Production and Operation Management
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Lecture 60
Some Latest and Some Future Issues

Welcome friends. So finally, we are here with the last session of this course of Production and Operations Management. This is the sixtieth lecture of this particulars course. And in this course, we have discussed the various traditional issues, we discussed how these issues have evolved over a period of time. And we also try to discuss the latest concepts with respect to those particular issues. Now in this final session, we will like to summarize the findings of our all the previous sessions.

Particularly, we will like to see that what are the contemporary issues, and what will be the future direction of production and operation management? What will be the future challenges of manufacturing industries? Because there are many things which are happening at the global and local level. And all this knowledge which we have gathered in our so many sessions need a practical orientation, and that practical orientation will only come when we have the complete comprehension of our discussions. Now, this particular session is designed so that we can understand the challenges, the current challenges, and the future direction.

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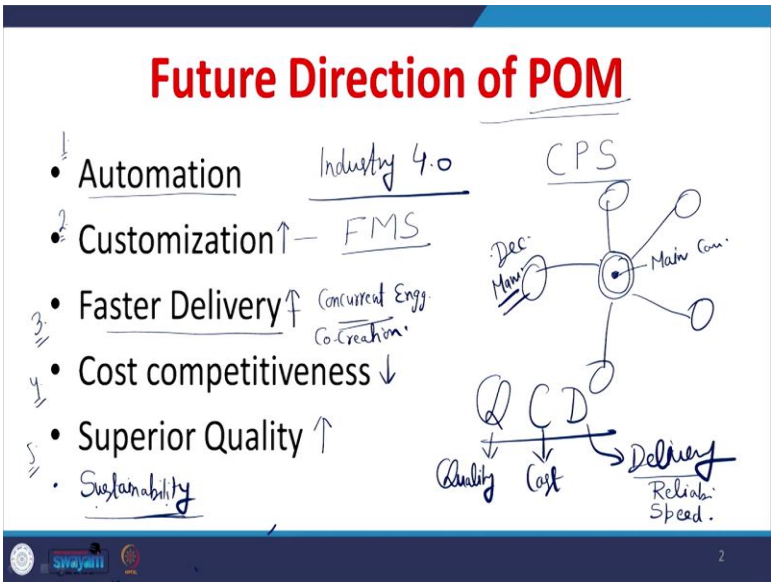

Now with respect to this discussion, the important future direction of production operation management. One important thing is automation, industry 4.0 that is the word you will hear again and again. Now, in this industry 4.0 lot of automation is happening, new cyber physical systems are coming. And because of that cyber physical systems, lot of disruptive challenges are coming in front of us and we need to solve those disruptive challenges. It is quite possible that many of our old concepts will no longer be applicable.

So, we need to work on theory side and we need to work on the practical side. And that is one very important issue at the current time because of the future direction of production operation management that what are the requirements of the industry? How the development is taking place? And that development requires new theories, that development requires new understanding of the discipline and automation is in the front list in that particular aspect.

The second important issue is related to customization. It is the important thing that nowadays we are no longer satisfied with the same kind of product. I always want unique products and so you also. We all want our products to be unique, and that is the meaning of customization, that more and more customization is the demand of the time. And operation management has to design the production planning and control in such a manner that we can produce in a smaller and smaller batch sizes.

Mass production is no longer required because we do not want similarity, we want special things, we want unique things. And therefore, our batch sizes are going to squeeze continuously. And therefore, things like flexible manufacturing systems will be very, very important that how we are able to provide is smaller batch sizes and we need to provide wide variety of products from our, and therefore it is quite possible that in coming times, lot of decentralization of manufacturing activities may takes place.

Because larger facilities will not be capable of a high level of customization, so we may have decentralized manufacturing. So that is again, from the theory and the practical point of view a very important challenge for operation managers that how to have decentralized manufacturing? What will be the new theories behind decentralized manufacturing? And then how to practically have those decentralized manufacturing, where you have a central unit and then you have various

decentralized smaller units. And maybe, industry 4.0 will guide the happening of this decentralized manufacturing.

You have the main command system, this is your main command, and these are decentralized manufacturing activities. So, you can get the command from a centralized place. And finally, your manufacturing facility, decentralized manufacturing facility is close to the market. So, that is another kind of challenge which is going to come, that is the future direction of operations management. Another important thing which is happening, we all have witnessed, we all are witnessing it, that is faster delivery.

We expect a very fast delivery of the products, we want that product should be given to us on a very, very faster way. Particularly, three things are fundamental to operation management, QCD which are known as Quality, Cost, and Delivery. These are the three important fundamental pillars of entire operation management. So now, we earlier was meaning with the delivery, that delivery reliability. Now we are talking of delivery speed also, that how quickly you can deliver the products.

So, it is at various level of product development. It is not only at the final level of the product delivery to the customer. It is not you may think of only last mile delivery. But no, it is not related only to last mile delivery, it is important with respect to last mile delivery, but it is also important at various stages of product development, that each stage of the product development needs to be completed at a much faster rate than what we used to do earlier.

And therefore, concepts like concurrent engineering. these concepts are becoming popular or will become more popular in coming times. So, you need to focus that how product development is taking place with concurrent engineering. And when we go to the class of marketing these same concepts with a different terminology known to us like co-creation. And right from the product development, design of the specification, production of the product, distribution, consumption, and after sales services, at all level co-creation is possible. And therefore, this faster delivery is a very important issue for the operation managers.

Then another important thing is the cost competitiveness. We have seen the Chinese magic, that how china is able to capture the global market. You go to any country, you go to Japan, you go

to America, you go to Europe, you go to any part of the world you will find Chinese products in their stores. And one of the, there may be many reasons, there may be many reasons but one of the most important fundamental reason of widespread availability of the Chinese product is the cost competitiveness. And many nations are following the model of China because they also feel that it is one way to give you huge success.

As in the 70s and 80s, when Japanese magic started beginning and that time many nations started following the quality revolutions. And now, Chinese magic is forcing almost all the countries to think about the cost competiveness. Though, there are people who say that it is not going to last very long. Ultimately, customer will think about the value and in our this session only, we will see that there are some contradictory reports available with respect to cost competitiveness. But as on today, cost competitiveness is a very, very important aspect for the manufacturing success.

Then another issue is superior quality. Customers expectations with respect to quality is continuously increasing. We need to have better quality products and the continuous issue is that, you want to have superior quality product, you want to have faster delivery, you want to have high level of customization, but all these things you want at lower cost. So, there is a very important challenge.

You want better service, you want high quality product, you want product which is especially made for you. But despite all these issues, we want lower cost. So, that is a kind of challenge manufacturing is going to have. The another important challenge, which is part of this list, is the sustainability. Because of more and more demand for manufactured products, the environmental impact of manufacturing activities is a very serious concern.

And at various forum, whether it is World Bank, whether it is World Economic Forum, whether it is U.N, or other economic organizations, all these organizations have expressed their concern about the changing environmental conditions.

And the manufacturing industries are considered to be one of the important reasons for the global warming. So, we want more and more manufacturing output, we discussed in first session if you remember, that government of India wants the contribution of manufacturing in its GDP to be raised by up to 25 percent. And when the manufacturing will become so prominent that the

contribution of manufacturing in India's GDP will be 25 percent, you can think of, you will not even be able be imagine that how much carbon footprint we are going to create.

So, that is another challenge in front of manufacturing industry that how to keep the issues related to environmental sustainability within check. If these issues are going beyond your control then again, your industry, your particular business is not in the interest of the society. So, these are the future directions important you can say, concern for production and operation managers.

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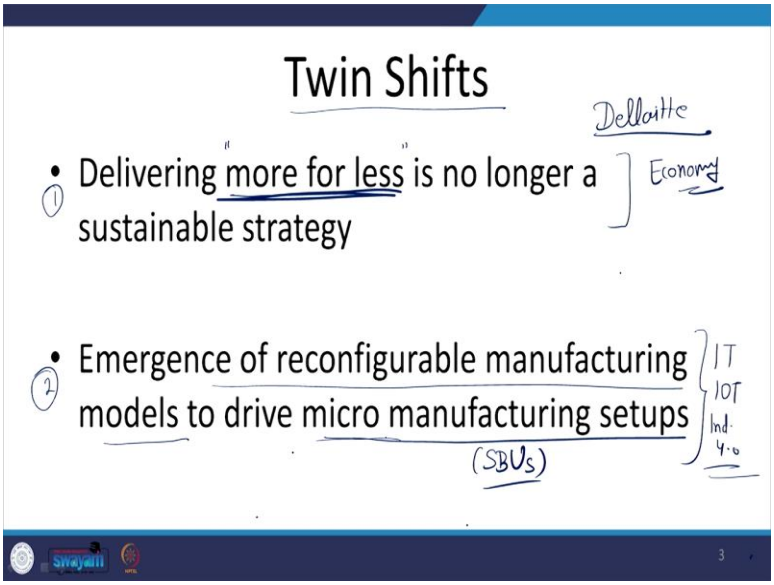

Now, there is a particular report from World Economic Forum and Deloitte. So, these two organizations reports we are going to discuss in this particular session, that what are the major shifts which are happening in the manufacturing sector and particularly related to competitiveness of our manufacturing sector. So, according to these reports one particular point, which is being identified by deloitte's report, this is from the deloitte.

And this report says that, delivering more for less, this delivering more for less this you can say like a phrase, delivering more for less means offering more things at lower price. So, delivering more for less or talking of economy is no longer a sustainable strategy. So, customer is more interested in right value, that whatever value I am expecting, whether your product is giving that value or not, whether your product is fulfilling my value expectations or not.

And when the product is fulfilling the value expectation, customer is ready to pay for that value because customer also understands what is the cost of this value. So, now customer is no longer looking for more for less, that give me more things and I want to pay minimum. So that type of mind set is changing, so that is not is a, that is not a sustainable strategy for the manufacturing organization. That is one important shift this report identified.

The second issue which is mentioned, that emergence of reconfigurable manufacturing models to drive micro manufacturing setups. I just discussed about the concept of decentralized manufacturing. So, it is like micro manufacturing setups. We need to create; it is quite possible that there is a central command and from that central command we have different type of micro manufacturing setups. Like in our strategic management, we call them SBUs, so these SBUs strategic business units are like your micro manufacturing setups.

So, we may have more and more micro manufacturing setups in coming time because, and this is also possible because of IT, IOT, and industry 4.0, these concepts will help us in achieving micro manufacturing setups. And because we want more and more customization, therefore the need of micro manufacturing setups are there. And another issue is that you will be able to use, you will be able to use your small investors for starting the manufacturing activities, a small investors cannot start large scale manufacturing activities.

So, if you can develop a model where micro manufacturing activities are required, so you can encourage your small investors to go for manufacturing activities. One of the reason of services becoming so popular that the initial investment is very low, initial investment requirement is very low in case of service activities. In case of manufacturing, initial investment in the plant, machinery, etc. raw material is used. So, therefore it is not that attractive.

Many a times the cash, positive cash flow is also coming after a long time in manufacturing. But if you have micro manufacturing setups, all these things will be easily possible. Now, after understanding these two major shifts which are going to guide our future operation management activities, let us see what are the key trends in manufacturing innovations.

Because disruptive technologies are coming and these disruptive technologies are doing lot of innovative stuff in manufacturing field also. So, let us identify some of the key trends in manufacturing innovation.

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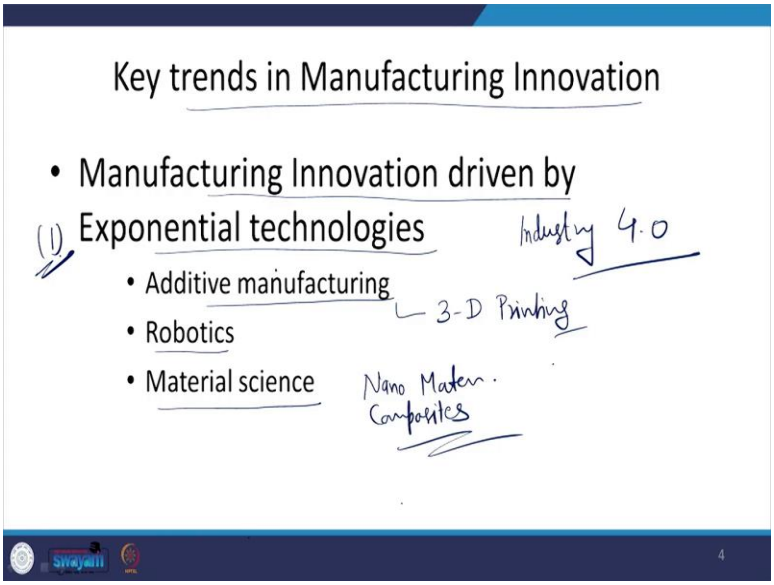

So, some of the key trends are manufacturing innovation driven by exponential technologies, this is particularly related to industry 4.0. Now, what are these exponential technologies, particularly additive manufacturing, or you can say, 3D printing. Use of more and more robots in your assembly line, in your job shop, earlier robots were mainly the part of assembly line. But nowadays, because of exponential technology, because of industry 4.0, because of cyber physical systems, we may have robots even in the job shops also.

So, they are not only doing the routine job, but they can do our general purpose jobs also. Earlier robots were only for special purpose activities, but now robots are possible for general purposes jobs also. So, more and more robots are involved in our manufacturing activities. So, that is also an example of exponential technology. Then the development of the material science, particularly nano materials, composites, all these things are giving you the scope of using new technologies, newer kind of machining methods, the non-conventional machining methods are becoming more popular or will be in more demand in coming times.

The conventional method, because now non-metals are also used to very prominently in the manufacturing activities. So, various kinds of non-conventional manufacturing methods will be the part. So, particularly manufacturing innovation will be driven by number one, using the exponential technologies.

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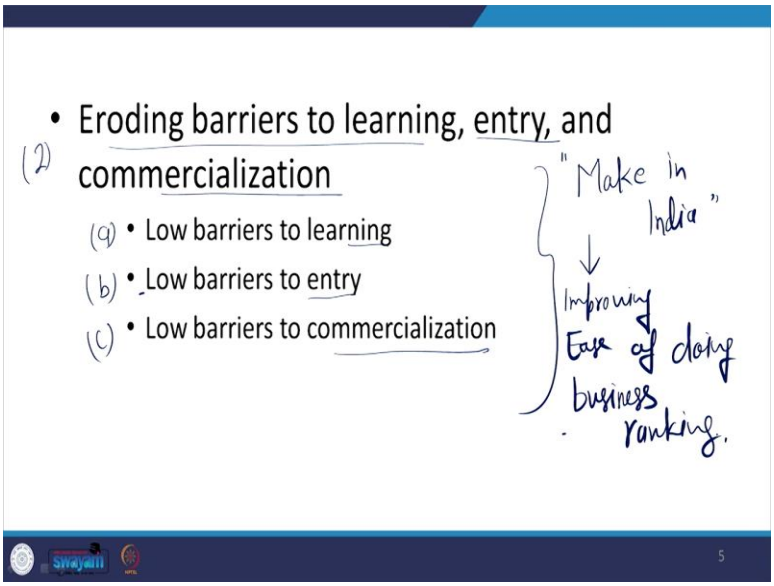

The second thing is eroding barriers to learning, entry, and commercialization. That is the second important issue. So, you have low barriers to learning, you have low barriers to entry, and you have low barriers to commercialization. The kind of efforts, whether it is Indian government or any other government.

Like, for example, in India, we have a program known as Make in India. It is one of the very ambitious program of government of India to boost manufacturing activities, in India. And under this program, make in India program, we are creating that eco system so that more and more investors can start their manufacturing activities in India. So, we are trying to improve our all these conditions which are required for manufacturing activities. And to improve this particular, to eliminate these barriers we are very aggressively working on improving ease of doing business.

So, if we can improve our ease of doing business ranking, that means we are creating low barriers to learning, low barriers to entry and low barriers to commercialization. And everywhere

now in India particularly, we are having the wide level of awareness activities with respect to how to eliminate these barriers, and how to create more investment friendly environment.

So, manufacturing will no longer be, manufacturing will no longer be limited to those few people, those few organizations which are capital intensive, it is going to become the activity which can be taken by any person. So, that is another very important trend which is going to happen in manufacturing innovation.

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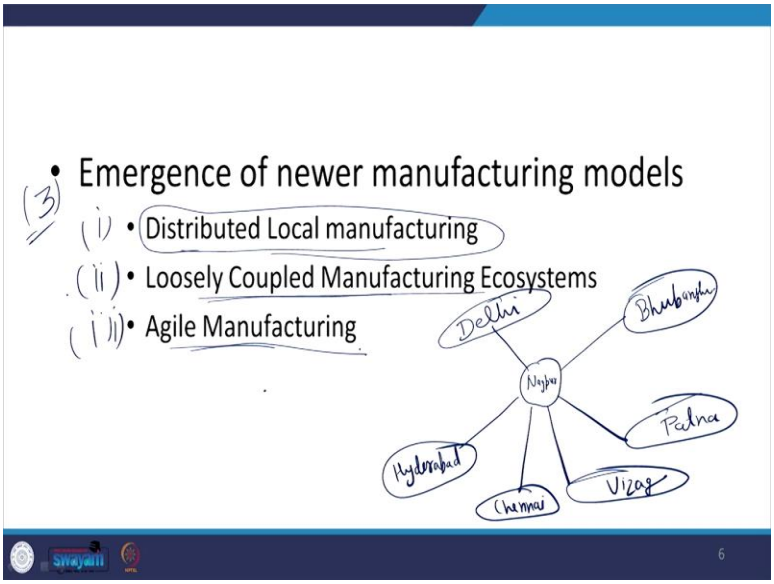

The third important thing is with respect to emergence of new manufacturing models. We have a traditional system of manufacturing, and particularly in that traditional system of manufacturing, the scale becomes a very important criteria. You want to enjoy economies of scale, we wanted to offer more for less. And that was one of the traditional thought, that how can you offer more for less? But now in these newer manufacturing models, we want to have different kind of things. Like, distributed local manufacturing, because more and more customization is required.

So, you cannot produce wide customization with low quantities, wide customization means wide variety and low quantities, low volume of each type of product in a very large plant. And therefore, it is going to be preferable that how to have distributed local manufacturing. You have a central plan and from that central plant you are able to produce locally required products at different locations.

Like in India, you have that central system at Nagpur and from Nagpur you have one facility at Bhuvneshwar, another facility at Delhi, another facility at Hyderabad, another facility at Chennai, another facility at Vizag, another facility at some other place like Patna. So, these maybe the different local manufacturing activity plants and the central command is at Nagpur. So, that type of things will be happening in the future.

Loosely coupled manufacturing ecosystem, very important thing for India. China has already done it, particularly in Chinese markets those things which were done under the you can say, some kind of infringement of patents, some kind of pirated product manufacturing used to happen. But now, slowly and slowly these companies, these organizations have followed the legitimate processes. And now, they have created the ecosystem of producing the products with sharing the facilities with one another.

In India, around our 90 percent of the small and medium enterprises are under these kind of, you can say unrecognized facilities. So, these loosely coupled manufacturing ecosystem where we have the knowledge that these organizations are there. But these organizations are not under the complete regulatory framework of the company, of the country. In that particular case, these organizations can flourish because their capabilities are limited with respect to following the complete regulatory framework.

So, you need to have because this is a new type of system which is going to emerge. In India, if we want that our Assamese should flourish, we need to actually promote this kind of system that is going to help of our small, and medium, and particularly micro enterprise. Then another important manufacturing model that is agile manufacturing. Because more and more customization is required, more and more flexibility is required, so it is again related to a smaller manufacturing facility.

If you have a bulky organization, if you have a organization of huge scale it is very difficult to have agile manufacturing in that organizations. So, you need smaller organizations which can quickly adopt to changing requirement. So, that agile manufacturing is also very important in our trends which are going to come in coming times. So now, after understanding the key trends for the global manufacturing environment and there implications for India also, let us devote some to understand the issues related to global competitiveness.

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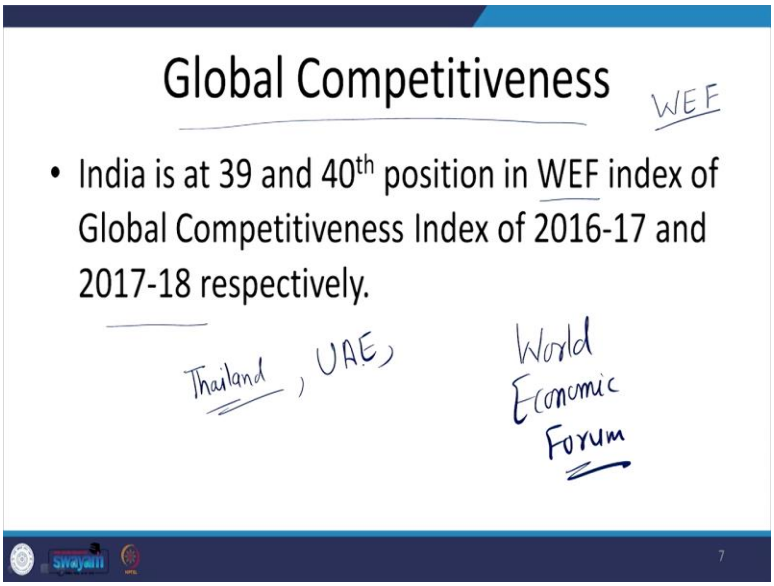

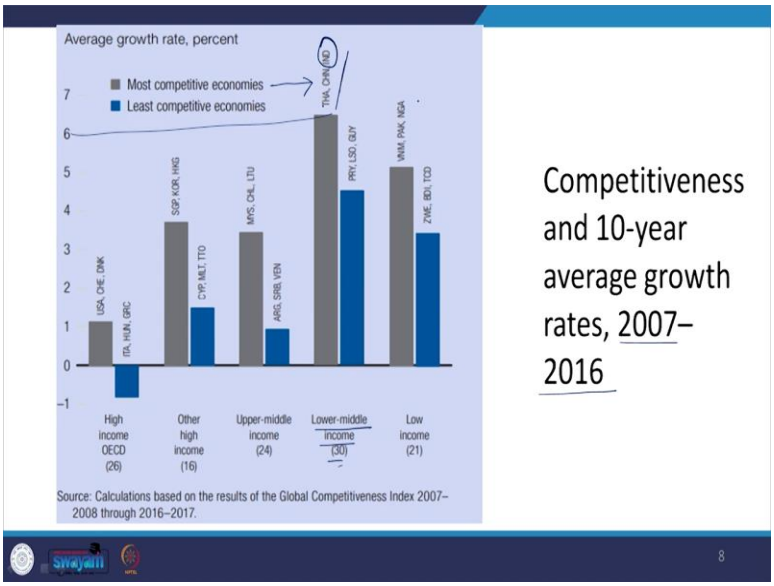

So here, I am giving you the data with respect to India only, that on these Global Competitiveness Index the report is a given by World Economic Forum. WEF stands for, World Economic Forum. So, India's position is around 39, 40, it was 39 in the previous year, then it decreased by 1 and it became 40, in 2017-18.

Now, on the basis of this global competitiveness index, we see that there is a huge scope to improve. We have various smaller nations, various smaller nations. Particularly I can name few, like Thailand, which is a much smaller country than India. UAE another smaller country than

India, but their global competitiveness index ranking is much higher than India's ranking. So, there is a serious issue with respect to global competitiveness, that how our manufacturing can be regarded as a important source of development for our country.

If you see, the same report and for a period of 2007 to 2016, here you see India in the lower middle income category, in the lower middle income category, 3 countries are considered to have most competitive economies and these are Thailand, China, and India.

These are the three most important economies in these 10 years period, based on aggregate growth rate percent, that their global growth rate is maintained around 6 or 6 plus. So, these countries are considered to be very, very competitive countries. Now the issue is that, we just need to maintain this competitiveness. And for that purpose, let me share some more data with you.

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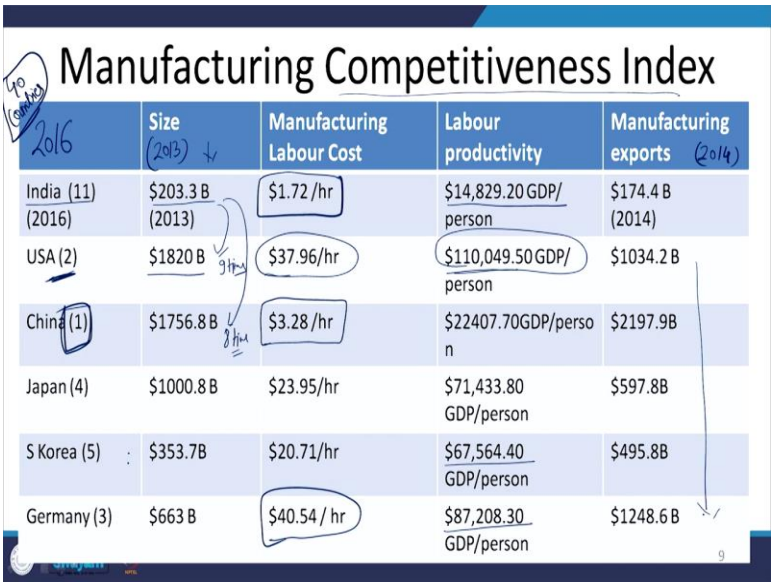

And that data is taken from the deloitte's report of manufacturing competitiveness index. This data was given, this index was prepared in year 2016, and it uses data of different years. Like, for the size of manufacturing it is the using data of 2013, and for manufacturing exports it is using data of 2014. Now based on that, if you see the India's position, this survey was done for 40 countries, this survey is based on 40 countries data.

India is at eleventh position in this survey. Now you see the various parameters. Now the manufacturing labour cost in India is just less than 2 dollar per hour, the manufacturing labour cost is just less than 2 dollar per hour. And China, which we say is a very competitive nation, it is at number 1, it is at number 1. Here the cost is slightly above 2, 3, so we offer lesser labour cost, but still we are much behind China.

People say that China is more cost competitive, but the data says that our labour cost is lesser than the Chinese labour cost. On the other hand, there are countries like Germany, where the labour cost is so high, 40 dollars per hour. And similarly, in case of USA, it is around 38 dollars per hour. But still these countries are able to maintain a very high level of competitiveness as compared to India.

The reason is very evident, you see the labour productivity in case of India, it is around 14829 dollars of GDP per person. And while in case of USA, it is 1 lakh 10000. In case of Germany, it is 87000. In case of a South Korea, it is 67000. So, you see that there is no comparison of labour productivity of India verses other countries. These are running into thousands and lakhs also; we are running in just the 14000.

So, that is a very important challenge. Another issue is with respect to the size of manufacturing activities. In India, the size of manufacturing activity is just 203 billion dollars. And on the other side you see, the size of U.S. manufacturing output is 1820 billion. So, it is around 9 times more, this is Chinese is 8 times more, so you see these economies, their manufacturing output is so huge as compared to India's manufacturing output.

Their cost is also very, very competitive. Though In case of a USA, the manufacturing labour cost is significantly high, but still it is able to maintain a second position on the global manufacturing competitiveness index because the labour productivity is very high, in case of USA. You will see that in this list, in this column of labour productivity, the highest labour productivity is of USA. And then obviously, the exports are also very, very high for other countries except for India.

India’s export is very low, as compared to other countries which include U.S, China, Japan, South Korea, Germany, etc. So, these countries are very small as compared to India, particularly

Japan, Korea, and Germany, but their competitiveness is much higher than the Indian competitiveness.

So, we need to see that the entire operation management, if we are not able to follow the trends which are going to be there in future with respect to automation, with respect to distributed manufacturing, with respect to identifying the new models of manufacturing, and then apply those things in our context, we will not be able to improve the competitiveness of Indian manufacturing sector. And with this, we come to the end of this course, where finally we think that it is very, very important to improve the competitiveness, using production and operation management.

And that is only going to happen when we understand that what are the future requirements, and we start working to fulfil these trends, we start working on adopting those trends. So with this, we come to end of this session. And with this, we also finish this particular course of production and operation management. I hope you enjoyed the journey of these 60 sessions. Thank you very much for being part of this course.