

3. Designing Of Operational System And Control.

3.1. Product Design.

* Product?

→ Important part of fundamental marketing mix.

* Product Design?

Collection of interdependent directional activities

↓

that are planned & executed

↓

in structured and planned way

↓

to develop value propositions to be offered to end customers

↓

for fulfilling their needs.

* Basic Objectives of Product design?

1) To develop products as per the needs of end customer, to provide optimum value.

2) To minimize cost & lead time

3) To maximize resource utilization.

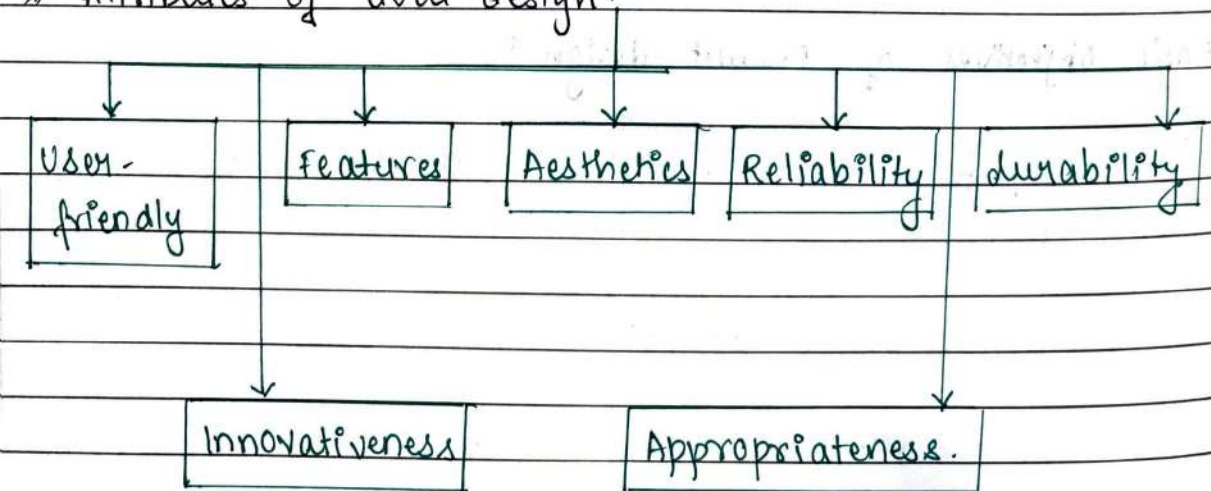
* Importance of Product design.

- 1) To establish detailed characteristics of products in line with market demand & competitors.
(core and augmented)
- 2) Provide the technological requirements & processes.
- 3) Guidelines for production system design.
- 4) Necessary impetus to production and operation strategy.

* Benefits of Good Product design.

- enables orgⁿ to stay ahead of competition.
- sustain in this VUCA world.
- helps to build long-term relationship with the end customers.
- indirect impact on employment.
- Acts as order winning criteria for Orgⁿ.

* Attributes of Good design.



* what does Product design do? (Responsibilities)

1. Understand & translate customer requirements (Voice of customers) → into set of technical requirements (Voice of Process) → for design and execution of planning and processes.

2. Differentiate existing products → stretch the product life cycle.

3. Developing new products.

4. Providing inputs required → forming quality goals.

5. Cost Optimization

6. Building & testing model prototypes.

7. Documentation → design specifications.

* Factors Affecting Product design.

1. Difficulty to get idea of unstated or latent needs of end consumers.

(Modern designers often rely on social media analytics for discovering the latent needs)

2. User-friendliness → attracts people from various demographic backgrounds.

3. Striking balance between → form, function/features & cost. [Economics of Scale & Economics of Scope].

4. Quality of RM / basic ingredients.

67 Quality & conditions of machines/instruments.

77 capability & maturity of the processes.

87 skilled resource persons.

97 Effect on existing products.

107 Presentation (Packaging) of product.

* characteristics of Good Product Design.

16 Product Quality → satisfy needs of customers → providing optimum value.

27 Product → reliable & worthy.

37 Product → designed at an optimum cost → affordable price to customers.

47 Shorten design to market lead time.

57 Aesthetics / looks → immediate impression for customers.

67 Compatible, user-friendly and upgradable with availability of after sales support. (spare parts)

77 Easily maintainable & reproducible.

87 balance between

Basic features

&

customized

Augmented features.

97 Detailed specification.

107 Safe, error proof, not to harm environment & users.

3.2. Process Design And Selection.

* Process Design?



All activities performed to produce final products.



as per the specifications in line with requirements of the customers.

* Process Design Depends on the following :-

1. Characteristics :- Type of product.
2. Variety :- degree of customization & standardization
(Make to order, Make to stock, Engineer to Order, Assemble to order)
3. Volume :- Amount to be produced & size of lot.
(single piece or batch or continuous production).
4. Level of involvement of human resource :-
process = automatic (least involvement of manual labour; capital intensive)
= semi automatic or manual (labour intensive)
5. Resource Requirement :-
Machines (special purpose / general), human capital, space, energy, raw material etc.
6. Expenditure :-
cost of operations (fixed and overhead)
7. Decision :-
In house (make) or Outsource (Buy) production.

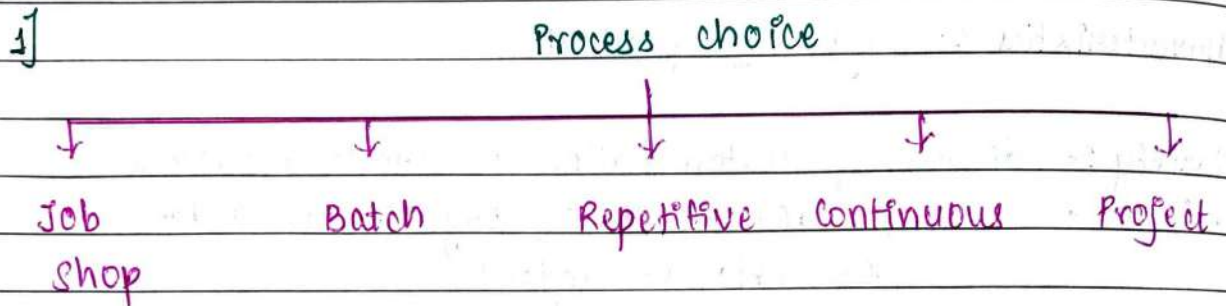
* Process choice :-

determines whether resources are organised around products or processes



in order to implement flow strategy.

→ It depends on
 ↗ volume
 ↘ degree of customisation

* Major Process decisions :-A] Job shop :-

- Used = low volume of high variety goods are needed.
- Each job = different processing requirements.
- High customisation
- High flexibility of equipment.
- Skilled labour
- low volume.
- Uses flexible flow strategy.

Eg:- Tool and die shop.

B] Batch Process :-

- Moderate volume & moderate variety of goods and services.

(Only point of difference between Job and batch)

- High volume bcoz same/similar products are provided repeatedly.

3] Repetitive Process :-

- Higher volume
- more standardised goods & services.
- slight flexibility of equipments
- low labour skills.
- eg) automobiles, home appliances, television sets, computers, toys etc.

Repetitive process → also referred as line process
(CO2 includes prodn lines & assembly lines in mass production)

- Resources = Organised around product/service
- materials = move in line from one operation to another with a fixed sequence.

This kind of process is suitable for:-

- 'manufacture to stock strategy'
 - "assemble-to-order"
 - "mass customisation"
- } also possible.

4] Continuous Process :-

- High volume
- Very highly standardised products.
- No variety in output.
- No need of equipment flexibility
- rigid line flows.
- operate round the clock to maximise equipment utilisation & to avoid expensive shut down & shutups.

eg → petroleum products, steel, sugar, flour, paper, cement etc.

5] Project Process :-

- high degree of job customisation
- large scope for each project
- need substantial resources
- project is complex, take long time
- equipment flexibility & labour skills (low to high)

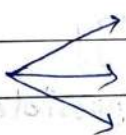
eg:- building shopping centre, dam, bridge, factory, hospital etc.

3.3. Product Life Cycle.

- cycles/phases during the usable life of a product is collectively called as Product life cycle (PLC)

A typical PLC has five stages :-

1st Introduction Phase :-

- product gets introduced in the market for first time. (either completely new product or a new variant of the existing product).
- low volume
- sales low
- effect of learning curve not realized.
- Return on Investment - low.
- High expenditure in promotional campaigns.
- Pricing depends on 
 - innovativeness of product
 - nature of target customer segment.
 - discounts given.

2nd Growth Phase :-

- Focus : Rapid revenue generation & market growth.
- Sales : cover up FC, bring down overhead cost.
- Utilizing learning curve.
- Promotional & advertising strategy → according to level of growth.
- Objective : Hold existing customers & create new customers.

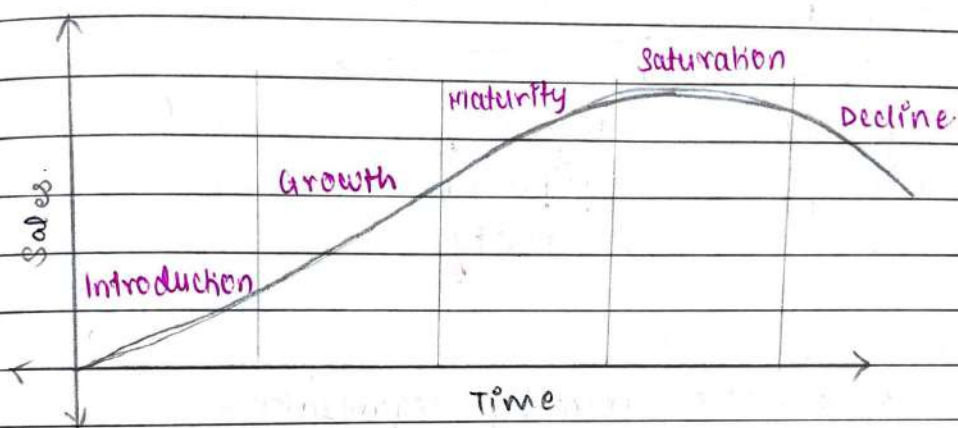
3rd Maturity Phase :-

- characterized by saturation in the market place.
- critical phase.
- Co. wants to flatten curve, to slow down movement towards fall down.
- Orgⁿ infuse variety & differentiation in products to start a new PLC.

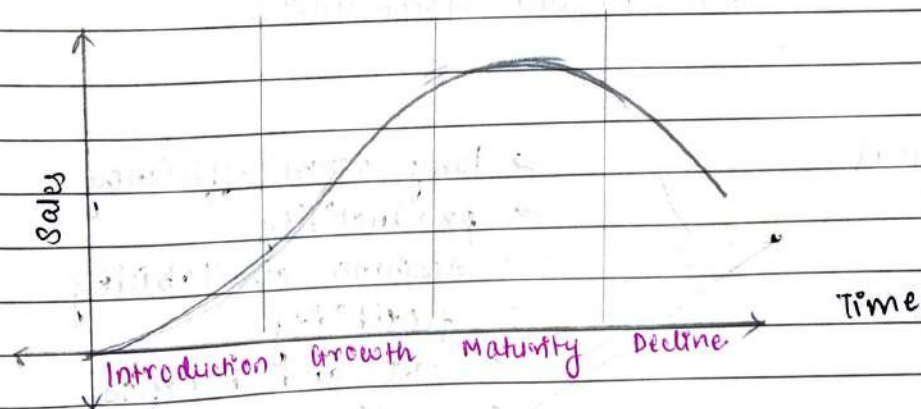
- Finding out niche market.
- Aggressive promotional & pricing programs.
- Profit margin = comparatively lower.

4. Decline phase :

- market and sales get falling down.
- Profit margin $\rightarrow$ increasingly narrower.
- scrap of product
- focus on cost consolidation.
- revival planning with product differentiation & promotional strategy.



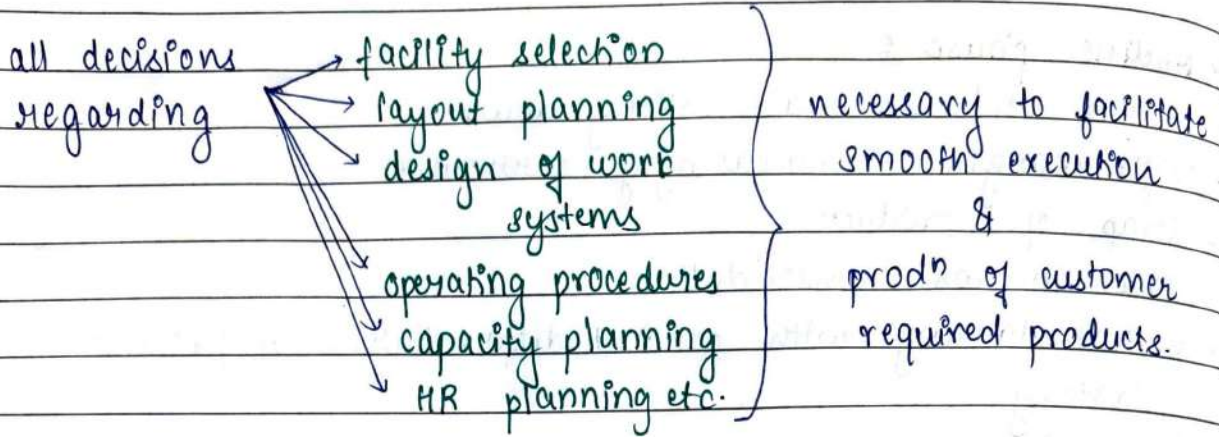
PLC for FMCG Product.



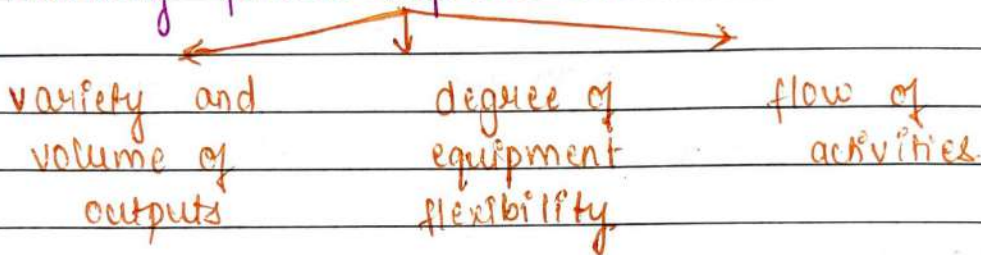
PLC for High Tech Product.

3.4. Process Planning And Selection.

* Process Planning ?



* Planning process depends on:-



* Process Strategy :-

A decision taken by organization

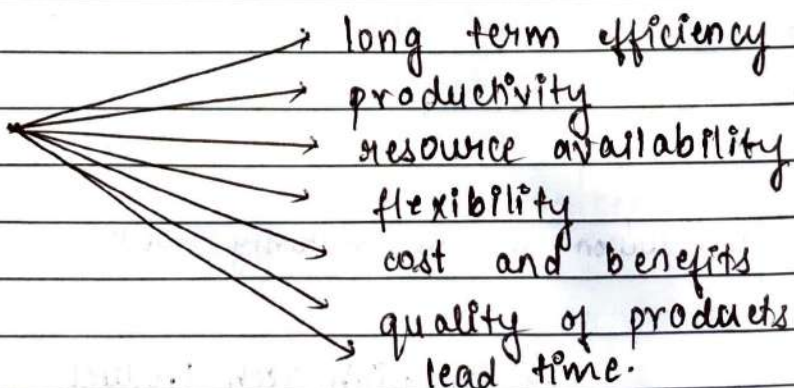
↓

selection of process for converting inputs into outputs

↓

with product specifications.

A typical process strategy depends on



* Process strategy stands on following premises:-

- 1) Trade-off between Make or Buy decisions.
- 2) Degree of capital intensity
(optimum balance between automation & manual)
- 3) Extent of flexibility required in process.
(positioning and functioning of M/c, work stations, skills for layout decisions)

* Three focused Areas for designing facilities:-

Process Focused	Product focused	Repetitive Focused.
--------------------	--------------------	------------------------

a) Process Focused :-

- designed in process centric way
- Each process → wide range of activities
- flexible to adopt changes.
- higher level of customisation.
- Also known as Job shop production.

b) Product Focused :-

- planned in product centric way
- Higher level of standardization.
- Higher volume with low variety
- Higher fixed cost.
- Suited for continuous flow and batch production.
- eg) steel, glass, paper, electric bulb, chemicals etc.

c) Repetitive Focus :-

- Benefits of above both arrangements.
- Uses modular production.
- Also known as Assembly production.
- eg) automobile process, household appliances etc.

* Process Layout Selection :-

Identify necessary arrangements of facilities for

- | | | | | |
|--|--|--------------------------------------|---|---|
| a) facilitating
production
efficiently | b) minimizing
unnecessary
movements
and
transportation | c) efficient
material
handling | d) effective
design
and
org ⁿ of
work
stations. | e) identification
& removal
of the
bottlenecks/
constraints |
|--|--|--------------------------------------|---|---|

1) effective utilization of spaces.

Objective → provide value added products & services
minimizing the waste
optimizing operational cost & resource utilization.

4 Types of Layouts.

Process layout/ functional layout	Product/ line layout	Group/ Combination layout	Fixed position/ project layout.
--------------------------------------	----------------------------	---------------------------------	---------------------------------------

A] Process layout / functional layout :-

- similar type of machines & services are located together.
- Each sub-facility is specialized.
- suitable for :- low volume
high variety prod.

} by job shop,
batch prodⁿ
and other
non-repetitive processes.

Eg:- Furniture, Restaurants etc.

B] Product layout / Line layout :-

- facilities organized as per logical / sequential flow of activities performed to produce products.
- Suitable for :- high volume continuous prodⁿ low customization.
- Eg:- Assembly line or mass prodⁿ used in consumer electronics, automobile sector etc.

C] Group / Combination Layout :-

- Features of both process & product layout.
- Individual processes are replicated at multiple cells. (each cell equipped with all facilities)
- Suitable for :- cellular manufacturing (that minimizes cost of transportation & material handling)

D] Fixed Position or Project layout :-

- Main facilities are fixed while,
- material, people and work stations move as per requirements.
- Single use layout.
- Suitable for :- Highly customized (ETO) type product.
- Eg:- Aircraft, ships.

* PV-LF Matrix :-

useful tool for analysing the similarities & differences among the seven production systems.

PV-LF Matrix has 4 dimensions :-

- 1) No. of products produced.
- 2) Prodⁿ volume of each product.
- 3) Layout or arrangement of equipment and processes
- 4) Flow of material through the equipment and

LAYOUT and MATERIAL FLOW, LF

PRODUCTS and VOLUMES, PV

Very many products; one or a few of each Many products; low volumes Many products; medium volumes Several products; high volumes One product; very high volume

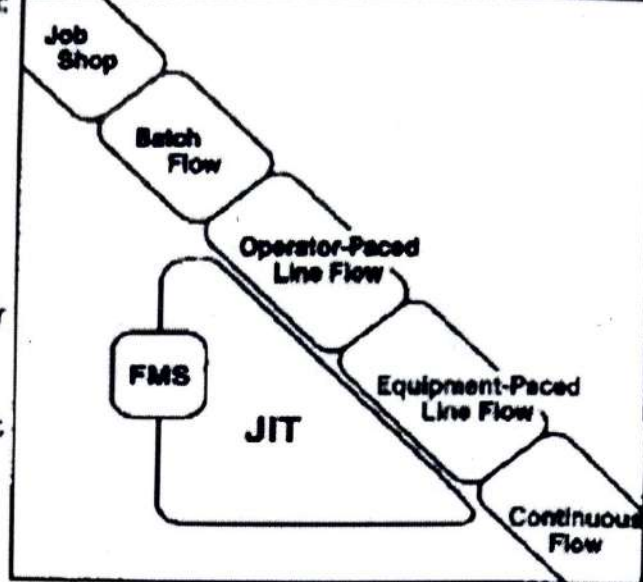
Functional layout; flow extremely varied

Cellular layout; flow varied with patterns

Line flow - operator-paced; flow mostly regular

Line flow - equipment-paced; flow regular

Continuous flow; flow rigid



3.5.

Design Thinking

What is Design Thinking?

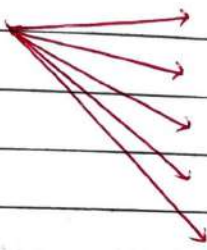
a non-linear, iterative process



that seeks to understand

- users needs
- challenge assumptions
- redefine problems
- create innovative solutions to prototype
- test

Five phases



Empathize

Define

Ideate

Prototype

Test

→ It is most useful to tackle problems that are ill-defined or unknown.

* The five stages of Design Thinking :-

The Hasso Plattner Institute of Design at Stanford (aka the d.school)



describes design thinking as five-stage process.

(Note :- These stages are not always sequential, and terms often run them in parallel, out of order and repeat them in an iterative fashion).

Stage 1: Empathize → Research your Users Needs.

- Gain an empathetic understanding of the problem you're trying to solve, through user research.
- Crucial to a human-centered design process
- Do need to set aside own assumptions & gain real insight into users & their needs.

Stage 2: Define → State Your User's Need and Problems.

- Accumulate information gathered during empathize stage
- Analyze your observation.
- Synthesize them to define core problems.
- These definitions are called problem statements.

Stage 3: Ideate → Challenge Assumptions and Create Ideas

- Ready to generate ideas.
- think outside the box
- look for alternative ways
- Identify innovative solutions.
- Brainstorming is particularly useful here.

Stage 4: Prototype → Start to create solutions

- Experimental phase.
- Aims to identify best possible solution for each problem
- Produce some inexpensive, scaled down versions.
- This could involve simply paper prototyping.

Stage 5: Try Your Solutions out

- Final phase
- Evaluators rigorously test the prototypes.
- Design thinking is iterative.
- Use results / return to previous stages to make further iterations, alterations & refinements, to find alternative solutions.

[Goal is to gain the deepest understanding of the and what their ideal solution / product would be]