Production and Operation Management
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Lecture 04
Types and Characteristics of Manufacturing Systems

Welcome friends. Now, we are moving into the fourth session of this course on Production and Operations Management. So, far we have discussed the meaning of operations management, we discussed about the global important events. We discussed about the development of operations management from the period of scientific management that how scientific management became a very important contributor in the development of operations management. We discussed the role of assembly lines, mass production. Then we also discussed the role of statistical sampling in quality management.

And finally, in our last session we discussed about productivity that how productivity is a very important aspect. Rather, you can say the whole operation management is all about to achieve higher productivity. And with higher productivity, I mean to say that how we can achieve more output with limited input.

An input, particularly we discussed of three types labor, capital and management. We discussed some of the data of year 2017 available from OECD that productivity of persons in India, we discussed particularly labor productivity is much lower as compared to many other countries in the world.

And we need to if we are such a large nation where more than 50 percent of the people who are employed are youth, if their productivity is so low, it is certainly a matter of concern and therefore, we need to work on improving the productivity. On one side, for improving the labor productivity there is a role of diet, there is a role of health. But at the same time, there is a role of proper methods, there is a role of proper tools, there is a role of proper skills, there is a role of proper training.

And with the help of operations management we can achieve an environment where all these things can be provided to the labor available in the country so that productivity level can be improved. Now, in this particular session, we are going to discuss what are the different types of manufacturing systems which are available.

And different types of manufacturing systems, they have different types of characteristics, and that will help you to understand that if this type of product is there, so which type of

manufacturing system need to be developed. And whether I have the appropriate manufacturing system or not, all those things will be discussed in this particular session.

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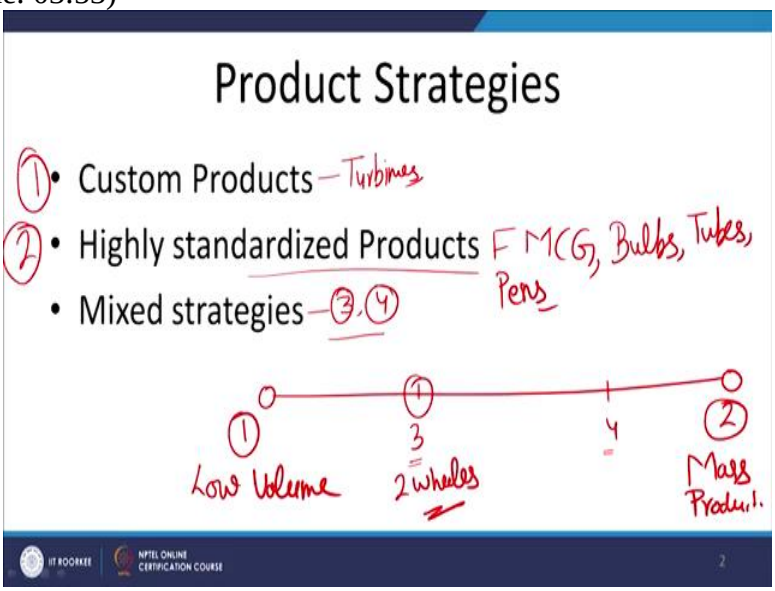

Now, in this case, the first important thing that we need to know that what are the different types of product strategies? There are primarily, two types of product strategies. One is custom products and the second is highly standardized products. So, you can understand that from this end to this end we have two very important types of product strategy. One product strategy is representing this number 1 that is the custom based products. And this is representing number 2 that is the standard products.

So, these are the custom products, number 1, number 2 is standard products. And in between, you may have two more types of strategies. So, you can say that these are the position for those additional strategies, where you have to some extent some customization and some standardization.

So, if I say point number 3, so more customization and some standardization. And point number 4, here I can say more standardization and some customization. So, in that way, we can say that there are primarily two strategies, product strategies. But based on degree of customization and degree of standardization, you can have multiple product strategies.

From 1 to 2, depending upon what level of customization and what level of standardization you are having, you can go through various types of combinations. So, large number of combinations, infinite number of combinations are possible from 1 to 2. Now, talking particularly of these two extreme cases, one is custom products, in these custom products,

those products are there which are uniquely designed, uniquely made for your customers. So, we know those products which are uniquely designed against your orders, these are custom products.

And if you see the list, you will find those heavy industrial products which are made against order, so like particularly if you see turbines, so turbines are one very good example which are highly custom products. And if you take examples for you, so when you go to a tailor and you give your measurements for a shirt, for a dress that is also a custom product. When you go to a jeweler, you give your own design that I want this kind of jewelry for my marriage that is also an example of custom products.

So, custom products are those products which are designed, which are produced for a particular customer. On the other hand, these highly standard products, you want a pen, you go to a stationary shop and you say show me some pens and available pens are shown to you and you purchase one of them.

Because all pens are standard, so there is no difference between a product, between a pen purchased by you or by your friends or by your parents, so they all can purchase similar type of pens. So, these are standard products. You purchase Haldiram Bhujia, I also purchase same Haldiram Bhujia, so it is the same product.

So, these are highly standard products, where the product is not made, the meaning is product is not made for any individual specific customer. Products can be made for a group of customers, for a group of customer that those who are in north India, they will get this kind of product, those who are in south India they will get this kind of product. So, that type of some degree of customization happens, so that will come in 3 or 4 or in between those situations.

But when we are making a medicine for Indian people, so that medicine, that ciprofloxacin will be same for all the customers, all the patients. So, there is these are examples of highly standardized products. So, many FMCG products, fast moving consumer goods, all these fast moving consumer goods come under the category of highly standard products.

Then there are examples of bulbs, tubes, pens. All these are examples of highly standard products. So, you get a very standard products and the idea of the standard product is to get mass production.

When we have highly standard products, these are produced in masses. And the custom products are produced in very low volume. So, these are produced in low volume and these are produced in mass. And you can very well understand when something is produced in mass, the cost of production per unit goes down.

So, here in this corner you enjoy economies of scale because of mass production. While customer is ready to pay premium if you are providing a custom service to that customer, so if you are flying with a charter flight, you are paying much higher because you have customized that flight for your requirement.

And if you are flying with a routine flight, you pay much less because that you are using a standardized product. So, when you are paying, when you are using standardize product, you need to pay less price. When you are using a custom product, you are happily giving higher price.

So, the service provider, the manufacturer gets higher margin if manufacturer is serving the customer product. So, it is a very important call that whether you are in a custom product category or in a standardized product category, because in various products, in various products, both these things are possible.

You are into the, a bakery shop. Now, in that bakery shop, it is quite possible that you may sell standard products and you may sell custom products. And it depends upon your choice that what type of bakery shop you want to have. And then third is, we have a mixed strategy where you have some degree of customization and some degree of standardization, where both these things are mixed.

Like for an example, we have two-wheeler, you have four-wheelers. So, to some degree we try to give a customization of your color, your headlight, your sitting style but to large extent we have similar kind of engines, we have similar kind of suspension, we have similar kind of breaking system.

So, to a great extent lot of similarity. There may be some kind of customization in the exterior of that particular product. So, you may have some kind of variability in the final product. But the core product remains the same. So, what is that core product, what are the boundaries of core product, how much standardization you are doing, that is again a matter of

your organization's choice. And therefore, we say that multiple combinations are possible on this spectrum. So, this is about the various product strategies.

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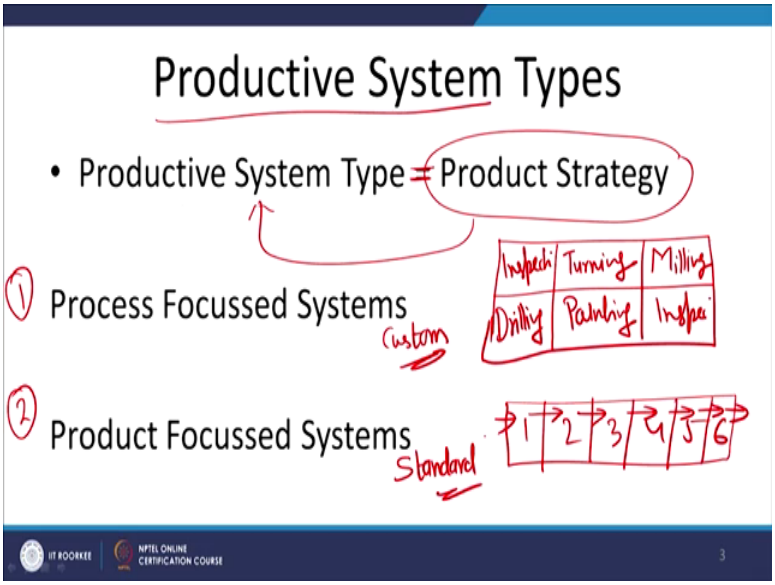

Now, the second important thing we like to discuss, different types of productive systems. That, what are the different types of productive systems? Now, it is very important to understand that your product strategy should guide the productive system type. What type of product strategy you have, accordingly your productive system should be designed.

Therefore, we have this equal to sign here that productive system type is in line with product strategy. If that is not happening, if you have a different types of product strategy and your productive system is not supporting that product strategy, it is going to be a disaster for your organization.

So, two types of productive systems are possible. One is process focused and the second is product focused. Now, in the process focused system, we have a system which is based on various processes. And the second is product focused, which is based on requirement of a particular product. The meaning is that we just discussed two types of product strategies one is custom and another is standard. Now, when I am having a custom product, when I am having a custom product, I go with this process focused systems.

And when I have a standard product system, a standard product strategy, I go with product focused system. Please remember, when we will be discussing layout strategies for our organization, we will again require this knowledge of productive system types. This

knowledge will be again used, this point will be again used in the discussions of layouts. So, please remember and we will require your input at that time.

Now, in the process focused systems, the complete organization is divided on the basis of various processes to be performed. Like this is milling area, this is turning area, this is inspection, this is drilling, this is painting, this is again inspection. So, different areas are there for different processes.

Now, you can move in multiple ways from one section to another section. It is not necessary that you go in a single straightforward path. On the other side, in this product focused system, you have 1, 2, 3, 4, 5, 6 and this entire 1, 2, 3, 4, 5, 6 is arranged in a way that it satisfies the requirement of only one particular product.

So, here in a product focused system, we are designing our entire productive system for a particular product. And in a process focused system, you can produce multiple products, different types of products because it provides you lot of flexibility, it provides you lot of flexibility, you can change the route of product's movement as per the requirement. But in case of product focused system, that flexibility is not there. You need to follow a particular path and that path is same again and again.

Another important difference, in case of process focused system, we use general purpose machines. Machines, which are capable of producing different types of products. While in case of product focused system, we use special purpose machines, which are capable of producing only a specific type of product because we want to achieve standardization and we are into mass production. So, there is no need to have a machine which require again and again setting of jigs and fixtures. You use same machine for repetitive use with same setting, which is not the case in case of process focused systems.

So, that is the difference between process and product focused systems. So, it has to be completely in line with your product strategy. If it is not in line with your product strategy, then it is going to give lot of problems that if you are having high volume of production, if you have very high volume of production and in that case you put process focused system, that is not going to give you the benefit of low cost because these are the general purpose machines. They are not suitable for high volume production.

For an example, in your house if you have a printer, in your house if you have a printer, that printer is for some very limited use. Whenever you require 2 page of printing, 5 page of printing, 10 page of printing, maybe 20 pages of printing, it is okay. But it cannot be used for printing the results of this NPTEL course, where thousands of students are appearing and you have to continuously print for 2 hours, 3 hours, 4 hours the result of students.

For that purpose, you need to use a custom printer. You need to use a custom printer, which is especially designed for printing the results. You must have seen the printers which are used in railway station for printing the railway tickets. So, you cannot print any other thing on those printers. So, that is a custom based printer. But the printer which you are using in your house, that printer is a standard printer. Printer which is used in banks for printing the passbooks, that is a custom printer.

You cannot print any other thing, you cannot take a printout of your CV from that printer which is used in banks. So, you can understand that, that is also a printer which is used in railway stations, which is used in banks and what you are using, the printer which is used in a shopping mall for giving invoices that is also a printer. But that can only print that invoice. It cannot print any other thing.

So, these are examples of custom and standard printers. Same thing is applicable in variety of other products. So, if you make a productive system which is not supporting the product strategy, it is going to give you lot of problems. So very first thing in development of operations management is to identify that what type of productive system you are going to have. And this depends upon the kind of product strategy you are going to follow. If you recall our discussion of very first class, we said that we need synergy between various functional areas.

Now, the product strategy which we are going to follow may not be 100 percent a decision of operation manager. It requires very close discussion with marketing manager. So, here comes the role of synergy. Whatever is being discussed with marketing manager, that will help you to decide the product strategy and based on that you are going to have your productive system. So, without synergy it will not be possible.

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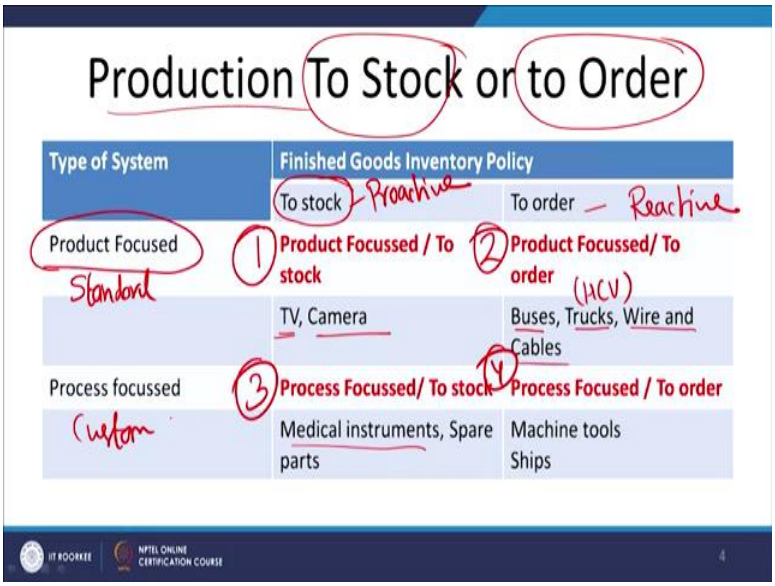

Now, next classification of our productive system is based on whether we are going to have a, To stock or to order, which type of inventory policy. So, now you see we will be having four types of combinations. You have two types of inventory policy, one is either to stock or to order. And two types of productive systems, processed focused and product focused. So, in all it gave you four different alternatives. Product focused to stock, product focused to order, process focused to stock and process focused to order.

So, these are my four different manufacturing systems. These are now four different manufacturing systems. Before I go for these four different systems, let me give you a very brief intro of to stock and to order kind of manufacturing systems. Now, to stock means things are readily available in your stock, things are readily available in your stock. You are anticipating that customers will come, you are anticipating that customers will come and in anticipation you are keeping those products readily available and customers are coming and they are purchasing.

So, your anticipation is correct. And in most of the FMCG products, we see this kind of behavior that the shopkeeper, retailer is keeping the products readily available. You go to the shop and you ask a product of your choice and shopkeeper gives you product because it is readily available, it is in the stock.

You can say product is available of the shelf. The other category of products are to order, where product is not readily available with the retailer, product is not available with the distributor. You give order and then shopkeeper says, retailer says, distributor says that okay,

you will get this product in 10 days of time, one week of time, one month of time. So, here the retailer or distributors are not keeping products in anticipation.

Rather everything is starting in reaction. You are giving order and in response of your order, the whole process, whole system has started working. You are giving order of turbine, then BHEL will produce turbine. Without your order BHEL will not keep turbine readily available.

So, only after order the turbine is produced. That is an example or to order. So, there are mostly, there are mostly high unit value products which come under the category of to order. And those products where the unit value is low are to stock category. So, now we have just discussed four types of manufacturing systems. Product focused and to stock and examples are also available with us. Like TV, camera, these are product focused.

So, here the manufacturing system is developed that you have a very standard kind of product which is TV. And there is a long assembly line and from one side it starts moving and components are being added as it goes through that assembly line and finally, at the other end of the assembly line product is readily available. So, that type of product focused and we all know that you go to a shop, large number of TVs, large number of cameras are available and you purchase one which is fitting your specification. So, that is produced focused and to stock.

The second type of product focused but to order. Here also you have a very, product focused means you have a very standard kind of system of production. Like buses, trucks, these are examples of Heavy Commercial Vehicles, HCVs. So, now you see these Heavy Commercial Vehicles are not readily available. These vehicle, you will not find huge showrooms of buses and trucks in any city. You may find huge showrooms, a very attractive showroom of Mercedes, Audi. You can find a good showroom of Toyota.

Because to some extent these products are coming under first category, product focused to stock. But you will find a very small office for bus, for truck sale. Why? Because they are not keeping any inventory. Though the product is very much standard but you go there, you order and in response of your order you will get your product after maybe two weeks, three weeks or one month time. So, that type of situation is there.

Similarly, wires, cables which are used for heavy electric work, all these things are available only after the order though these are product focused kind of products. Then the third is process focused and to stock, where it is more like customized products but these are available in stock like medical instruments, spare parts. These are to some degree the interchangeability is there. But larger number of spare parts are there. But because of the importance of these parts if these spare parts are not available, take an example of bearing.

So, bearings you need to keep in stock and each bearing has a different type of specification. And without bearing it will not be possible to run a motor. So, and that may create large amount of losses to the organization. So, we keep all those things readily available in our stock though these products are under the category of process focused because the volume of production is very low.

These are process focused because the volume of production is very low. So, these are not exactly that reactive kind of process focused where you have each product highly unique but still you keep some of them in our stock because of criticality of these items.

And the fourth is process focused and to order. These are typically highly customized products which are coming extreme on that spectrum like machine tools, ships, the airplanes or missiles. These kind of products are processed focused and these are only available, these are only available when you give order for these products. So, these are highly customized products and you do not keep any inventory of these products, only when order is there.

So, point number 3 is that these are also customized products but you keep some inventory of them. Point number of 4 again customized products but you do not keep any inventory. Point number 1 and 2, both are to some degree standard products. In one case, you are keeping inventory. In another case, you are not keeping inventory. So, whenever the unit value is very high, you do not keep inventory. So, if you see the point 1 and point 3, in these two cases the medical instruments, the spare parts here, the inventory is kept.

In point number 2 and 4, inventory is not kept. So, you can group these things in multiple ways. One way of grouping is on the basis of to stock, means inventory is readily available. Finished good inventory is readily available. To order means this is reactive. This is proactive. Product focused means you have standard products. Process focused means custom products. So in this way, in this manner you can understand that how to classify your various kind of manufacturing systems.

And if you have the whole idea of this discussion is that, if you have proper productive system as per the requirement of the product strategy then only your entire operation management will help you in achieving higher productivity. If your productive system is wrongly designed, if it is not matching with the requirements of the product strategy, then higher productivity is almost impossible. So, that is the end of today's session. Thank you very much.