Automation in Production Systems and Management
Prof. Pradip Kumar Ray
Vinod Gupta School of Management
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Automated CAPP (Part-II)
Lecture - 59
Process Planning and Concurrent Engineering

During this week we are discussing the various critical issues related to process planning.

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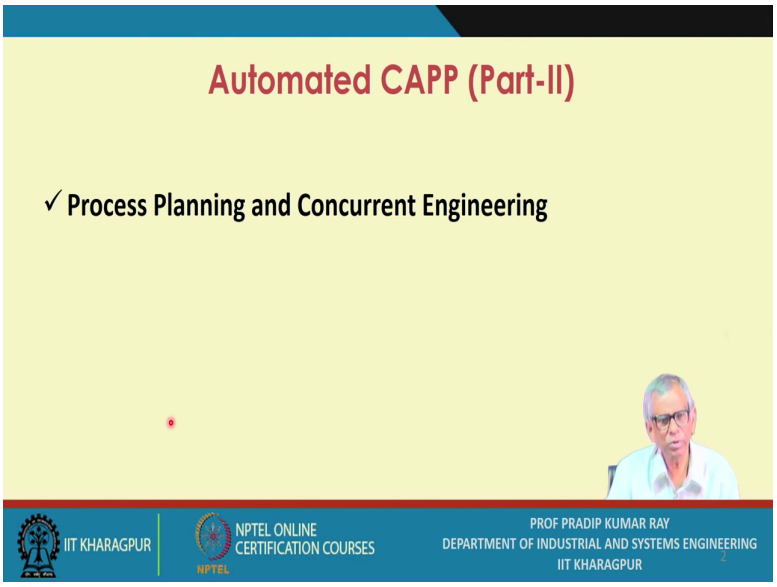

We will be discussing the relationship between Process Planning and Concurrent Engineering.

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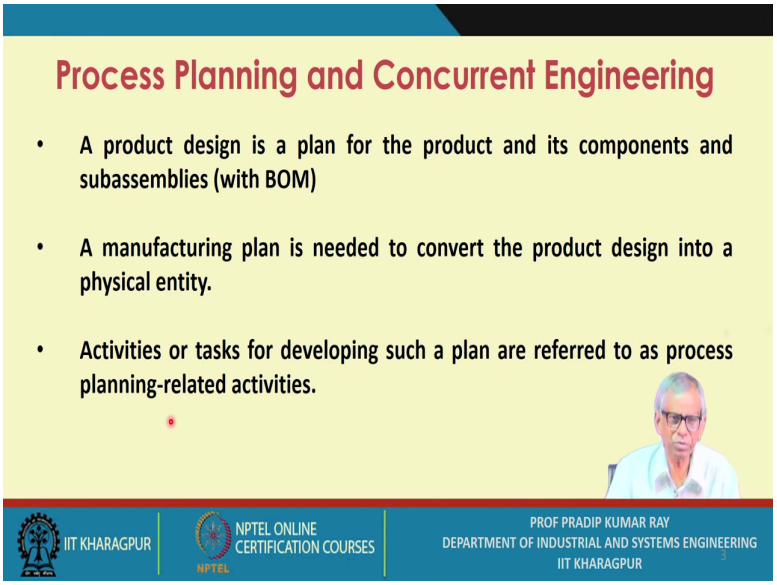

The product design is the plan for the product and its components and subassemblies. A manufacturing plan is needed to convert the product design into a physical entity. The activity of developing such a plan is called process planning.

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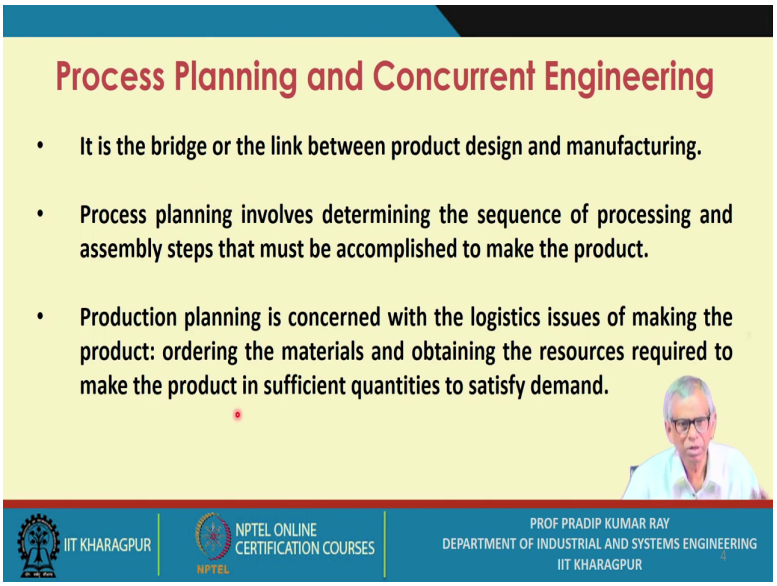

It is the bridge between product design and manufacturing. Process planning involves determining the sequence of processing and assembly steps that must be accomplished to make the product. Production planning is concerned with the logistics issues of making the

product: ordering the materials and obtaining the resources required to make the product in sufficient quantities to satisfy demand.

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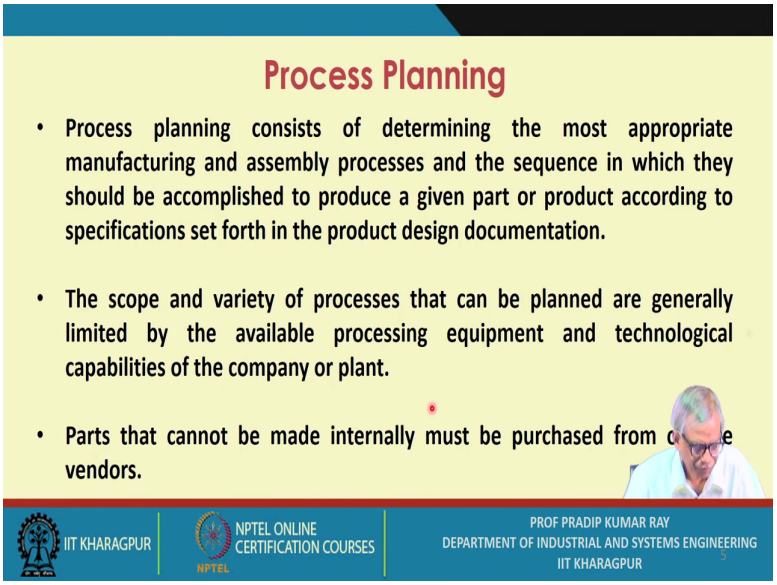

Process planning consists of determining the most appropriate manufacturing and assembly processes and the sequence in which they should be accomplished to produce a given part or product according to specifications set forth in the product design documentation. The scope and variety of processes that can be planned are generally limited by the available processing equipment and technological capabilities of the company or plant. Parts that cannot be made internally must be purchased from outside vendors.

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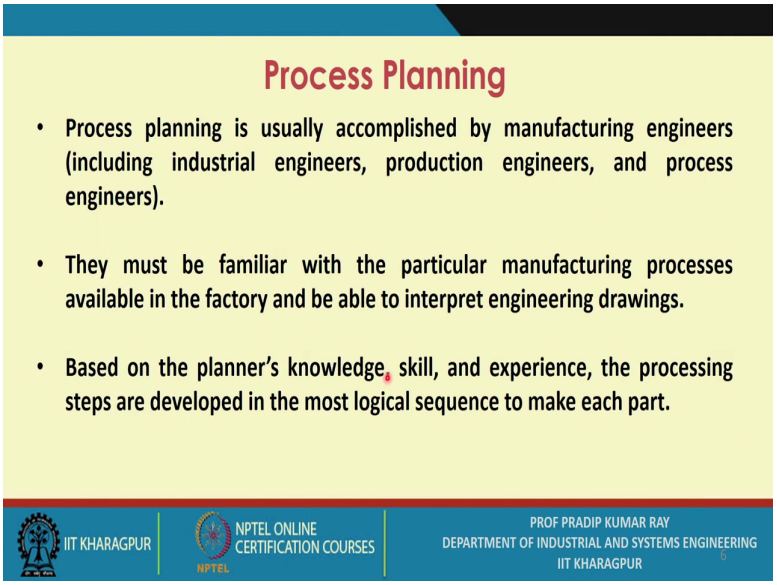

Process planning is usually accomplished by manufacturing engineers (other titles include industrial engineers, production engineers, and process engineers). They must be familiar with the particular manufacturing processes available in the factory and be able to interpret engineering drawings. Based on the planner's knowledge, skill, and experience, the processing steps are developed in the most logical sequence to make each part.

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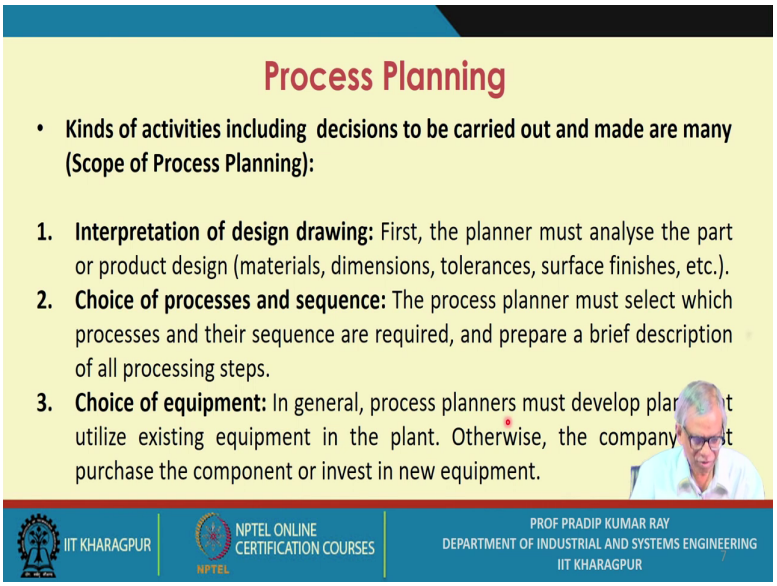

Following is a list of the many decisions and details usually included within the scope of process planning.

Interpretation of design drawing: First, the planner must analyse the part or product design (materials, dimensions, tolerances, surface finishes, etc.).

Choice of processes and sequence: The process planner must select which processes and their sequence are required, and prepare a brief description of all processing steps.

Choice of equipment: In general, process planners must develop plans that utilize existing equipment in the plant. Otherwise, the company must purchase the component or invest in new equipment.

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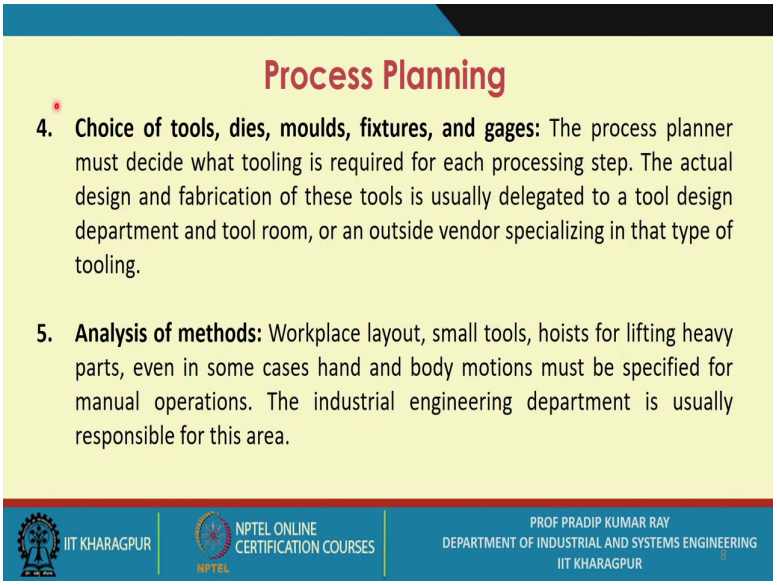

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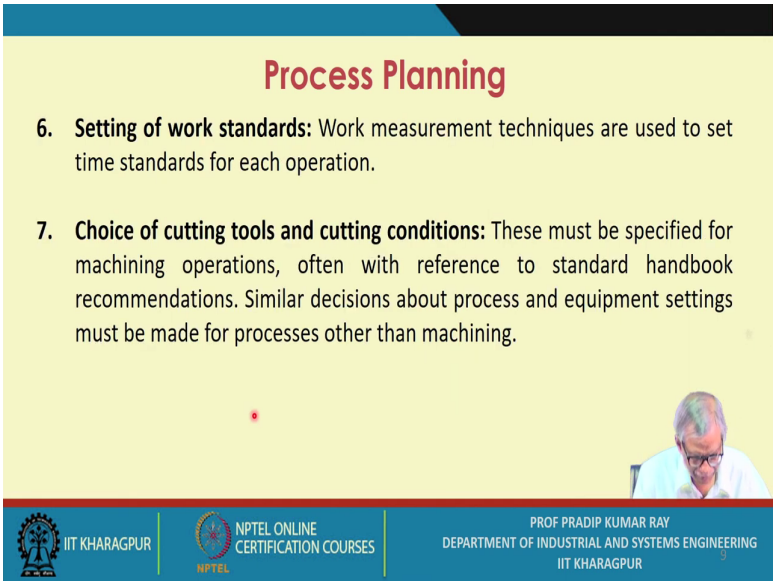

Setting of work standards: Work measurement techniques are used to set time standards for each operation.

Choice of cutting tools and cutting conditions: These must be specified for machining operations, often with reference to standard handbook recommendations. Similar decisions about process and equipment settings must be made for processes other than machining.

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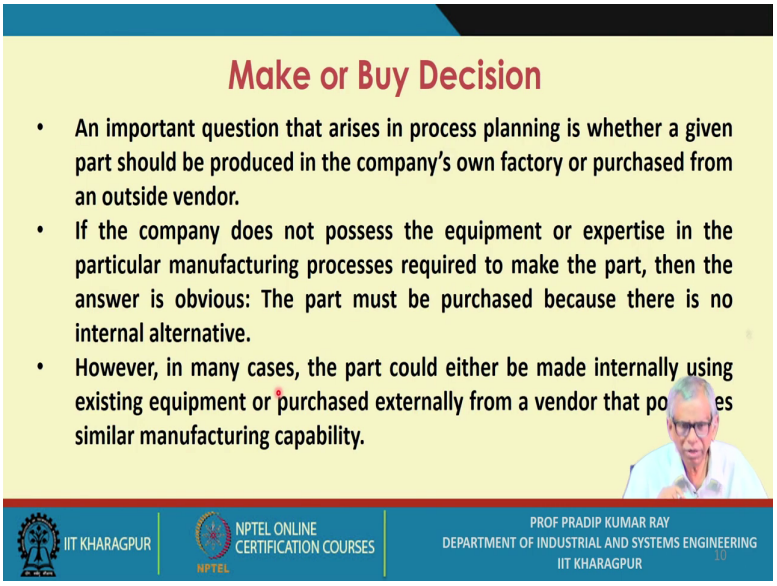

An important question that arises in process planning is whether a given part should be produced in the company's own factory or purchased from an outside vendor.

If the company does not possess the equipment or expertise in the particular manufacturing processes required to make the part, then the answer is obvious: The part must be purchased because there is no internal alternative.

However, in many cases, the part could either be made internally using existing equipment or purchased externally from a vendor that possesses similar manufacturing capability.

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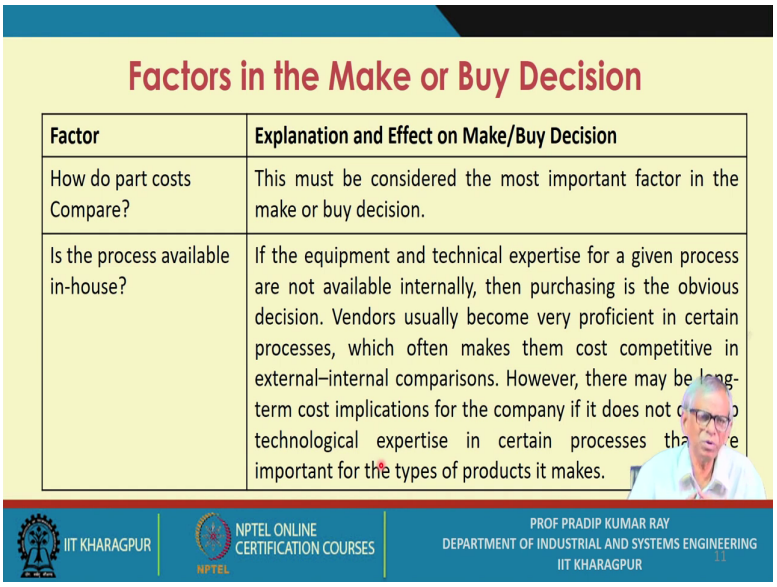

Factors in the make or buy decision are given below with explanation:

a. How do part costs Compare? This must be considered the most important factor in the make or buy decision.

b. Is the process available in-house? If the equipment and technical expertise for a given process are not available internally, then purchasing is the obvious decision. Vendors usually become very proficient in certain processes, which often makes them cost competitive in external–internal comparisons. However, there may be long-term cost implications for the company if it does not develop technological expertise in certain processes that are important for the types of products it makes.

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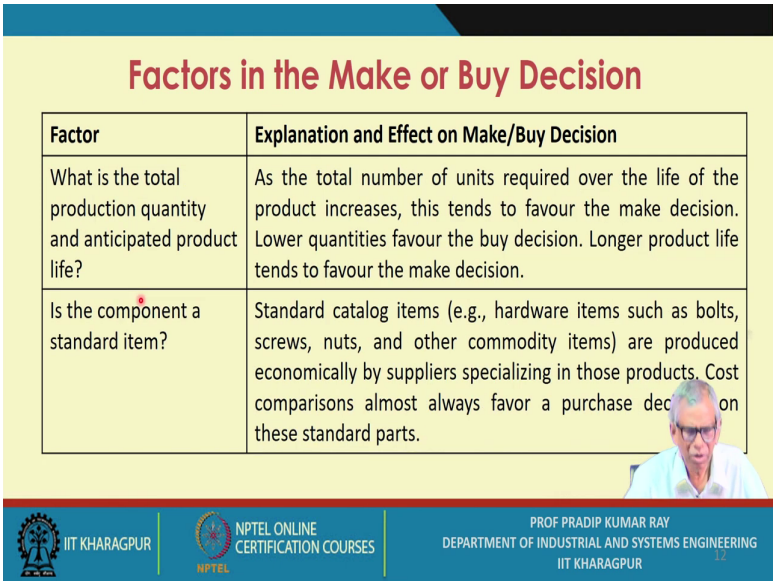

c. What is the total production quantity and anticipated product life? As the total number of units required over the life of the product increases, this tends to favour the make decision. Lower quantities favour the buy decision. Longer product life tends to favour the make decision.

d. Is the component a standard item? Standard catalog items (e.g., hardware items such as bolts, screws, nuts, and other commodity items) are produced economically by suppliers specializing in those products. Cost comparisons almost always favor a purchase decision on these standard parts.

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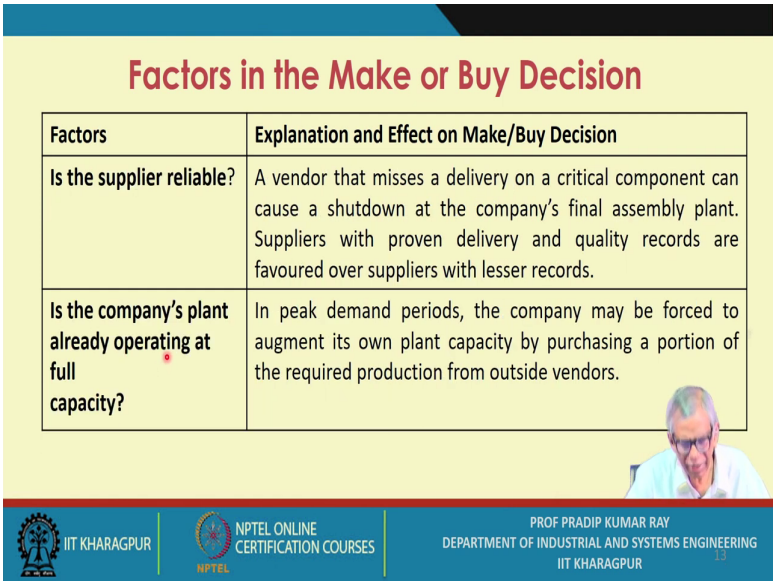

e. Is the supplier reliable? A vendor that misses a delivery on a critical component can cause a shutdown at the company's final assembly plant. Suppliers with proven delivery and quality records are favoured over suppliers with lesser records.

f. Is the company's plant already operating at full capacity? In peak demand periods, the company may be forced to augment its own plant capacity by purchasing a portion of the required production from outside vendors.

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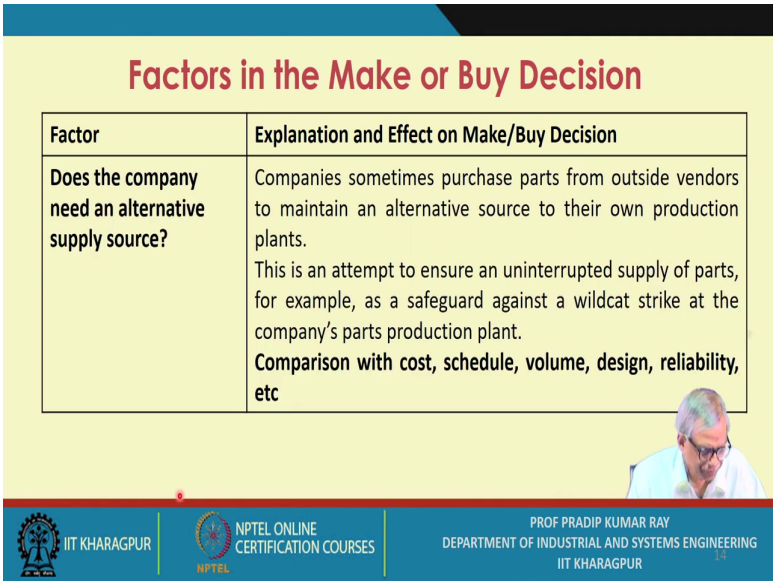

g. Does the company need an alternative supply source? Companies sometimes purchase parts from outside vendors to maintain an alternative source to their own production plants. This is an attempt to ensure an uninterrupted supply of parts, for example, as a safeguard against a wildcat strike at the company's parts production plant.

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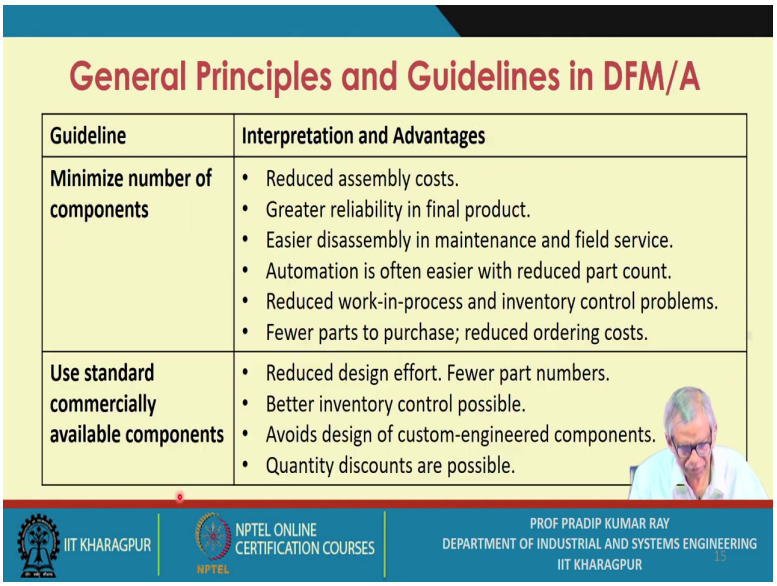

The second important aspects to be consider is the guidelines or general principles in DFM/A.

A. Minimize number of components: advantages are mentioned below:

1. Reduced assembly costs.
2. Greater reliability in final product.
3. Easier disassembly in maintenance and field service.
4. Automation is often easier with reduced part count.
5. Reduced work-in-process and inventory control problems.
6. Fewer parts to purchase; reduced ordering costs.

B. Use standard commercially available components and advantages are:

1. Reduced design effort. Fewer part numbers.
2. Better inventory control possible.
3. Avoids design of custom-engineered components.
4. Quantity discounts are possible.

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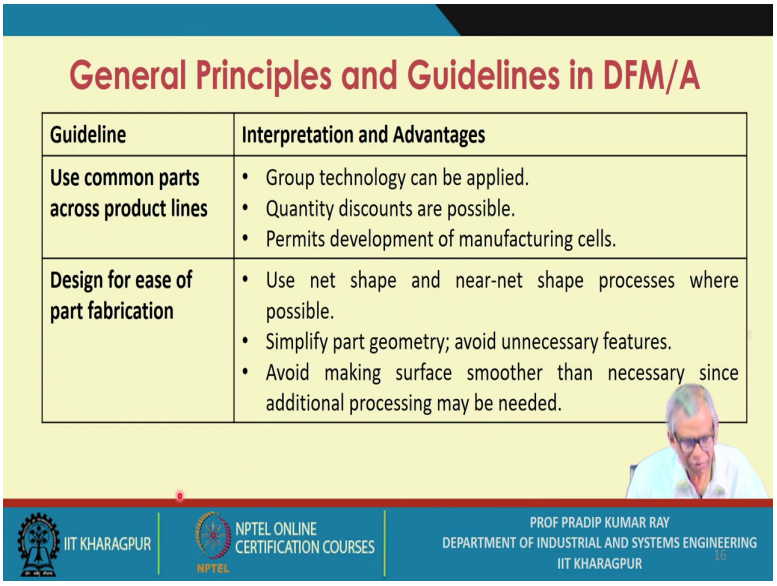

C. Use common parts across product lines. Advantages are:

1. Group technology can be applied.

2. Quantity discounts are possible.

3. Permits development of manufacturing cells.

D. Design for ease of part fabrication:

1. Use net shape and near-net shape processes where possible.

2. Simplify part geometry; avoid unnecessary features.

3. Avoid making surface smoother than necessary since additional processing may be needed

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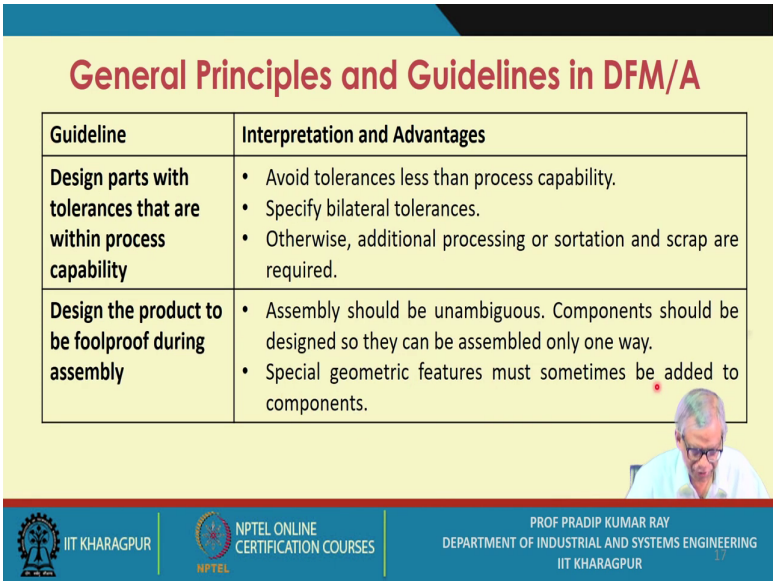

E. Design parts with tolerances that are within process capability. The process capability means referring to a particular machine tool and checking that to what extent that particular machine tool or that particular machine is capable of producing the parts as per the specifications. The definition of quality is conformed into acceptable standards and specifications from the engineering point of view.

F. Design the product to be the fool proofed during assembly. Only the part manufacturing the quality of part manufacturing could be excellent that system. But many times when you go to the assembly stage, we will find the kinds of the difficulties and then you have to relook the tolerances or the part geometry once again.

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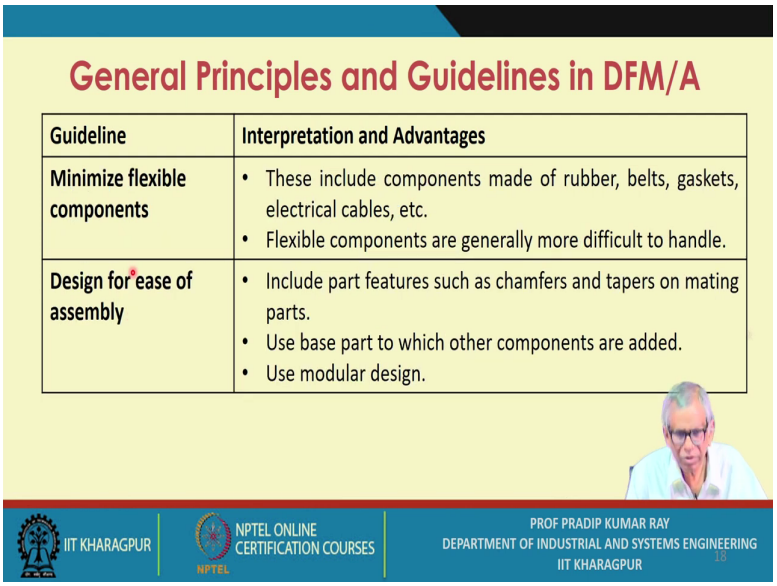

G. Minimize flexible components:

1. These include components made of rubber, belts, gaskets, electrical cables, etc.
2. Flexible components are generally more difficult to handle.

H. Design for ease of assembly:

1. Include part features such as chamfers and tapers on mating parts.
2. Use base part to which other components are added.
3. Use modular design.

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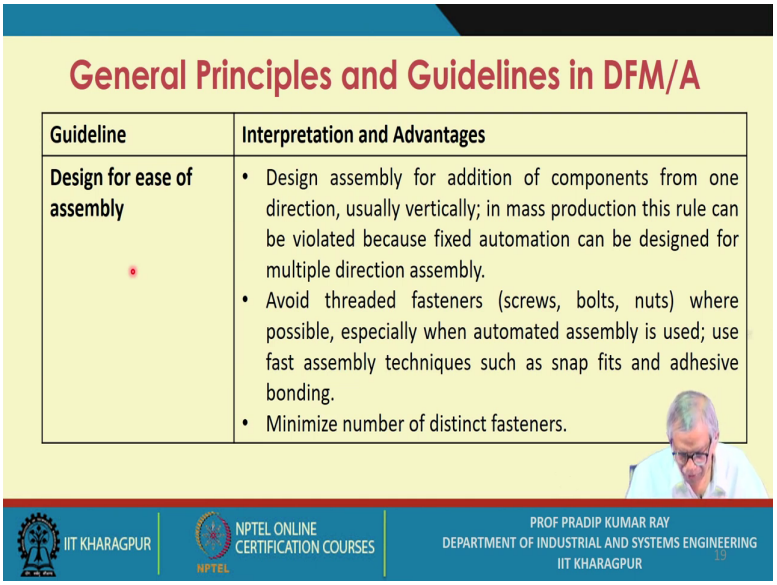

- Design assembly for addition of components from one direction, usually vertically; in mass production this rule can be violated because fixed automation can be designed for multiple direction assembly.

- Avoid threaded fasteners (screws, bolts, nuts) where possible, especially when automated assembly is used; use fast assembly techniques such as snap fits and adhesive bonding.

- Minimize number of distinct fasteners.

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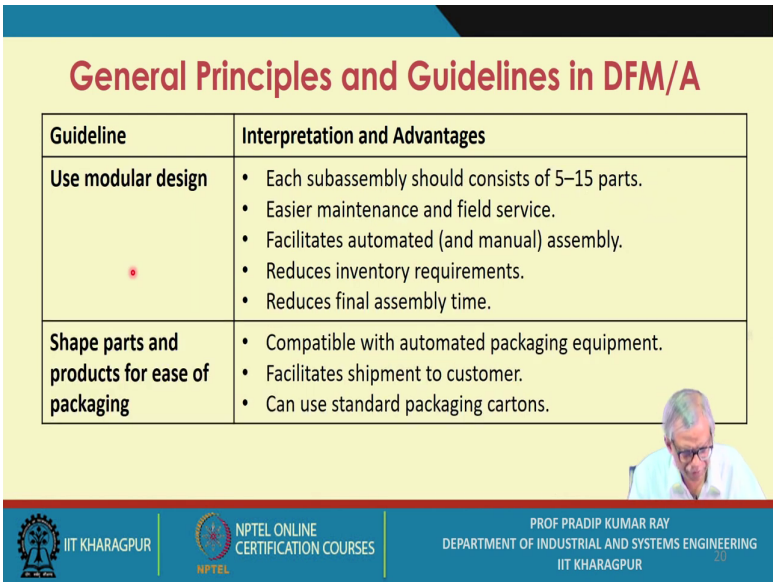

I. Use modular design, before you go for automation make sure that this modular design concept is applicable. There are lot of advantages particularly when you go for assembly if you opt for the modular design; that means, various combinations are possible, if it is a modular design and the manufacturing process accordingly; that means, with the same set of sub-assemblies or the parts you can you can and against each set it again each sub-assemblies there are multiple types offered and you can offer different combinations it. So, many companies for many products these days that modular design concept is applicable and based on modular design so you have to propose a process plan.

J. The shape parts and the products for ease of packaging. So, this is also to be considered.

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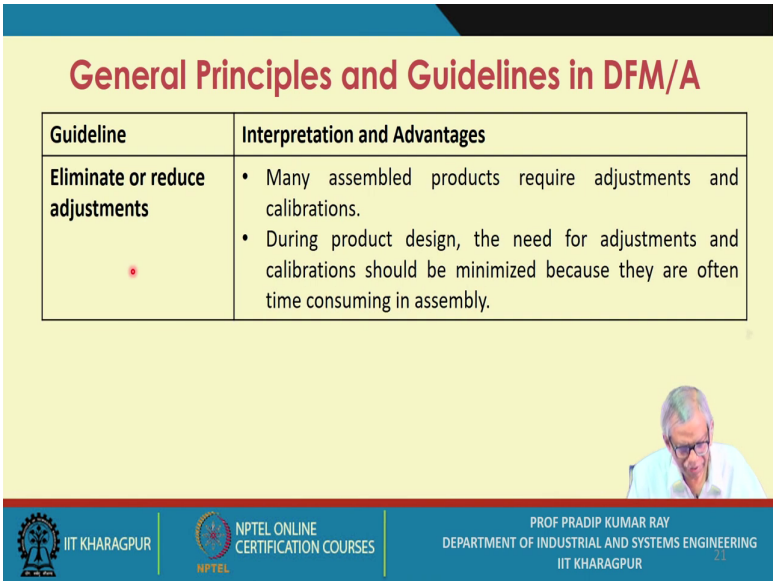

Because it is a concurrent engineering approach and that is why in the quality loop elements there are 11 elements and all these 11 elements are to be integrated.

And then you check that how many activities in all these elements can be are to be automated. So, that ultimately that overall manufacturing performance reaches its maximum level.

K. Eliminate or reduce adjustments as far as possible.

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That means what you are believing in that you go for if you opt for this one ultimately you will create a you will be create a system for a process planning which may be referred to as the advanced process planning or manufacturing planning. So, this that should be our goal. Advanced manufacturing planning emphasizes planning for the future. It is a corporate level activity that is distinct from process planning because it is concerned with products being contemplated in the company's long-term plans (2- to 10-year future), rather than products currently being designed and released. Advanced manufacturing planning involves working with sales, marketing, and design engineering to forecast the future products that will be introduced and determine what production resources will be needed to make those products. The future products may require manufacturing technologies and facilities not currently available in the firm.

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In advanced manufacturing planning, the current equipment and facilities are compared with the processing needs of future planned products to determine what new technologies and facilities should be installed. The general planning cycle is portrayed in Figure 24.5. The feedback loop at the top of the diagram is intended to indicate that the firm's future manufacturing capabilities may motivate new product ideas not previously considered. Activities in advanced manufacturing planning include (1) new technology evaluation, (2) investment project management, (3) facilities planning, and (4) manufacturing research.

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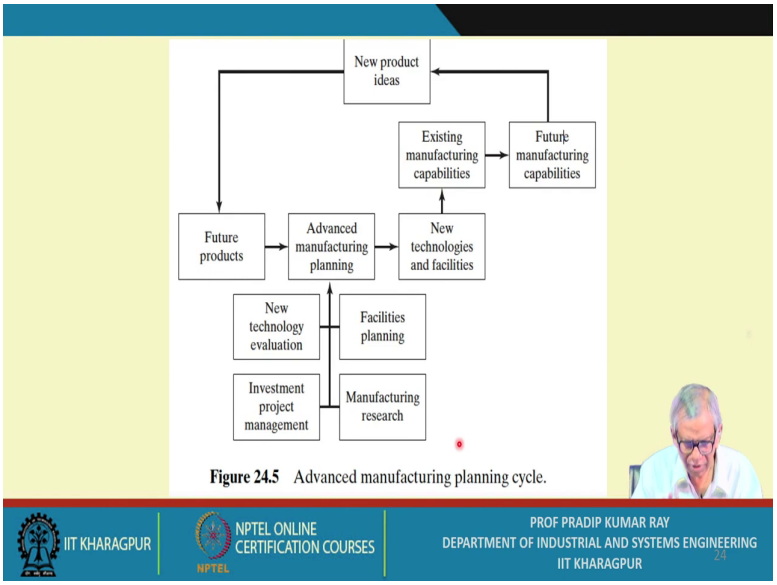

This is one framework that is the advanced manufacturing planning cycle, all these modules of invention. So, what is the main issue, just you refer to all these details.