BA4204- OPERATIONS MANAGEMENT

UNIT-III

Product Design - Criteria, Approaches-Product development process - stage-gate approach - tools for efficient development. Process - design, strategy, types, analysis. Facility Layout – Principles, Types, Planning tools and techniques.

Product design is the process designers use to blend user needs with business goals to help brands make consistently successful products.

The objective of product design is to create a good or service with excellent functional utility and sales appeal at an acceptable cost and within a reasonable time. The product should be produced using high-quality, low-cost materials and methods

Objectives of Product Design

The essence of product design is to satisfy customer and maximizes the value for the customer at minimum cost. The product or service should also be able to meet primary needs and desire of the customer. This may not require development of new product, but enhancement to existing product or service.

Factors Affecting Product Design

A successful product design is combination factors as follows:

Correct Team Selection: This is very essential to get the correct team in place which has expert designers who are not only aware and comfortable with technology but also understanding of customer expectation.

Customer Involvement: Involvement of customer in product design and testing can provide insight into the direction of the project

Prototyping and testing: Product design is high-risk concept as it involves commitment of capital and manpower; therefore, it is imperative that extensive prototyping and testing are done with customer and market.

Raw Material: It is essential that raw material to be used in the production meet the quality standards of the product. Furthermore, procurement system needs to be in place to ensure continuous, cost effective supply.

Production method and process layout: Feasibility of production method and process layout determines future success of the product.

External Factors: Environmental and government regulations play an important part in product design. In addition, these norms are updated from time to time, so product design should have the flexibility to adapt.

Stages of Product Design

Product design is a creative process which looks at all the available options and beyond. The process is can be divided into three stages:

- **First stage:** this stage involves ***brainstorming, bringing ideas and analysis of customer and market feedback.***
- **Second Stage:** ***Idea is converted into a feasible solution*** to satisfy the customer expectation, using available resource and technology.
- **Third Stage:** This is the last stage in which ***the product is introduced*** in the market

What is Product Development?

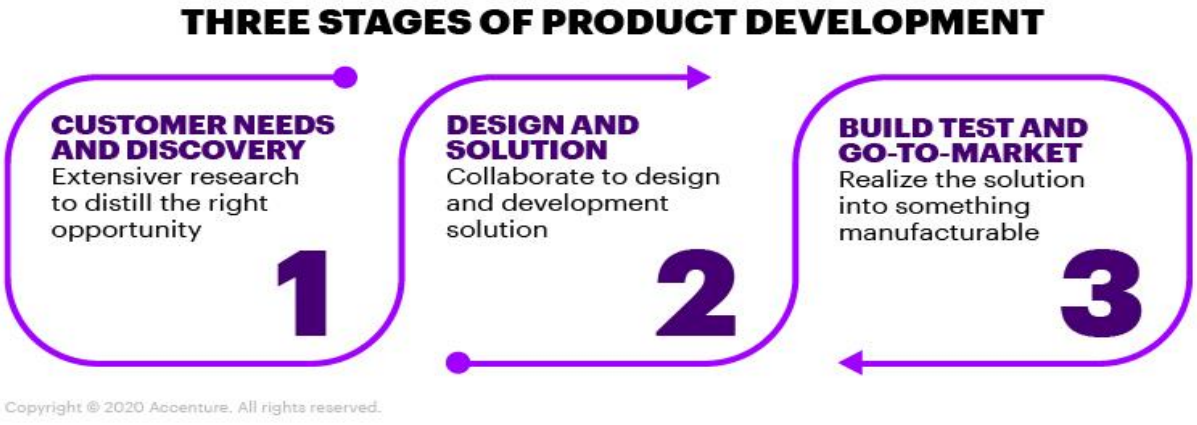
Product development is the processes required to bring a product from being a concept through to reaching the market. There are many steps required to take a product from the early stages in the product development process, from product idea generation and market research through to research and development, manufacturing and distribution.

Why Product Development is Important

Product development strategies are important to ensure value for your potential customers, as well as ensuring that there is demand and that your final products are of the highest possible quality before you take the products to market.

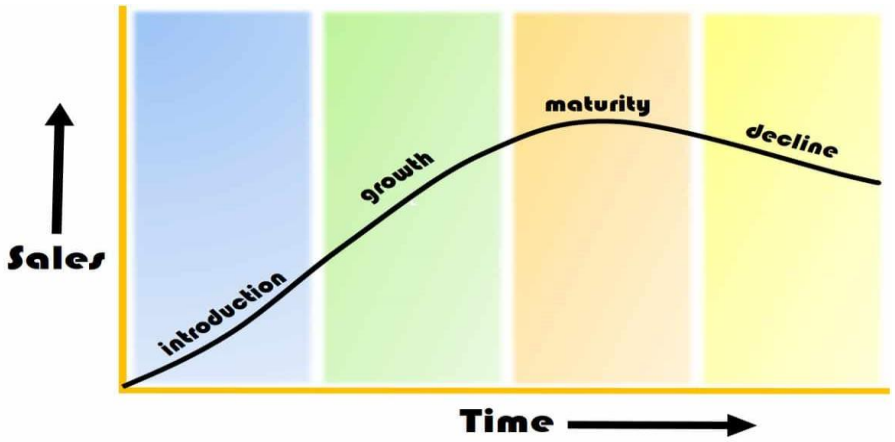
The very best products also help society improve, whether through the product line itself or through the employment and income generation the new items deliver.

On the business side of things, a new product can improve market share and create growth in a company, providing economic sustainability through new revenue streams. Of course, it can take years for development teams to take a product from the design process through to the point where it is ready to market and distribute. As a result, it is important that a plan is put in place for any new or existing products to be successfully developed.



PRODUCT LIFE CYCLE

Understating in which phase of the product life cycle, the product is there is the basis for the any product design and development activity. As you know any product has many brands, example, if you consider refer generator. You have Samsung, brands. Each brand has the demand pattern the summation of the entire brand's demand pattern provides information in which phase the product is,



The Pattern of PLC

Introduction

In this phase, there is a more risk involved there is possibility that the customers do not accept the product. This results in early exit of the product. This is all about the acceptability of the product.

In this phase the competition will be less if the product in the introduction phase, you should not think about going for heavy investment because of more chance for infant mortality of the product.

Growth

In this phase, the people know more about the product that increases the potentiality of the demand. The competition gradually picks up here you should concentrate more on the attributes like quality, performance, delivery time, serviceability that helps the organization to establish the product as a leader among the players. At present in Indian cell phone is in the growth stage of PLC. Comparatively the profit the maturity stage will be high.

Maturity Stage: In this phase more competitors will be there and here all well-established facilities were available and everyone is enjoying is the economy scale. But profit margins of the competitor are less. Because the facilities may be in reality at the end of their life cycle.

Because markets are matured, organization finds it difficult to capture a small increase in market share. Packed mass consumption goods, soap are for examples, which are in the maturity state of the PLC.

Decline

After maturity phase, the product enters into the declining phase. The reasons may be attributed to people would have found another alternative for the product, usually for the most of the time the business cycle and product cycle go together. In this case, if the economy is in the declining stage then there is a chance that product may enter into the declining stage. In such a case the organization has to make all effort to revive the product by adding some features in the product or family declining stage early then this becomes big problem for the organization because you cannot utilize facility available.

This problem is made in the case of mass production industry. This problem is severe if the industry is of the mass production type because the less demand the investment made in technology becomes turtle. At present the black and white TV is in the declining phase of PLC.

Because of Organization and lot of development in the field of electronic goods the product life cycle is so short may be three or four gems. The organization should be more vigilant in introducing more number of products within short span of time.

With this understanding of product life cycle curve, another activity inters turned with the use product life cycle namely the new product development process in this next section.

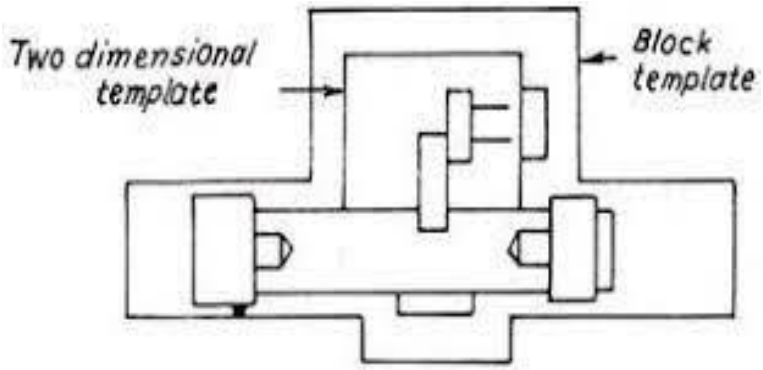
Planning Tools and Techniques

Planning related to the physical arrangements of the activities (involved in production) in a plant

Templates, Block Diagramming, Operations Sequence Analysis, Line Balancing, Use of Computers

Templates

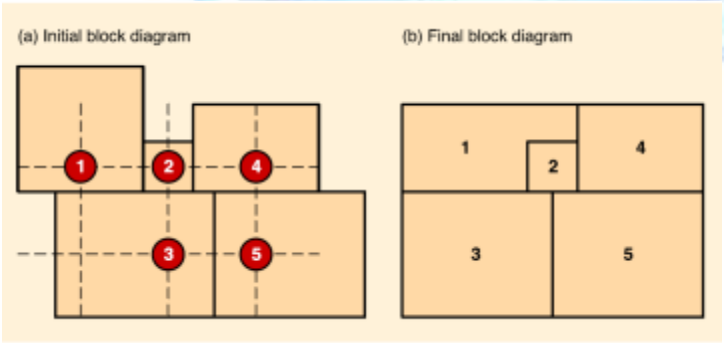
- 2D or Block Templates-Formulating layouts-used for measuring Physical object in a layout
- Object (5M's) helpful in Mechanical Work
- Constant as Plan Drawing
- Acts as Blue Print for the Layout



Block Diagramming

- Well defined structure-flowchart
- Process, its relationship, involvement of the Blocks
- Does not give in-depth detail needed for planning
- Historical data or predicted movement of material between departments in the existing or proposed facility.
- Information's are provided in the form of a from/to chart, or load summary chart. The chart gives the average number of unit loads transported between the departments over a given period of time.
- A unit load can be a single unit, a pallet of material, a bin of material, or a crate of material--however material is normally moved from location to location.

  Eg: In automobile manufacturing, a single car represents a unit load. For a ball-bearing producer, a unit load might consist of a bin of 100 or 1,000 ball bearings, depending on their size.



The layout solution in grid 2 represents the relative position of each department. The next step in the layout design is to add information about the space required for each department. Recommendations for workspace around machines can be requested from equipment vendors or found in safety regulations or operating manuals. In some cases, vendors provide templates of

equipment layouts, with work areas included. Workspace allocations for workers can be specified as part of job design, recommended by professional groups, or agreed upon through union negotiations.

*A **block diagram** can be created by blocking in the work areas around the departments on the grid. The final block diagram adjusts the block diagram for the desired or proposed shape of the building. Standard building shapes include rectangles, L shapes, T shapes, and U shapes.*

Line Balancing

- Line Balancing is leveling the workload across all processes in a cell or value stream to remove bottlenecks and excess capacity.
- Line balancing is reorganizing the resources and workloads of the production line processes to remove bottlenecks and excess capacity that harm efficiency.
- Line balancing is basically a trial and error process. We group elements into work stations recognizing time and precedence constraints. (For simple problems, we can evaluate all feasible groupings of elements. For more complicated problems, we need to know when to stop trying different workstation configurations.
- Reduce waiting waste, inventory waste and production costs and increase profits, Absorb internal and external irregularities, Meet customer targets. Increase revenue. Eliminate overtime.

Use of Computers

A recent trend has been the development of computer programme to assist the layout planner in generating alternative layout designs. Computerized layout planning can improve the search of the layout design process by quickly generating a large number of alternative layouts.

Computer aided Layout Planning(CALP)

This method has 3 steps. They are as follow:

Preparation phase, Specification phase and Analysis

In the preparation phase, planning objectives are set and the information essential for decision making is identified. This phase specifies the input required for computer. Structuring of different computer disc files is as well defined in the specification phase one has to decide how relevant planning details are to be delivered to the computer.

In the third phase that is analysis phase model building and analysis of output is considered. The CALP system should be flexible to date change and error corrections. With a suitable computer model major summaries and output reports are generated, which give a good documentation to measure the effectiveness of various alternatives.

Both ALDEP and CORELAP are concerned with the construction of a layout based on the closeness ratings given by the REL chart.

CRAFT is concerned. With the minimization of a linear function of the movement between departments Typically CRAFT employs an improvement procedure to obtain a layout design based on the objective of minimizing material handling costs.

CORELAP

It begins by calculating which of the activities in the layout is the busiest or most related. The sums of each activity's closeness relationships with all other activities are compared and the activity with the highest total closeness relationship (TCR) count is selected and located first in the layout matrix. This activity is named Winner. Next, an activity which must be close to the winner is selected and placed as adjacent as possible to winner: This activity is denoted as A (closeness absolutely necessary) and is named Victor.

ALDEP

It is to plan the order of the operation by process, regarding the fixed orders through the Operation Order Release Planning. It is to grasp the progress status of the operation, to consider the priority, setup time, and etc., and to make an operation sequencing list.

CRAFT

It is the only one which uses flow of materials data as the sole basis for development of closeness relationships. Material flow, in terms of some unit of measurement (pounds per day, in terms of skid-loads per week), between each pair of activity areas, forms the matrix to the programme.

A second set of input data allows the user to enter cost of moving in terms of cost per unit moved per unit distance.

Space requirements are the third set of input data for CRAFT. These take the form of an initial or an existing layout. For new area layouts, completely random layouts can be used. In any case, activity identification numbers, in a quantity approximate to their space requirements, are entered in an overall area of continuation. The location of any activity can be fixed in the overall area through control cards CRAFT limits the number of activities involved in the layout to 40.

Process

- An arrangement of resources that produce some mixture of products and services-collection of activities that converts INPUT to OUTPUT
- Process operations means any method, from action, operation or treatment of manufacturing or processing, including any storage or handling of materials or products before, during or after manufacturing or processing.
- Any part of an organization that takes inputs and transforms them into outputs is a process

- Process analysis is to systematically examine all aspects of a process to improve its operations with regard to cost, quality, speed, and responsiveness
- A few examples of processes might include:

  Preparing breakfast, Placing an order, Developing a budget.

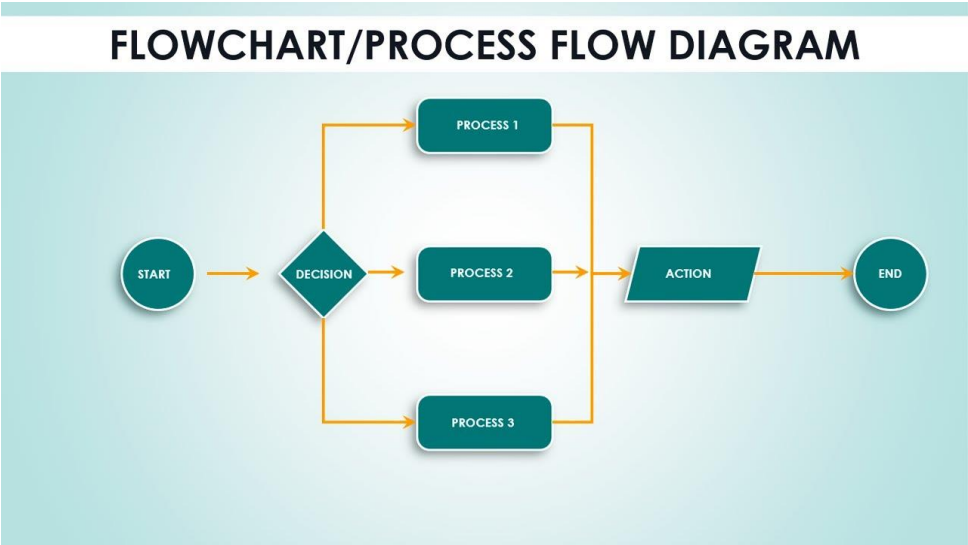
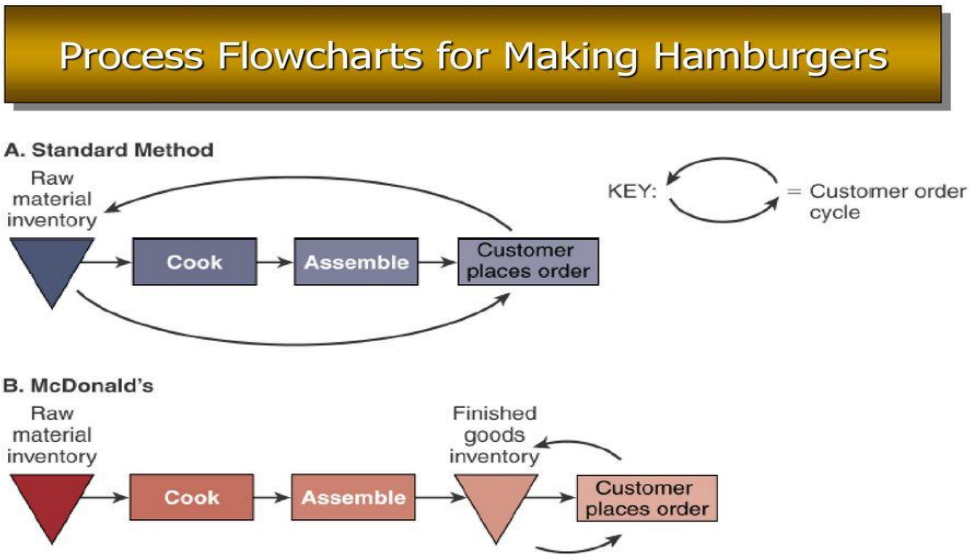


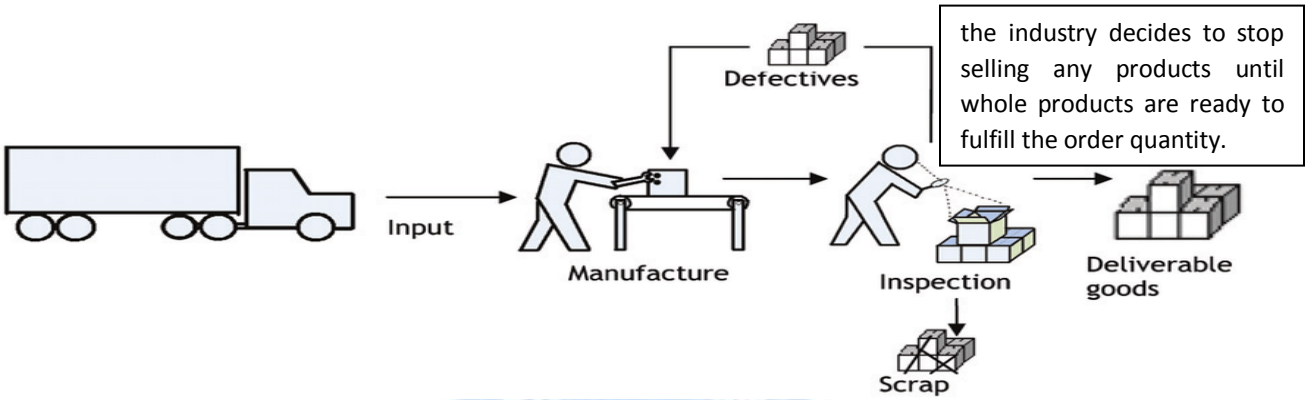
Diagram showing the major elements of a process and their interconnections

- tasks or operations
- flows of materials or customers
- storage areas or queues.



Single-StageProcess

A single-stage process can be defined as one in which two different phases are brought into intimate contact with each other and then are separated.



Multistage Process

A series of single-stage processes, each of which is composed of the input from the previous stage (prior input), the input during the current stage (in-process input), and the output as the result of the current stage.

Automotive manufacturing facilities are configured as a sequence of three major stages. These are: the body line where pressed steel components are welded into unpainted bodies, the paint line where protective and decorative coatings are applied to the bodies and the trim line where the vehicles are fitted with mechanical and trim components.

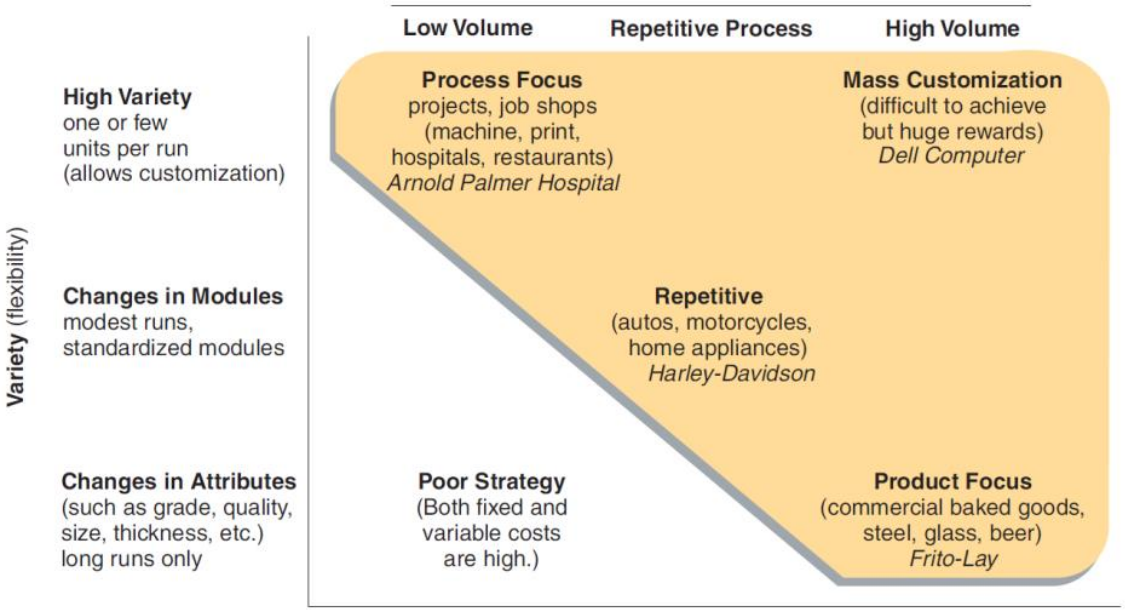
PROCESS STRATEGY:

A process strategy is an organization's approach to transforming resources into goods and services. The objective is to create a process that can produce offerings that meet customer requirements within cost and other managerial constraints.

The process selected will have a long-term effect on efficiency and flexibility of production, as well as on cost and quality of the goods produced. Virtually every good or service is made by using some variation of one of four process

Strategies:

Process focus, Repetitive focus, Product focus,



1.**PROCESS FOCUS:**

The vast majority of global production is devoted to making low-volume, high-variety products in places called "job shops." Such facilities are organized around specific activities or processes.

> In a factory, these processes might be departments devoted to welding, grinding, and painting. In an office, the processes might be accounts payable, sales, and payroll. In a restaurant, they might be bar, grill, and bakery.

Such facilities are process focused in terms of equipment, layout, and supervision. They provide a high degree of product flexibility as products move between the specialized processes. Each process is designed to perform a variety of activities and handle frequent changes. Consequently, they are also called **intermittent processes.**

- Facilities are organized around specific activities or processes (In factory, these processes might be departments devoted to welding, grinding and painting.)
- General purpose equipment and skilled personnel
- High degree of product flexibility
- Typically, high costs and low equipment utilization
- Product flows may vary considerably making planning and scheduling a challenge

2. REPETITIVE FOCUS:

Repetitive processes, Modules are parts or components previously prepared, often in a product focused (continuous) process. The repetitive process is the classic assembly line. Widely used in the assembly of virtually all automobiles and household appliances, it has more structure and consequently less flexibility than a process-focused facility**.**

- Facilities often organized as assembly lines
- Characterized by modules with parts and assemblies made previously
- Modules may be combined for many output options
- Less flexibility than process-focused facilities but more efficient

3. PRODUCT FOCUS:

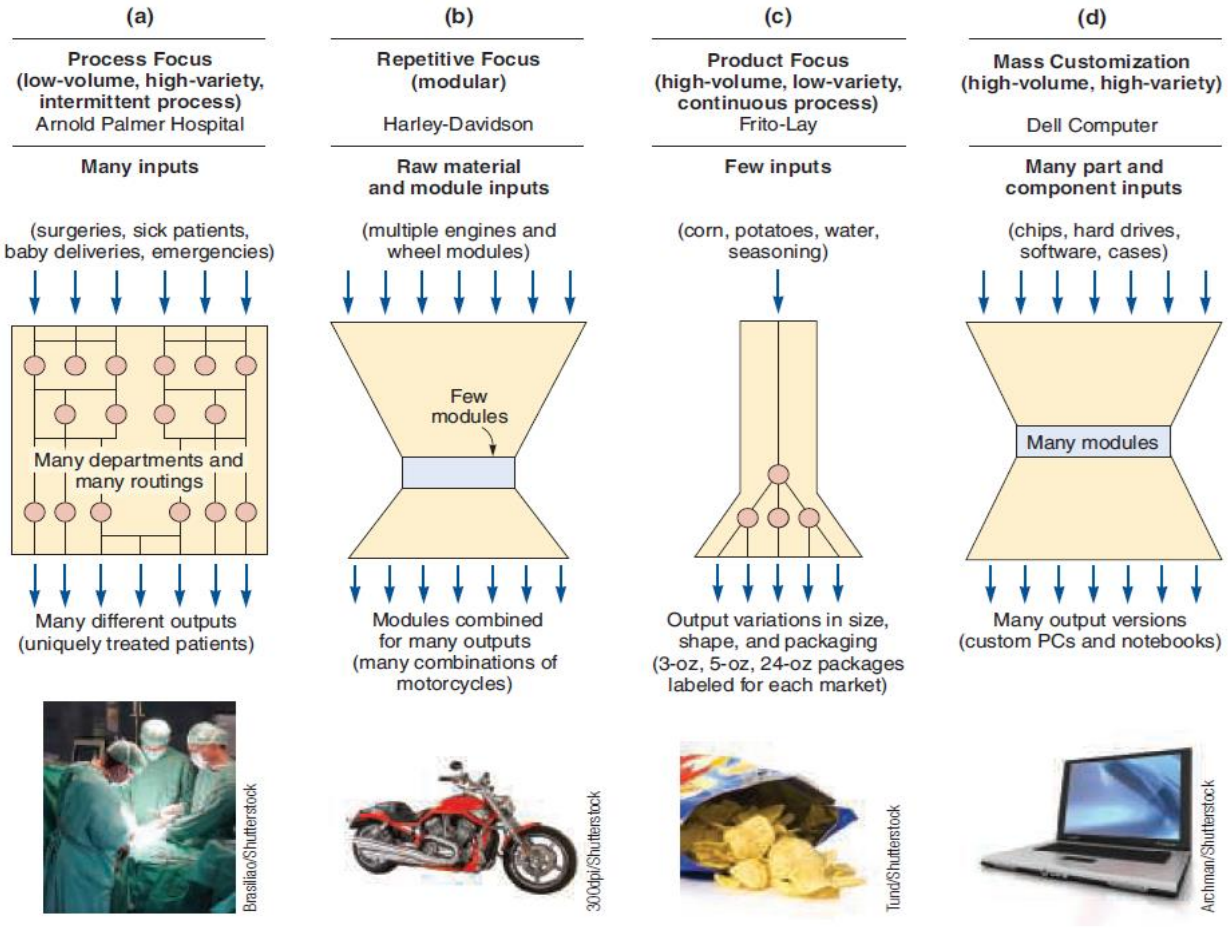
High-volume, low-variety processes are product focused. The facilities are organized around products. They are also called continuous processes because they have very long, continuous production runs. Products such as glass, paper, tin sheets, lightbulbs, beer, and potato chips are made via a continuous process. Some products, such as lightbulbs, are discrete; others, such as rolls of paper, are made in a continuous flow. The specialized nature of the facility requires high fixed cost, but low variable costs reward high facility utilization.

- Facilities are organized by product
- High volume but low variety of products
- Long, continuous production runs enable efficient processes
- Typically, high fixed cost but low variable cost
- Generally, less skilled labor

4. MASS CUSTOMIZATION FOCUS:

Operations managers use mass customization to produce this vast array of goods and services. Mass customization is the rapid, low-cost production of goods and services that fulfill increasingly unique customer desires. But mass customization is not just about variety; it is about making precisely what the customer wants when the customer wants it economically. Mass customization brings us the variety of products traditionally provided by low- volume manufacture (a process focus) at the cost of standardized high-volume (product-focused) production.

- The rapid, low-cost production of goods and service to satisfy increasingly unique customer desires.
- Combines the flexibility of a process focus with the efficiency of a product focus.


(a)
Process Focus
(low-volume, high-variety, intermittent process)
Arnold Palmer Hospital
Many inputs
(surgeries, sick patients, baby deliveries, emergencies)
Many departments and many routings
Many different outputs
(uniquely treated patients)
Brasilao/Shutterstock
(b)
Repetitive Focus
(modular)
Harley-Davidson
Raw material and module inputs
(multiple engines and wheel modules)
Few modules
Modules combined for many outputs
(many combinations of motorcycles)
300dpi/Shutterstock
(c)
Product Focus
(high-volume, low-variety, continuous process)
Frito-Lay
Few inputs
(corn, potatoes, water, seasoning)
Output variations in size, shape, and packaging
(3-oz, 5-oz, 24-oz packages labeled for each market)
Tund/Shutterstock
(d)
Mass Customization
(high-volume, high-variety)
Dell Computer
Many part and component inputs
(chips, hard drives, software, cases)
Many modules
Many output versions
(custom PCs and notebooks)
Archman/Shutterstock