Manufacturing Strategy
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Module No. #06
Lecture No. #28
Process Choice

Welcome, friends. So far, we discussed about, various stages in the development of Manufacturing Strategy. And, in last few sessions, we discussed about, a very important aspect, on which, the concept of excellence is based. And, that important concept was, the concept of quality. We discussed in detail about, what is quality? How the quality has developed, or evolved, in its present form? The contribution of, some of the important quality gurus.

And then, we also discussed finally, that how, you can see that, quality is finally implemented, in the processes of the organisation. And, in our last session, where we discussed about, some business excellence models. One important thing, I will like to remind you, that most of the organisations, or most of the awards, are focused about processes, that how are we improving our processes.

Because, the whole idea, is not about improving the product, but improving the processes. Improving the processes, how to improve the capability of the process, so that, you can achieve the objective of prevention, and therefore there is less requirement of detection. So, this is one very important phenomena, we need to keep in mind, that processes are very important thing. If you have sound processes, if your process capabilities are higher, then your output will also be good.

So, your output depends, upon your process. And, if you do not have appropriate processes, however good quality product, you have designed, you will not be able to deliver that quality product. But, if your processes are good, then only you can make that product, then you can deliver that product, without much detection requirements.

So therefore, processes play very important role, in our manufacturing excellence journey. And, this particular session, is focusing on, choices of processes. So, we will discuss, a very

important issue, that how do we make choice, for a particular process. Now, when we see, the choice for a particular process, so this particular figure, comes to our mind.

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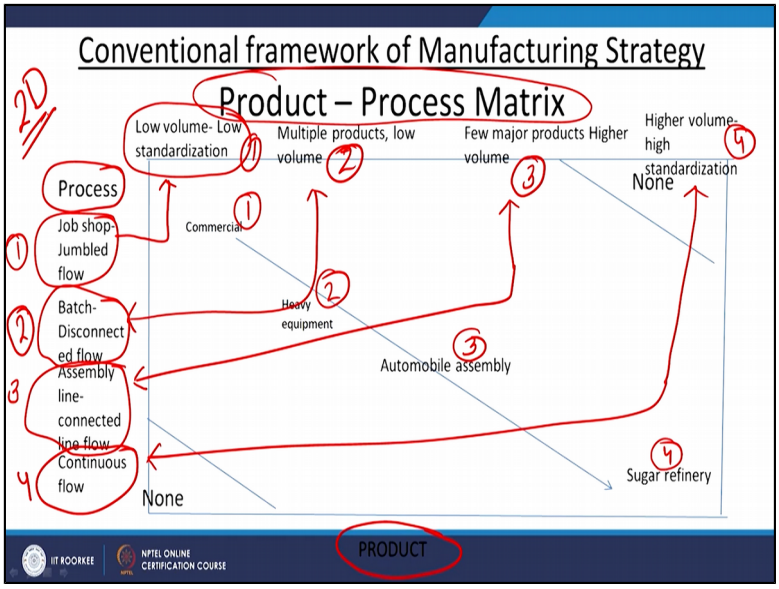

Where, we have, a very conventional framework, of Manufacturing Strategy. Or, you can say, Generic Manufacturing Strategy. We already have, few classifications of manufacturing strategies, in our previous sessions. We discussed, different authors, taxonomies related to Manufacturing Strategy. But, one very particular, one very popular, taxonomy you can say, one very popular classification of Manufacturing Strategy, you say, is available on the basis of Process Choice.

And, let us see, what is this conventional framework of Manufacturing Strategy. Now, in this conventional framework of Manufacturing Strategy, we have two dimensions. One is, this process dimension. And, another is this, product. Now, based on this, we call it, Product Process Matrix. The name is, Product Process Matrix. That is the name. And, that is a very popular way of, defining your Generic Manufacturing Strategies.

Now, what is this Product Process Matrix? You see, there are different types of product examples, which are available, in front of us. Now, what are these, like one type of products are, low volume, low standardization, where volume of each product is less, you are producing in smaller quantities, and standardization is also not there. Or, you can say, low standardization means, more customisation.

So, as per the requirement of customer, you can offer, different types of products. But, since volume is low, so obviously, you can fulfil the requirement of, large number of customers. Because, they all require, different type of product. So, each product is required, in less quantity. Therefore, it is low volume, and low standardization. Then, you go to the second category, that is, multiple products, low volume.

Here, you have, again low volume, but it is not exactly low standardization, but you have slightly some specific type of products, but volume also increases, from this first category, to second category. So, more volume, and some multiple products are there. Now, then we move to third category, where we have, few major products, and higher volume. Now, the volume increases. And, when volume increases, the number of variety decreases.

So, variety and volume are, inversely proportional, in this discussion. If you have, less variety, you produce in very high volume. And, in this fourth point, you see that, we have, higher volume, and high standardization. Higher volume, high standardization means, you are producing in large quantities. And, you have very high standardization means, variety is very less. You are producing, only very limited type of varieties, of the product.

So, from 1 to 4, you can see that, our volume per type of variety, is increasing, and therefore, number of varieties are decreasing. As, we are coming to Point Number-1, we can see that, volume per variety is very, very low, therefore, varieties are very large. And, as I go to Point Number-4, the volume per variety is very high, therefore, varieties are very less. So, these are different types of combination, of volume and variety, in our manufacturing organisation.

And, on the basis of these volume and variety, you have different types of processes. Now, when we have, low volume, low standardization, we have job shop type of production system. We have, a very flexible type of production system, because volume is low. So, there is no need to have, a production system, which can automatically produce, large number of quantities. Each time, I get a different type of product design.

And therefore, my production system, my process, should be able to facilitate, the production of unique designs. So, the job shop jumbled flow, is suitable type of process, for this kind of volume requirement. So, this is, 1:1. Then, second type of process is, batch, or disconnected

flow lines. So, this is second type of production system, where you have some products, some products variety is still sufficiently large, but volume is also, considerably okay kind of thing.

So, this is, the batch kind of production, like you have example of, some kind of pharmaceutical production, etcetera, where we have batch production. And, one particular pharma company is making, large number of medicines. So, each batch, has significant number of production. So, that is the, batch, or disconnected flow kind of process arrangement. Then, third is, few major product lines. And, for that purpose, you have assembly line, and connected line flow system. That is the, third type of arrangement.

So, this is suitable, for this type of, volume variety combination. That is, the assembly line, or connected line flow system. You are making, one particular type of product, for long duration. So, that is normally possible, in assembly line system. And, our automobile sector, is a very good example, of this third category, where you have, assembly lines to assemble the body of the car, you have assembly line to assemble the engine, or some other kind of components.

So, that is, for few major products. And, volume of each product, is also significantly high. And, then, we have the fourth category, where you have, very high volume of production, and high degree of standardization. And, this is possible, because you have, almost no variety. And, in this case, the process which we follow, is the continuous flow. That, continuous flow process is suitable, for this fourth case, where your volume is also very high, and you do not have any variety, and only one type of product is continuously produced, in your organisation.

So, this is the fourth type of process. So, you see that, these four processes are connected, with four different types of product variety combinations. And therefore, you see that, examples are also available. That, how we have seen that, different types of examples are there. That, here in this particular case, we have this centreline, which is giving you, that for continuous flow, where we have very high volume, the example of sugar refinery.

So, this is for, fourth case. That, sugar refinery, no variety is there, or you have, only one type of sugar coming, continuously from that. Refinery, another example, where only one or two type of products are coming, and you have same process, for all the varieties. Automobile

assembly, we already discussed that, for third type of case, where few variety is there, but volume in each variety, is also sufficiently high.

So, that is the automobile assembly lines. Then, heavy equipment, or even in the case of, your pharmaceutical manufacturing, we will find this type of, multiple products. And, each product has, very low volume of production, at a particular time. So, in heavy equipment industry, where you are making things like, let us say, blades for turbine, transformers, etcetera. So, these are the examples of, batch and disconnected flow,

And then, the tool room, where you have, each product coming with, unique requirement. That is, the job shop kind of arrangement. And, that is the first type. So, depending upon, the Process Choice, depends upon, your product variety, or you can say, volume variety combination, depending upon your volume and variety, you will select, a particular type of process.

So, this is our conventional framework, which is a 2-Dimensional framework. It is a, 2-Dimensional framework. The only thing in this is, we are considering, variety, and volume. So, this is a, 2-Dimensional framework. And, since long, if you go to text book of Operations Management, you will find, only this 2-Dimensional way of, understanding our Process Choice. That is, based on volume and variety.

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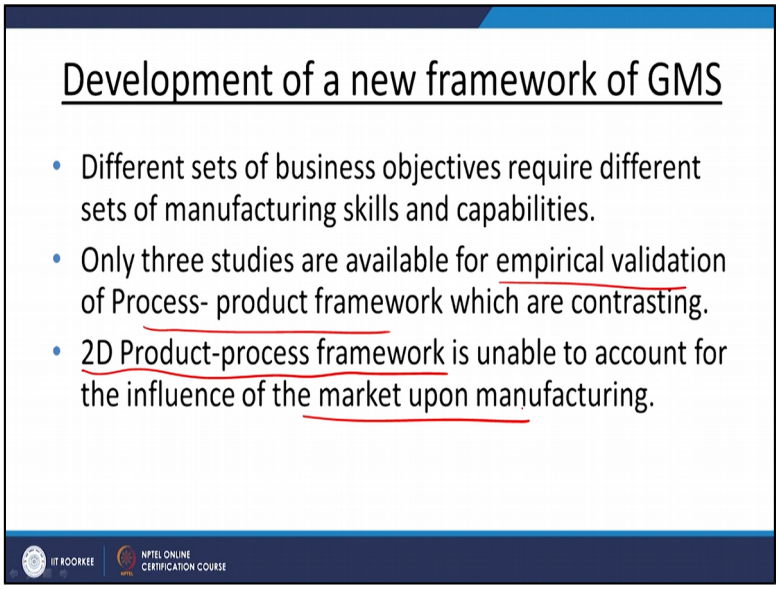

Now, there is some research, happening in the development of, new frameworks, for these generic manufacturing strategies. And, under these new frameworks for generic

manufacturing strategies, we are now trying to consider, few more dimensions. And, now, if you see that, apart from manufacturing skills, organisations require, some other capabilities also.

And, if you see that, in research, what are the different types of researches, which are available, related to validation, empirical validation I am talking, for process product framework. These are, only three studies. And, all these three studies, are contradicting in their findings. Some of the studies have validated, the choice of process, based on variety and volume.

And, some of the studies, have not followed. But, since only very limited number of studies are available, we cannot reach to any conclusion, just by three studies. And, those three studies are also, not in sync with each other. So, this is 2-Dimensional, this product process framework, is not sufficient, may be because, it is not very comprehensive framework.

And, when people started empirically validating it, then they realised that, it is not a very comprehensive way of selection of process. So, we have also realised that, there is sufficient influence of market, on the manufacturing. And, in our so many last sessions, we have discussed that, there is a need of manufacturing, to be market-driven.

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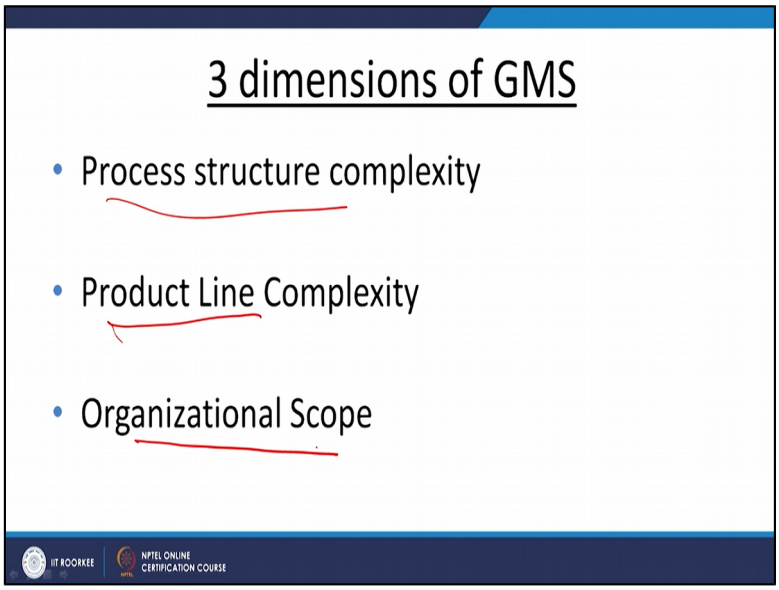

And, with that idea, this new framework is being proposed, and where we have, three dimensions. One dimension is, about the process related thing, which is already available, in our previous 2-Dimensional framework. The other is related to, product line complexity. And,

third is related to, organisational scope. So, there is, some changes in the nomenclature, and at the same time, there is addition of one more dimension.

So, now we have, a 3-Dimensional framework, for Generic Manufacturing Strategy. So, this you can say, our movement from the traditional 2D, to this enlightened, 3D view of generic manufacturing strategies. Now, what is it, this Generic Manufacturing Strategy, in a 3-Dimensional case.

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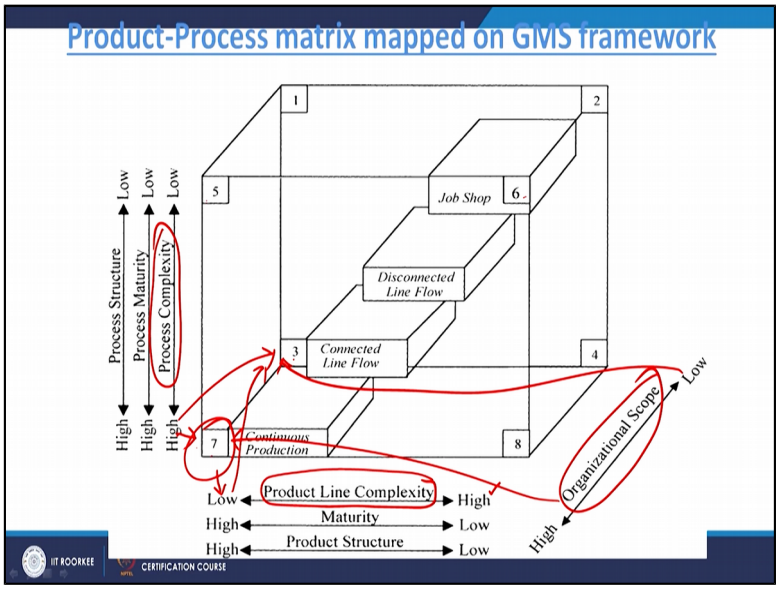

Now, here we see, this 3-Dimensional framework. And, we have tried to map, our conventional Product Process Matrix, on this 3-Dimensional Generic Manufacturing Strategy system. Now, here you see, this line, which is known as our, X axis. It is representing, the product line complexity. And, the Y line is representing, the process complexity. And, the Z is representing, the organisational scope. So, here, we are having, 3-Dimensional view.

And, therefore, it is not a 2/2, it has become a kind of cube, in its understanding. And, you have, eight corners, of this cube. And, these different corners are giving you, different type of Generic Manufacturing Strategy. And, when you see, that our conventional product process framework. So, from this corner, where you see, the job shop. Now, in this job shop, if you go to this corner, the top corner of this side, of this new cube framework, in this job shop represents, that you have, very low volume, and high variety.

This was the, conventional way, of understanding the job shop, that you have, very high variety, and low volume. Now, here you see, the product line complexity. When you are

offering, large number of varieties, you have very high complexity. And therefore, this is coming, on this side, of this framework, where you have, very high line complexity, towards 8 or 6. Both these points are falling, in the same straight line.

So, that is, the high line product complexity. Then, you see, the process complexity. Process complexity is moving from, high complexity to, low complexity. Because, each product requires, a different kind of manufacturing processes. And, you have, mostly the flexible manufacturing system, in case of this, job shop kind of production environment. So, you have, limited or low process complexity.

So therefore, you are combining, the slow process complexity, and this high product line complexity. And therefore, you are reaching to this, Point Number-6 here. And, just to come to this end point, Point Number-7, where we are talking of, continuous production. Now, in continuous production, we are having, very limited variety, and the volume is very high. Now, when we are talking of limited variety, the Product Line Complexity reduces very much.

You are only making, one or two types of products. Sugar, for an example. So, very limited variety, you are making. So, the Product Line Complexity is, very, very low. And, the process complexity. If you visit a sugar factory, you know that, how complicated the plant is, because of, high standardization of your processes. So therefore, you get a highly complex process, and very low production line complexity. And therefore, it comes on this Point Number-7, when we are talking of, continuous production.

And, we will also add, the dimension of organisational scope. And, for that purpose, let us first try to understand, the meaning, under this 3-Dimensional GMS, what is the meaning of process complexity, what is the meaning of product line complexity, and what is the meaning of organisational scope. So, let us see, that first. Now, when I am saying, the process structure complexity, now the process structure complexity, is seen to be, low and high.

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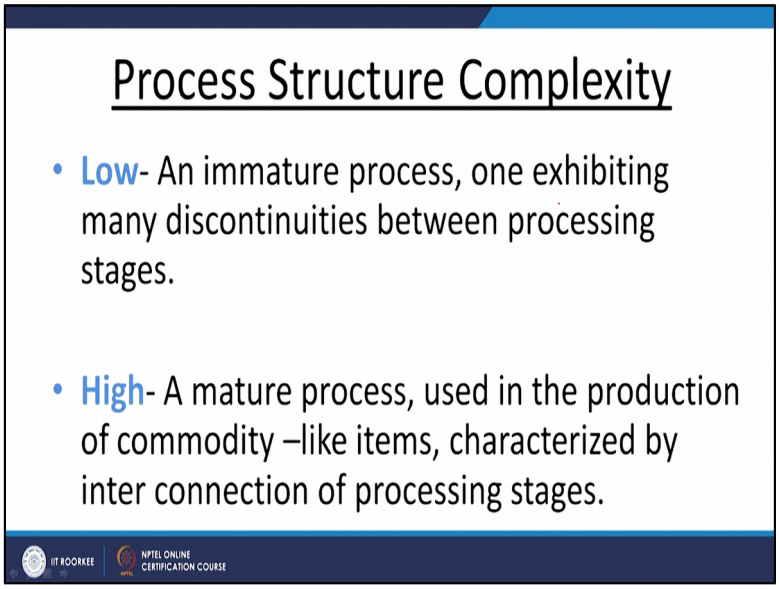

Now, low and high Process Structure Complexity means, that an immature process, one exhibiting many discontinuities between processing stages. So, that is the, low process structure complexity. And, high process structure complexity, a mature process, used in the production of commodity like, items characterised by, interconnection processing stages. So, where, you have more interconnectedness, between the process stages, that is known as high process structure complexity.

And obviously, if you go to a refinery, if you go to a sugar factory, if you go to a paper mill, you will see that, stages are interconnected, one after another. And, the whole things are arranged, in a very systematic manner. So therefore, these are, high process structure complex systems. On the other hand, if you go to a tool room, you will see that, there are large number of, stand-alone machines.

And, depending upon the requirement of, each new object, these processes are decided. And therefore, lot of discontinuity is there, between processes, for each product. So, therefore, these are characterised as, low process structure complexity. So, this is about, process structure complexity. Then, the second dimension, in this 3D view is, product line complexity.

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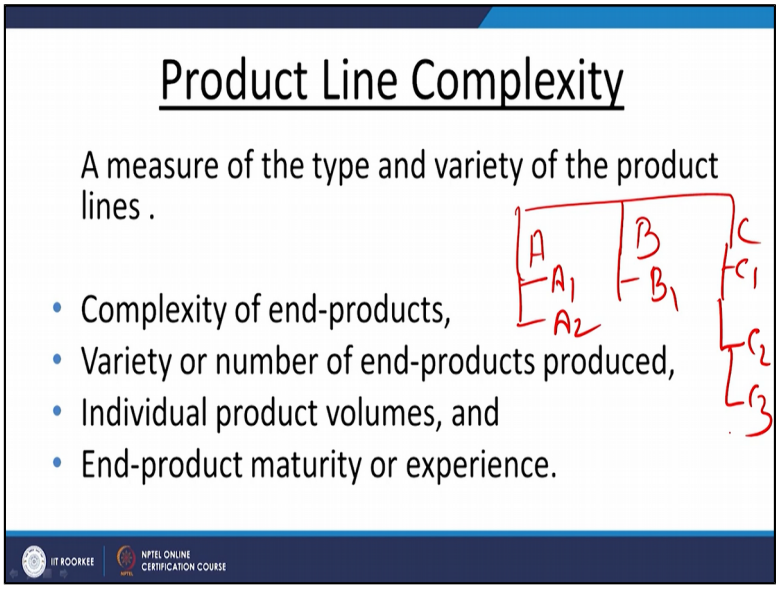

Now, the Product Line Complexity is the measure of, type and variety of the product lines. So, it takes care of your, marketing dimension. That, how many types of products, you are offering. How many type of variance, you are offering? So, we need to go to the concept of product line, where you may have, different types of products, A, B, C. And, in each you may have, different types of, variants like this. So, depending upon, what type of product line you have, you will decide your product line complexity.

So, complexity of end products, variety or number of end products produced, individual product volumes, and end product maturity or experience. So, the Product Line Complexity is made of, all these things. Now, when we have, obviously you can understand, if you have a product line, where you are having, A, B, C, D, E, F products. And, for all these products, you have different variants available. So, you have a highly complex product line. Because, different products, there are different variants, may be at different stages, in their product life.

On the other side, if you have, very limited number of products, or if you have, only one product, in your product line, your Product Line Complexity will accordingly be, much less. So, if you recall, in our discussion, when we are saying the continuous production, on Point Number-7, it has low Product Line Complexity, because you have, very limited, or only, one or two types of products. When we are saying, the Product Line Complexity high, and we are taking, the example of job shop.

Because, in job shop, you have almost, infinite number of jobs. You cannot say that, how many jobs, you are producing. And therefore, you are going towards the complexity, high

product line complexity side. So, that is depending upon, the variety, the number, the volume, and their stages of these products, in their product life cycle. So, that is about the definition of, Product Line Complexity. Then, the third important dimension is the, organisational scope. Now, organisational scope is measured, in two terms.

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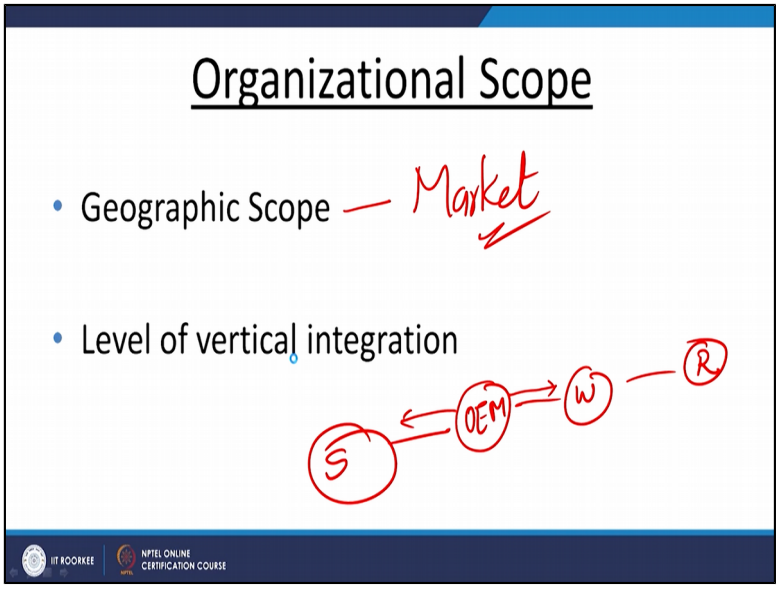

And, these two dimensions, earlier two dimensions, Product Line Complexity, and process complexity, are related to our, product process discussions. But, this is a new dimension, we are adding. And, that is, geographical scope of the organisation. So, geographical scope, is related to, your market. That, how much market? Where is the market, of the organisation? And, the second is, level of vertical integration. That, what level of vertical integration, you have, in your organisation.

So, like you have, this supply chain, where you are this OEM, then you are having a wholesaler, a retailer, and a supplier. So, the meaning of vertical integration is that, you may move, to acquire the business of your wholesaler, you may become a distributor of your own products, or you may start making the components, which are being supplied by your supplier. So, level of vertical integration, whether it is forward, or backward, how much integration you are doing, in your supply chain.

So, that is the meaning of, organisational scope. So, that is a third dimension, which was not there earlier, was added into this, Generic Manufacturing Strategy framework, for three dimension. So, based on that, we have eight points. If you remember, in that cube structure,

we have these eight points, 1, 2, 3, 4, 5, 6, 7, 8. Now, these eight points will give us, eight different types of characteristics, with respect to, these three dimensions.

Like, if I talk of, Point Number-7, the Point Number-7, and if I include all three dimensions, so this is a point, which is characterised by, low Product Line Complexity, it has high process complexity, and it has high organisational scope. Similarly, Point Number-3, it also has high process complexity, it also has low production line complexity, but the organisational scope is low, in this particular case. So, by this way, we will be having, different types of combinations, for these different corners of this cube.

So, we will be discussing, these eight different types of, Generic Manufacturing Strategy, in our next session. Where, we will see that, out of eight, these corner points, some of the points, are actually those points, where an organisation will like to go. And, there may be some points, where we may not be willing to go. And, if we are moving towards those point, we need to see that, how we change our direction, and go to some other desirable points. So, that all we will discuss, in our next session. Here, we come, to end of this session. Thank you, very much.