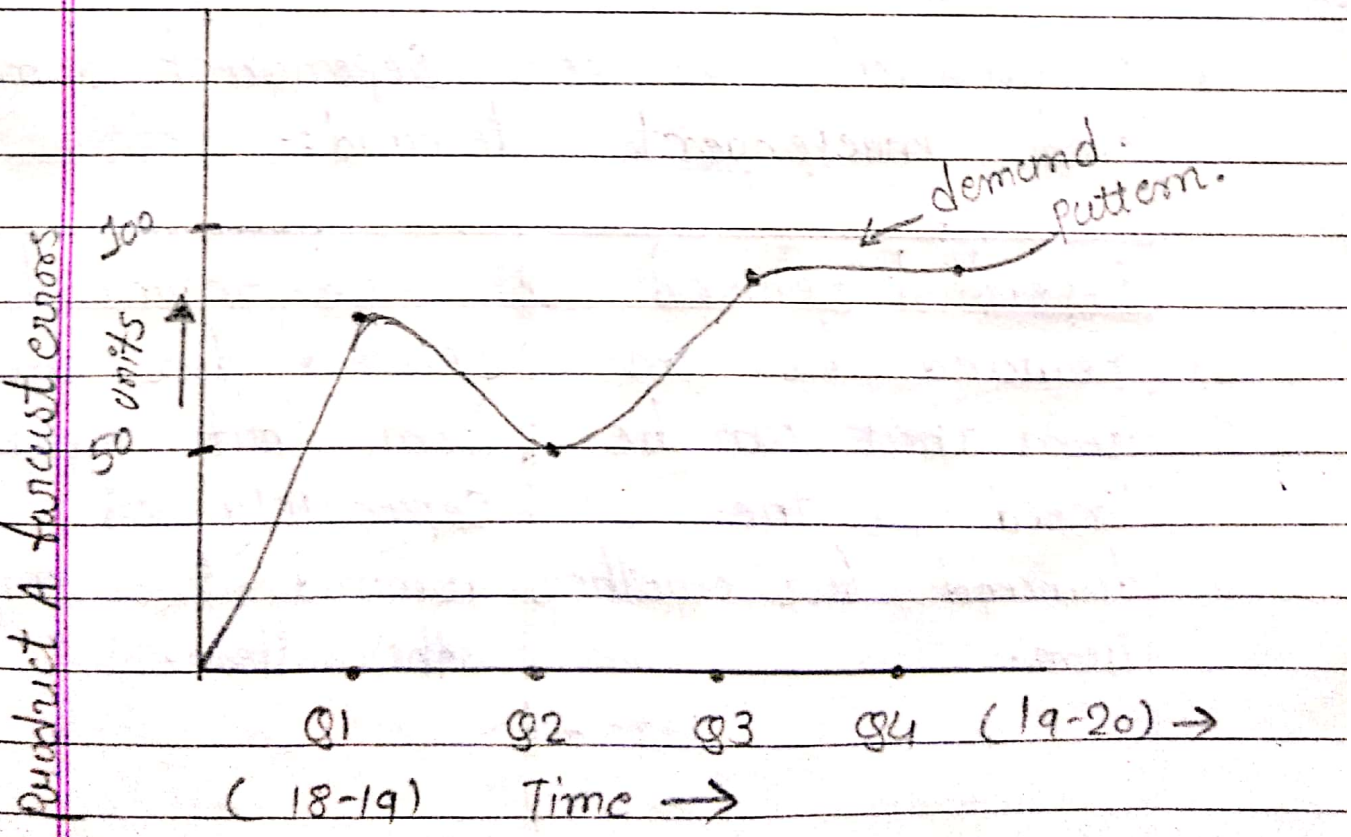
- There are three define the demands of production → {seasonal, trend, constant}

⇒ Define Demand pattern:-

- General shape of time series, usually constant, trend, seasonal or some combination of this shapes.

⇒ Types of Demand pattern:-

1) High noise demand pattern.
2) low noise demand pattern.



1) High noise:- it means many of the points lie relatively far away from the pattern.

2) Low noise:- All or most of the points lie very close to the pattern.

⇒ Define Noise:-

Difference in demand about a demand pattern. it means the forcast error.

⇒ Demand stability:- Tendency of time series to retain the same general pattern overtime.

* Differentiate between Dependent demand and independent demand:-

	Dependent Demand	independent demand
1)	Demand for an item that can be linked to the demand for another item.	Demand for an item that occurs Separately of demand for any other item.

Page
Date

* Forecust Error:-

The numeric difference of forecusted (last) demand and cuctucl demand (current)

Formulu:- Forecust Error ⇒
Forecusted Demand - Actucl demand

Signed is positive (-), unsigned is negative for compuny in numeric.

Eg:- 500 - 450 = 50 negutive
500 - 525 = -25 positive.

⇒ There ure two method to find forecust:-
(i) mean Absolute Deviution (MAD)
(ii) Bius.

(i) mean Absolute Devicition (MAD):-

A forecust error meusure thut is the uvercuge forecust error without regurd to direction; culculuted us the sum of the ubsolute vulue of the forecust error for ull periods divided by the totul number of periods evuluted.

Page
Date

Formula:-

$$\sum_{i=1}^{n} | \text{Forcasted demand } i - \text{actual demand}$$

$$n$$

Eg:

	F-d 18-19	ad 19-20	Fd-ad
Q1	100	90	10
Q2	120	120	0
Q3	110	100	10
Q4	130	100	30

$$= \frac{|10+0+10+30|}{4}$$

$$= \frac{|40|}{4}$$

$$= \boxed{10}$$

Eg:-

Q1	100	90	10
Q2	120	120	0
Q3	110	100	10
Q4	130	200	-70

$$= \frac{|10+0+10-70|}{4} = \frac{|-50|}{4}$$

$= |-12.5|$

$= \boxed{1.25}$

⇒ Asolute Deviation:-

MAD expresses the magnitude but not the direction of the error. this meusure of absolute value is culled absolute deviation.

(ii) Bias:-

A forecust error meusure that is the average of forecust error with regard to direction and shows any tendency consistently to over- or underforeccasts culculated as the sum of the uctual forecast error for all periods divided by the total number of periods evaluted.

Formula:-

$$\sum_{i-1}^{n} (\text{forecusted demand} - \text{actual demand } i)$$

$$n$$

Eg:-

	Fd	ad	Fd-ad
Q1	100	90	10
Q2	120	120	0
Q3	110	100	10
Q4	130	200	-70

$$= \frac{10+0+10-70}{4}$$

$$= \frac{-50}{4}$$

$$= -1.25$$

∴ negative

* Forecasting models:-

Types of Forecasting:-

1) Intuitive Forecast:- That essentially are a manager's guesses and judgements concerning future events qualitative forecasting methods.

2) Statistical Forecasting:- models casting forward past data in some systematic methods used

in time series analysis and projection.

3) Demand-based Forecasting:-

A statistical forecasting model based solely on historical demand data.

4) Causal Forecasting model:-

A statistical forecasting model based on historical demand data as well as on variables believed to influence demand.

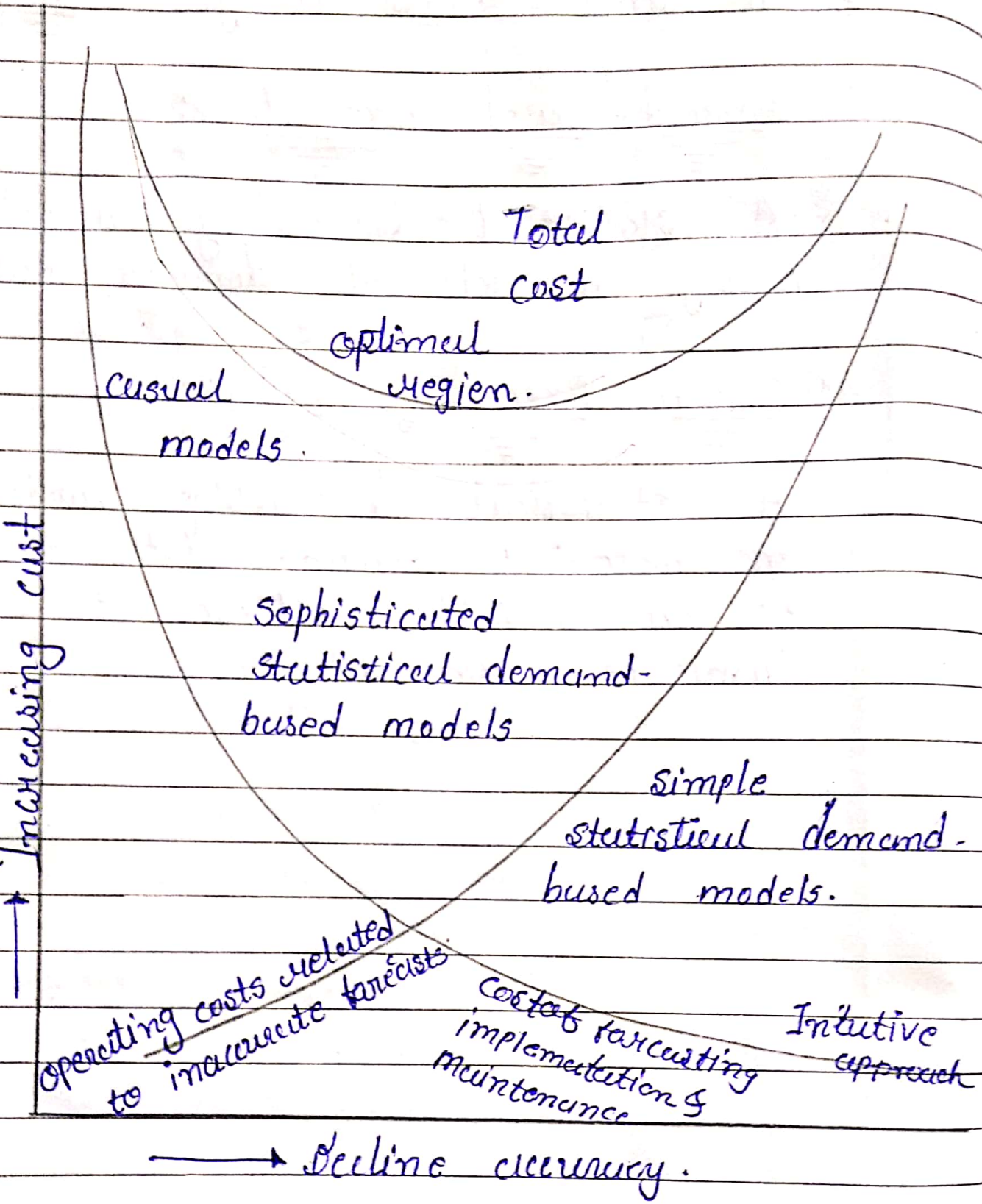


fig:- Cost/accuracy trade offs in forecasting.

Date

⇒ Costs and Accuracy:-

There is clearly a cost/accuracy tradeoff in selecting a forecasting approach.

- The more sophisticated approaches tend to have relatively high costs of implementation and maintenance, but they often provide more accurate forecasts, resulting in lower operating costs.

- figure illustrates one hypothetical cost situation. Not that for any forecasting situation there is an optimal region where reasonable accuracy and cost are obtained.

- our goal in forecasting for operations is to operate somewhere in this optimal region.

Page
Date

★ NEW PRODUCT DESIGN (PRODUCT DEVELOPMENT)

→ Business people frequently start new business at the basic of unique product idea or needed services.

★ PRODUCT LIFE CYCLE:- [6m]

Product life cycle pattern of demand throughout the product's life; similar patterns and stages can be identified for the useful life of a process.

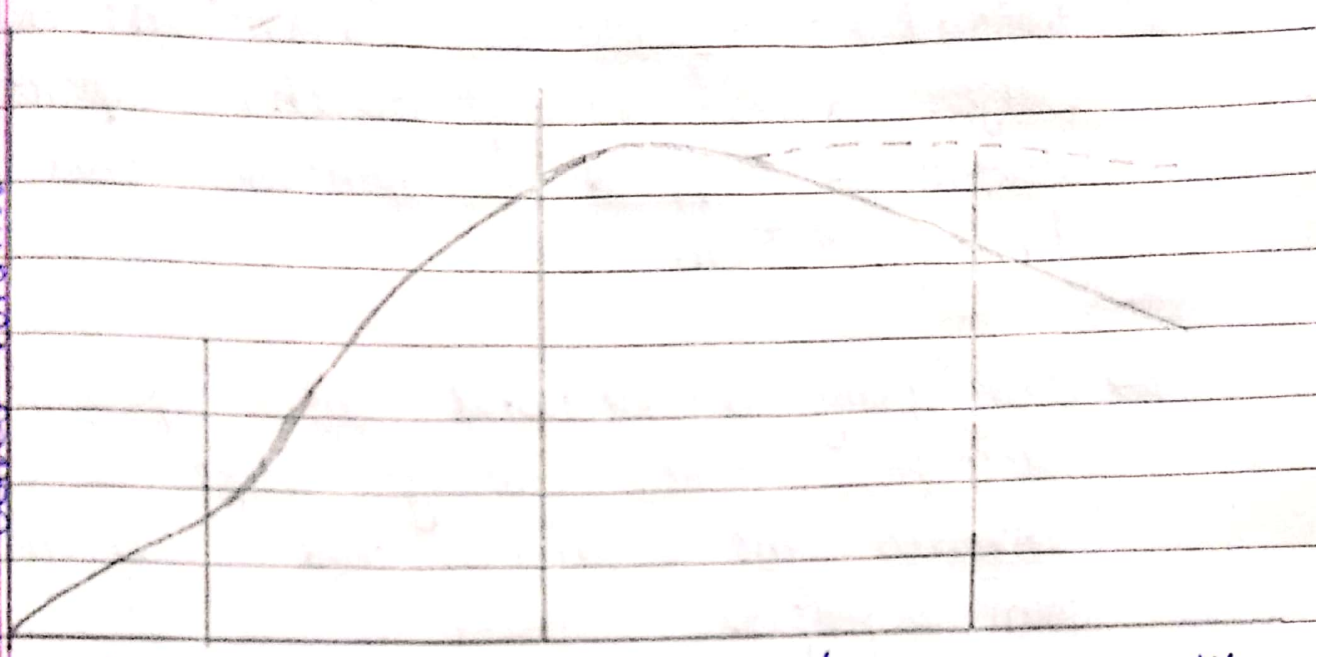
→ products go through a ~~Series~~ series of stages, beginning with low demand during market development proceeding through growth, maturity, high-volume saturation, and finally decline.

→ The time spans of the stages vary considerably across industries.

→ The time from birth to death may be as short as a few weeks or months. for other products the

Date

life cycle may span many years or even decards.



Characteristics	Start-up	Rapid growth	maturation	commodity or decline
	Stage			
product Veriety:	Great variety	increasing Standardization	Emergence of a "dominant design"	High standardiz -ation "comme -dity" character -stics.
product volume/model:	Low volume	increasing volume	High volume	High volume
Industry structure:	Small Competion	Fallout and Consolidation	Few large companies	"Survivors"
Form of Competition:	product characteristics	product quality & availability	price and dependability	price

Page
Date

* Research and Development (R&D):-

→ organizational efforts directed toward product and process innovations; includes stages of basic research, applied research, ~~applied~~ development and implementation.

→ Developing a successful new product or process takes many steps and involves the talent and expertise of many people.

→ As new-product ideas are created, they are evaluated for economic feasibility, Market potential, Functional testing and so on.

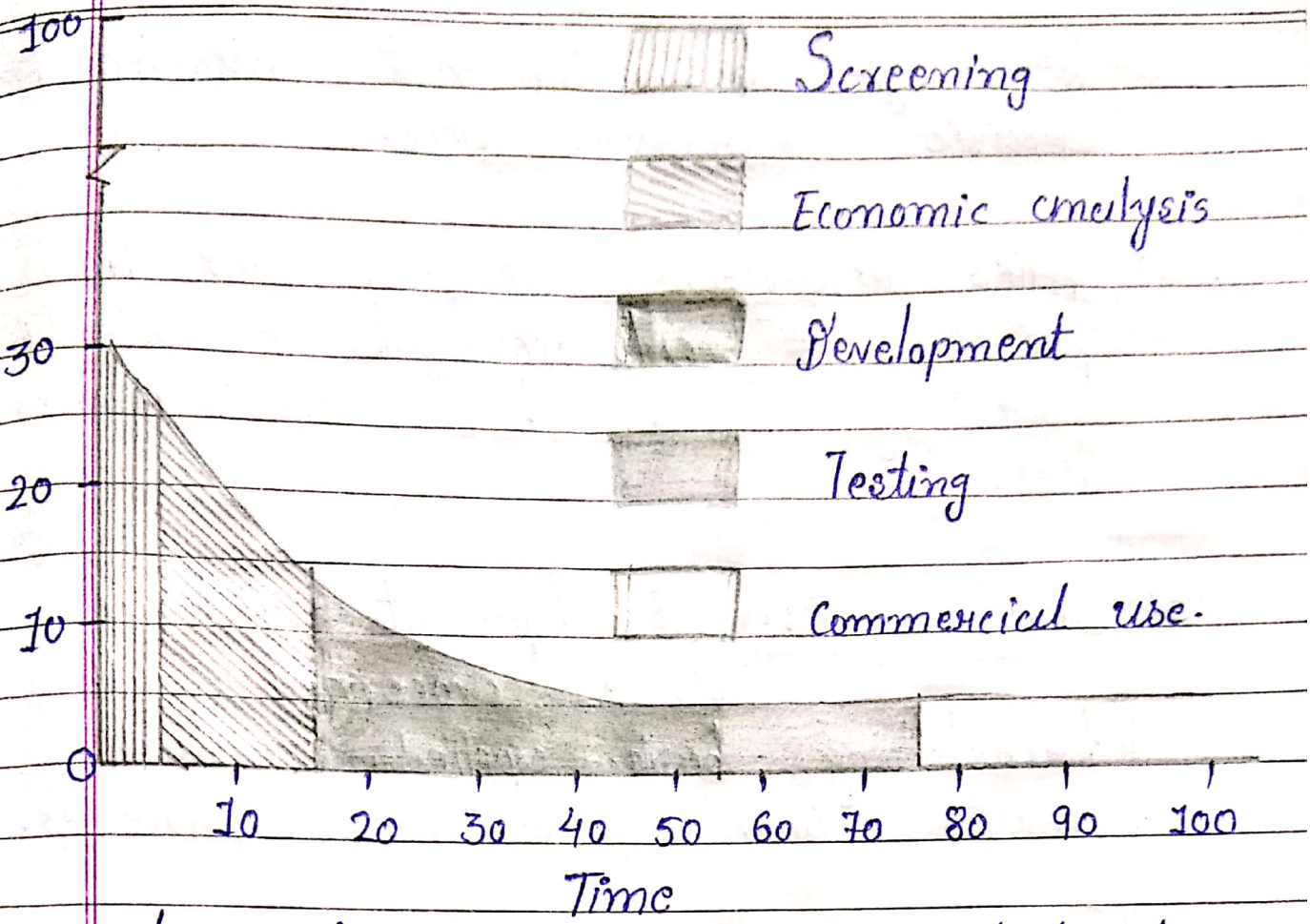


fig:- Decay curve of new product ideas.

→ These risks are offset, however, by those few successful products that generate sufficient revenues to make R&D a worthwhile long-term venture.

⇒ Components of Innovation or Component of R&D:- four generic components of technological innovation are:.

1) Basic Research:- Research for the advancement of scientific

knowledge that is not intended for specific commercial uses.

2) Applied Research:- Research for the advancement of scientific knowledge that has specific commercial uses.

3) Development:- Development Technical activities concerned with translating basic applied research results into products or processes.

4) Implementation:- Activities concerned with designing and building pilot models, equipment, and facilities for, and with initiating the marketing channels. for, products or services emerging from research and development.

* Organization of R&D:- In most companies R&D is a staff function located at either the corporate or divisional level.

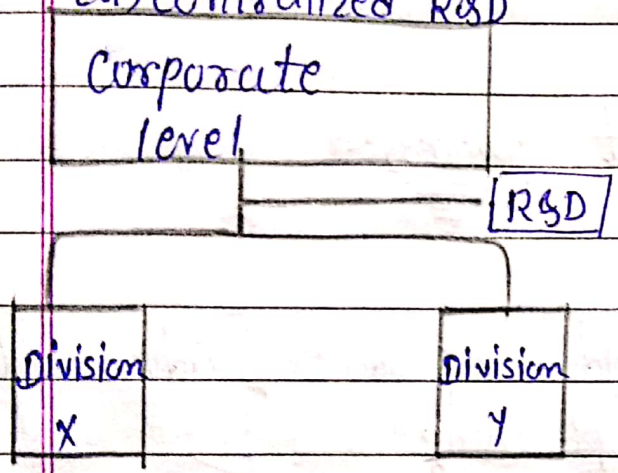
→ Three examples of R&D organizational structure are (1) R&D is centrally located. From this location, R&D can

economically serve the needs of all divisions and avoid duplicated effort.

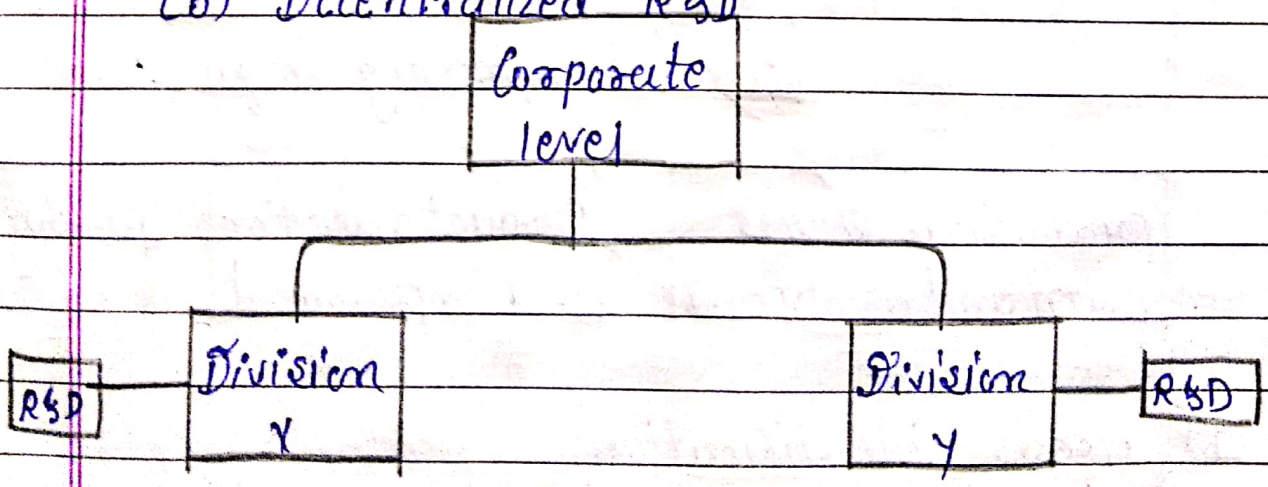
(2) This structure, however, can tend to raise the costs of R&D since efforts may be duplicated.

(3) attempts to reap the best of the benefits offered by both centralization and decentralization.

(a) Centralized R&D



(b) Decentralized R&D



(c) Combination.

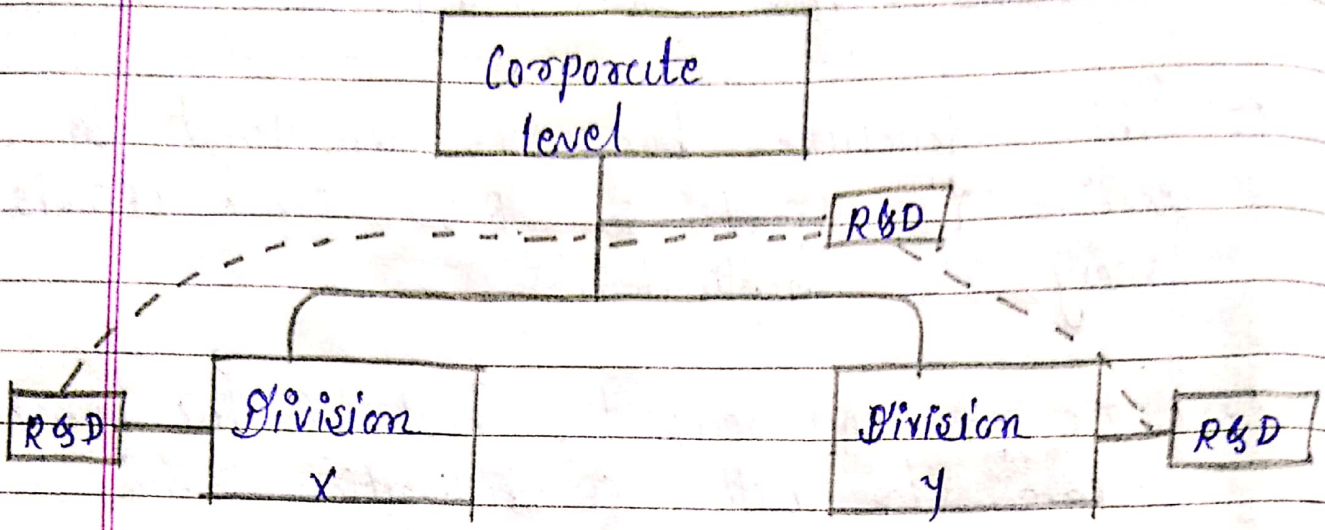
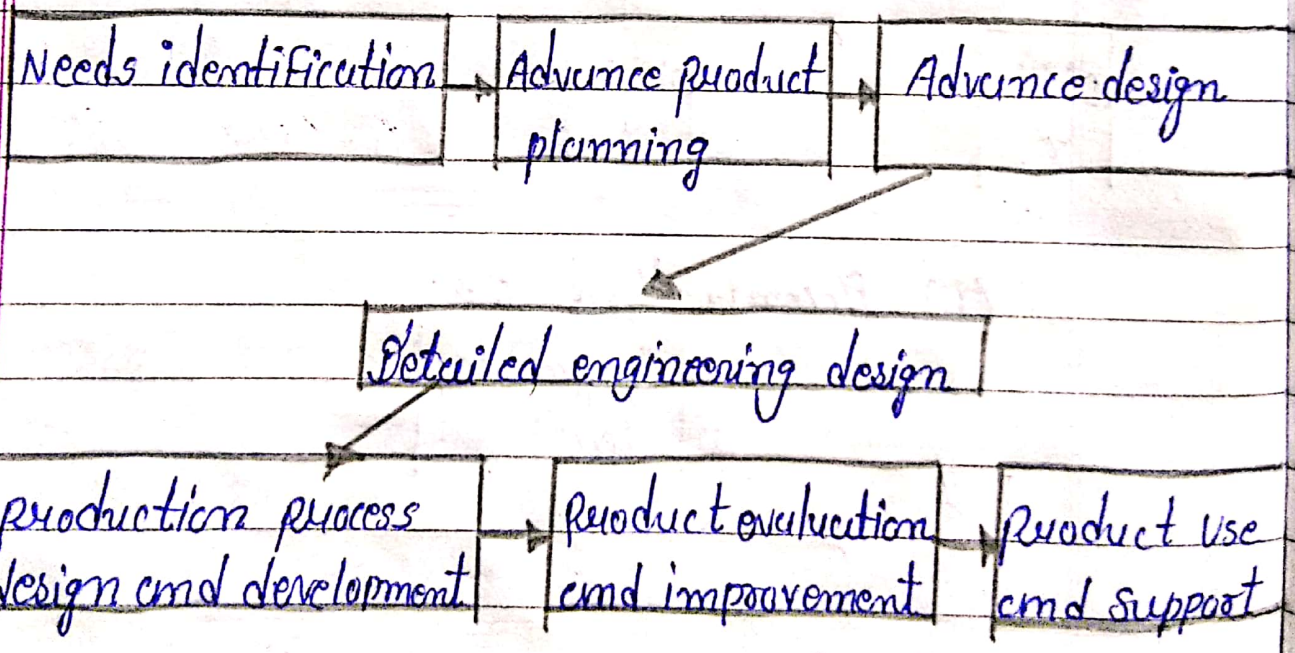


Fig:- R&D location in organization structure.

★ Product Development process:-



1) Needs identification.
2) Advance product planning

3) Advance design
4) Detailed engineering design.
5) Production process design and development
6) Product evaluation and improvement.
7) Product use and support.

* modular Design & standardization :-

→ modular design :- The creation of Products from some combination of basic, preexisting subsystems.

- In selecting a personal computer system, for example:- you may have your choice of three video monitors, two keyboards, two computers, ~~different computer systems with~~ three printers.

- The modular design concept gives consumers a range of product options and, at the same time, offers considerable advantages in manufacturing and product design.

→ Standardization:- product standardization offers both benefits to consumers and producers alike.

- In designing new products, standardization can bolster productivity by

(1) avoiding unnecessary engineering design when a suitable component already exists.

2) Simplifying materials planning and control during production because fewer components are in the system.

M.Imp ★ PROCESS TECHNOLOGY:- [6/2 M].

- Equipment, people, and systems used to produce a firm's products and services.

→ List various types of process technology:-

1) Project Technology:- Deals with one-of-a-kind products

that are tailored to the unique requirements of each customer.

- A general construction company, with its many kinds and sizes of projects, is an example.

- Since the products cannot be standardized, the conversion process must be flexible in its equipment capabilities, human skills, and procedures.

2] Job Shop:- A process technology suitable for a variety of custom-designed products in small volumes.

for eg:- The jobs done by a printing shop. Each product uses only a small portion of the shop's human resources and general purpose equipment.

- Some equipment is overloaded while other equipment is idle, depending upon the mix of jobs at hand.

3) Batch Technology:- A process technology suitable for a variety of products in varying volumes.

- Batch technology is a step up from job shop technology in terms of product standardization, but it is not as standardized as assembly line technology.

- The system must be flexible for the low-volume / high-variety products, but the higher volume products can be processed differently.

For example:- By producing some batches for stocking rather than for customer order.

4) Assembly line:- A process Technology suitable for a narrow range of standardized products in high volumes.

- Laundry appliances are a representative example. since the product designs

are relatively stable, specialized equipment, human skills, and management systems can be developed and dedicated to the limited range of products and volumes.

- Beyond this range, the system is inflexible.

5) Continuous:- A process technology suitable for producing a continuous flow of products.

- materials and products are produced in continuous, endless flow, rather than in batches or discrete units.

- Continuous flow technology affords high-volume, around-the-clock operation with capital-intensive, specialized automation.

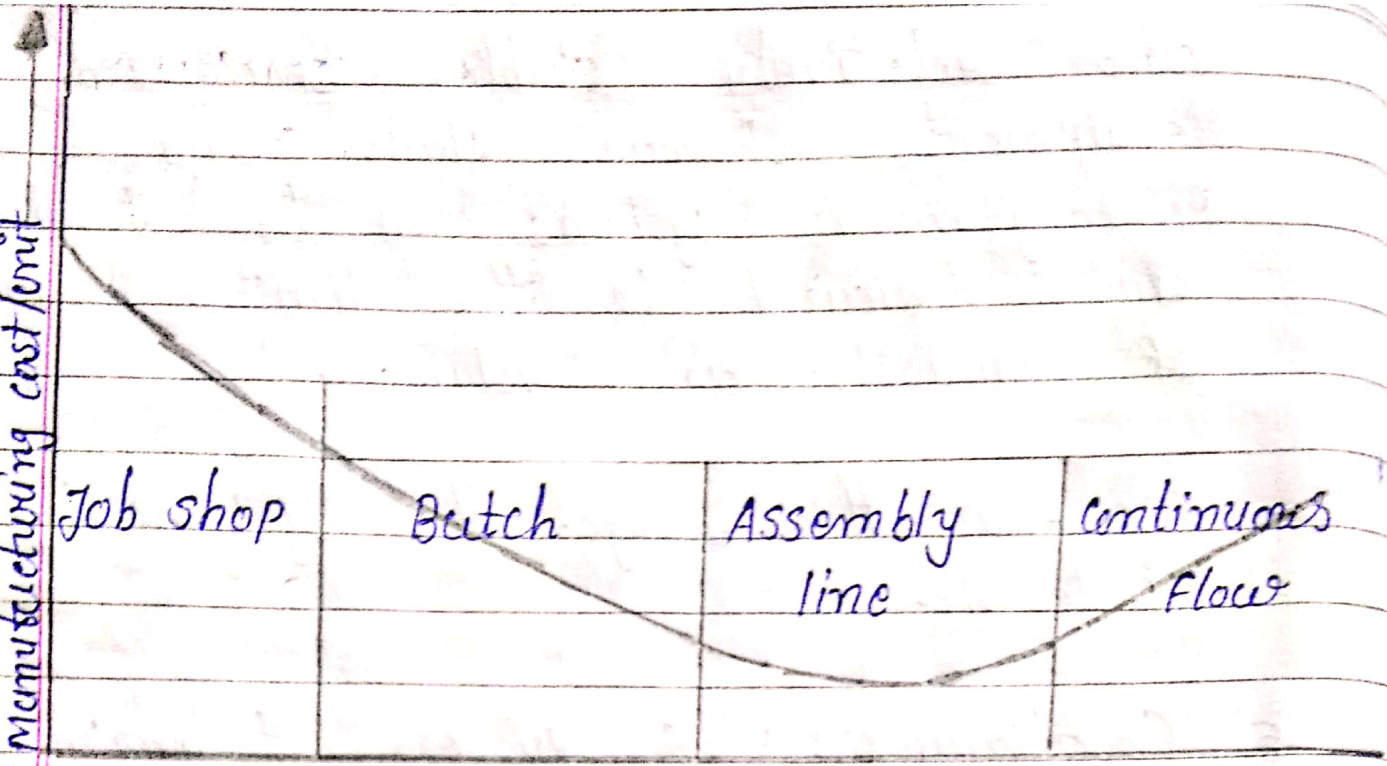


Fig:- 4.6 The process life cycle.

★ FLEXIBLE MANUFACTURING SYSTEM (FMS):-

- A computer-controlled process technology suitable for producing a moderate variety of products in moderate volumes.

Product structure

Product life-cycle stage.

Process structure / Process life-cycle stage	I	II	III	IV
	low volume, low standardization, one of a kind	multiple products, low volume	Few major products, higher volume	High volume, high standardization, commodity products.
1 Jumbled Flow (Job Shop)	Commercial printer			void
2 Disconnected line Flow (batch)		Heavy equipment		
3 Connected line Flow (assembly line)			Auto assembly	
4 Continuous flow.	void			Sugar refinery

fig: 4.7. matching major stages of product and process life cycles - the product-process Matrix.

Date

* Characteristics of An FMS:-

- that can produce a moderate variety of products in modest volumes, and can do so quickly and with high quality.

- operating costs, too, can be reduced with an FMS; lower direct labor costs lead to lower manufacturing costs.

An Fms is generally appropriate when:

1. All products are variations of a stable basic design;

2. All products utilize the same family of components;

3. The number of components is only moderate (10 to 50);

4. The volume of each component is moderate (1,000 to 30,000 units annually), but in lot sizes as small as one unit.

Date

* GOAL OF AN FMS:-

- The goal is to produce a moderate variety of products in moderate, flexible quantities. clearly, an FMS is more flexible than conventional high-volume production systems.

- It is less flexible than a job shop that specializes in one-of-a-kind products.

- An Fms is a "mid-range" system appropriate for moderate variety/moderate volume markets.

* LAYOUT CONCEPTS:-

- physical location or configuration of departments, work centers, and equipment in the conversion process.

- it is an arrangement of physical resources used to create the product.

→ Types of layout:-

1) Process oriented layout:-

- Process layout the arrangement of a facility so that work centers or departments are grouped together according to their functional type.

- A process-oriented layout is appropriate for intermittent operations when work flow is not consistent for all output.

2) Product oriented layout:-

- The arrangement of a facility so that work centers or equipment are in a line to afford a specialized sequence of tasks.

- A product-oriented layout is appropriate for producing one standardized product usually in large volume volume.

3) Fixed position layout:-

- fixed-position layout the arrangement of a facility so that the product stays in one location; tools, equipment, and workers are brought to it as needed.

4) Combination Layout:-

- Combination of layouts must be used. of any two or three of above listed layout.