Entrepreneurship
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Technology, Business and Operation Strategies
Part 5

Friends, welcome to the NPTEL course on Entrepreneurship, we have in the earlier sessions discussed the role of technology and very specifically we talked about business strategy. We also said that business strategy comprises several other functional strategies of which operations strategy is one important aspect. In this session we will talk about operational strategy little more.

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To recall business strategy comprises product strategy, technology strategy, operation strategy, sales and marketing strategy, financial strategy and human resource strategy. Each of these strategies is very important and the inputs or rather the outcomes of these strategies directly feed into the business strategy and they serve as the inputs to the business strategy.

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What is operations strategy? The operations strategy of a firm is a plan it specifies how an organization should deploy its resources, how it has to organize itself to convert the inputs it has into an output, which is the product which is required in the marketplace. And in essence, how does the business strategy.

And how does the product strategy get converted into a physical product or service that is the soul and spirit of the operation strategy challenge and it is driven typically by the need to maximize the efficiency and effectiveness of the business strategy in actual operations.

A very good business strategy can become very ineffective if the operation strategy is not done appropriately. And in an industry which comprises many similar products, in an industry, which has got technology which is rather commoditized. The only way in which an industry can be differentiated by firms is when one firm has a superior operation strategy compared to another firm.

So operational strategy is actually the execution of all of the business strategy and also all of the product strategy and when technological competencies are equal, for example, in the smart phone industry, where everybody is able to come up with the same types of displays, same types of camera sensors, the same types of music systems, the only differentiator is how effective you are operational strategies and how you are able to move your operational cycle far ahead of the others. But that said, operation strategy comprises many components as well.

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It comprises the manufacturing strategy, how would I machine the components? How do I assemble them into a product? The Quality Strategy, how do I in-build the quality into the operations of the company? How do I protect the environment while I convert the product? How do I have the safety of workers and the environment assured and how do I take care of the health aspects of operations?

And what is my networking strategy globally to be able to source the right kind of components at the right kind of costs and then produce in the most appropriate places nearer to the markets hopefully, and what kind of facility I should design and what kind of supply chain strategy I should adopt to support both manufacturing in terms of components and also the facility in terms of the equipment. So, these are the aspects of the operations strategy.

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To enable business growth and operations strategy has to be driven again by four foundational factors. First, it should obviously help the company achieve the business goals. Therefore, the operation strategy cannot be independent of the business aspects of the strategy or the company.

So it should be driven by the business, operations cannot be an independent kingdom, which does things by its own will and by its own power, and in some industries and in some firms operations are tend to have strong power because they are the companies which respect the wealth that is generated in the factory or the workplace.

And that is also the industry where the production heads by virtue of their power authority have got a way of doing things by themselves in the manner, they think they deem fit. But such operations tend to be decoupled from the business strategy of the company and what is ultimately provided may not be very effective and timely. So, business is the key driver of operations strategy.

Secondly, operations are being done to fulfill customer needs. Therefore, like business strategy, it also has to be customer centric. Similarly, operations has to be competency driven, because many leading edge competencies are getting integrated into the operations space and operations while recognizing that you cannot replace your machines every year must also be understanding how the machines can be updated to the latest technological trends.

And how operations can be a unique competitive advantage for the firm? How can I make my OEE, the operating utilization of the company the maximum, the best possible in the industry, how could I reduce my breakeven levels? These are the challenges which the operation strategy of a company needs to address.

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So, there are a few critical limits we have seen in the previous session how business strategy gets developed through several steps here also we have got the operational strategy of a company getting developed through certain critical steps, but fundamental building block for any operation strategy is the product portfolio and the SKU distribution.

Product portfolio reference refers to the number of products which you have in the portfolio while the SKUs determine the unique store keeping units which the operation strategy has to plan for. And from these two inputs we develop the demand forecast, region wise as well as the product wise forecast will be developed and that leads to the capacity plan.

Once you understand that, this is the capacity that this plant must aim for, you look at a location which is most appropriate for fulfilling this capacity and while choosing the location you may keep various factors in mind whether the industry is developed in that location whether the material suppliers are proximate to the location etc-etc.

Then you design the facility and process that is required to convert those materials components into the product and you select the plant and equipment and at that point of time

you develop a very detailed bill of materials and you create the vendor master list and then start sourcing the components and take off with the production.

So, these are the key steps. And each of these steps again has got certain pros and cons in terms of decision making and also certain imperatives and compulsions while making those decisions.

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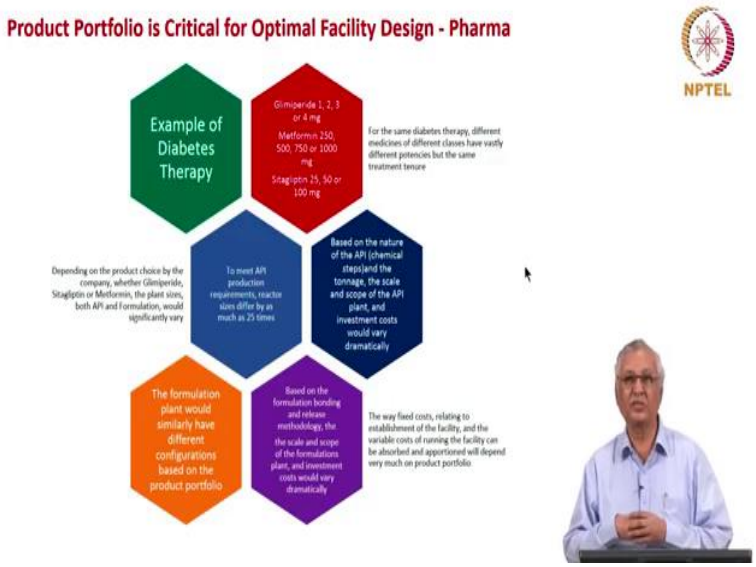

Now product portfolio I said is very critical for optimal facility design, I will take the example of diabetes therapy. As you know, diabetes is a lifelong disease and there are certain oral dosage firms which are available for treating diabetes and there are two types of products. One is a product which is sulphonylurea, which is Gilimiperide, which is available in 1 mg, 2 mg, 3 mg strength and its role is to stimulate the pancreatic beta cells to produce more insulin.

Then you have got another class of drugs called Metformin kind of drugs, which are available in 250, 500, 750 or 1000 mg and they utilize the insulin in a better fashion they reduce the insulin resistance, then you got to more modern products like Sitagliptin which is available in 25, 50 and 100 mg. You can very well imagine and these are all lifetime products and also a patient may take just 1 mg of Gilimepiride or he may take 500 mg of Metformin, or a combination thereof are in different levels.

So, if you decide to plant for Gilimepiride, you will be out of the market for providing Metformin. On the other hand, if you design the plant for Metformin, which is let us say 100

times more in terms of scale compared to the sulphonylurea, you are going to have a plant which is unlikely to be efficient in terms of the batches the size of the batches.

So, product portfolio is extremely important. Therefore, the variability of the plant depends on the potency of the product and you will understand the potency of the product only when you understand the product portfolio. Therefore, building the product portfolio is essential to get into the market on a very related aspect. This applies both for the bulk drug as well as for the formulation.

Because the speed of the machines the size of the reactors in respect of the formulation as well as in the API differs depending upon the kind of product you have done. Therefore, the configuration of the plant itself is very different. And the fixed costs as well as the variable costs also dramatically vary depending upon how you choose your product and how you choose your manufacturing technology.

This is one simple example as to how product portfolio is critical for an optimal facility design. So, operations strategy many times inherit something which has been done in a kind of hasty manner. Many times, the CEO says that I ought to get into the market. And the best way to get into the market is to build a plant and directions are given that he must build the plant but without understanding the exact products, which the company would like to do.

So, little time taken in understanding the product portfolio and building the right plant configuration ensures that the operation strategy is much more effective.

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The same applies to a commercial vehicle industry. If you want to manufacture light commercial vehicles you have got certain size and scale. On the other hand ,if you want to specialize in extremely heavy duty vehicles the nature of the plant is very different.

So, the annual production volume, as well as the scale of the corridors scale scale of the assembly lines vary substantially whether it is just ACE kind of a mini bus or mini truck or whether it is a hippo beaver kind of heavy duty truck. So, this is important another example from the automobile industry.

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But to be able to be competitive, operations strategy has to fulfill a few factors, I would say that concurrent design and manufacturing is the first foundation and we have got books which talk about concurrent design and manufacturing very extensively. You will also need lean and flexible manufacture. Third, you need globally networked production. You cannot afford to think that everything you will be able to produce within our country or within one country.

Similarly, you can also assume that single sourcing will be effective, you need to have multiple sources in case there are certain issues in any of the countries which are support and then we need to have a pull type production system which ensures that the inventory accumulation is minimized in this system.

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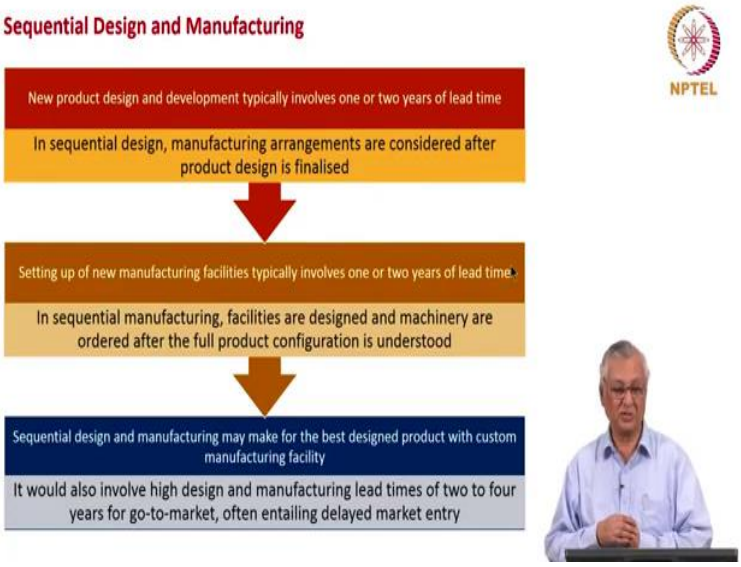

Typically, we have sequential design and manufacture in any industry. New product design and development takes at least one to two years of lead time. In sequential design, you ensure that manufacturing takes place only after the product design is finalized. Obviously, this will delay the manufacturing activity by at least one to two years.

So, the lead time is lost and you need another two years to set up the manufacturing plant therefore, from the time you decided on the product concept, you would take four years to get the product out of the manufacturing thing. So, it may have the best designed product best designed customization of manufacturing activity, but the time taken for go to market is substantially higher.

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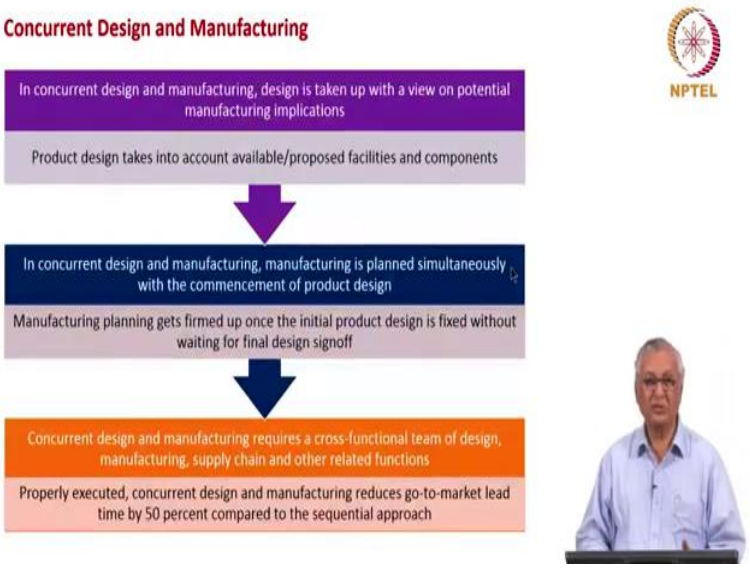

So the option for that is concurrent design and manufacturing where you bring up all the manufacturing implications, all the design implications around the table and ensure that whatever you can do with the existing machinery or whatever you need to do with the new machinery for the existing product or for the new product, there all put together and you create a manufacturing ecosystem, which is quite capable of being designed along with the product.

So, when properly executed, the manufacturing lead times can be cut by at least 50 percent compare to the sequential design and manufacturing systems. There are research findings which demonstrate that.

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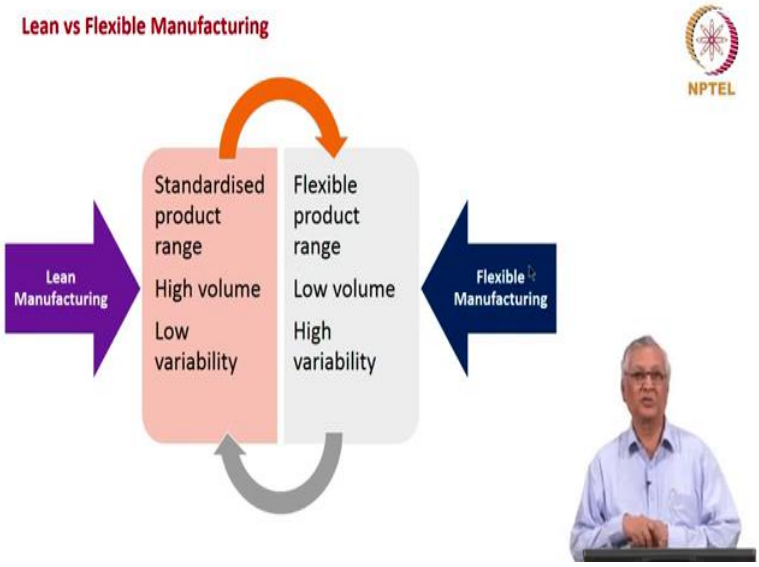

Then we have the second important aspect of lean versus flexible manufacturing. When you talk about lean manufacturing, you should aim for highest throughput, you should have a low number of machines, low variation and is a kind of 4T assembly kind of system everything going through in rapid pace without much variation.

On the other hand, when you have flexible product range and when you have mass customization you need low volume, but also high variability. So, the inherent contradiction between lean manufacturing and flexible manufacturing, if the company is able to address through lean as well as flexible manufacturing, the operation strategy will be very effective.

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So, in automobile industry for example, we have adopted unit operations as one way of handling the case for lean manufacture for multiple products. Typically, in an automobile industry, you have machining centers, which are dedicated for let us say a 4 cylinder engine or 6 cylinder engine or 8 cylinder engine.

But you may reconfigure the entire manufacturing system in such a way that you have unit operations that is the machinery is designed for machining only one board so, even if you have a 4 cylinder engine or a 6 cylinder engine, it does not really matter, because what the machining center does, is unit operation. So, by focusing on unit operations, you can bring in certain flexibility in terms of handling different kinds of products.

Second, you can have flexible assembly systems which can cater different kinds of products, which requires different kinds of jig and fixturing arrangements, but the cost involved in that is worth it in terms of handling different types of products. And the third one is make or buy decisions that is the ability to insource product products and components to be able to make different kinds of products.

We will see that when we come to the final case studies, we will find that one engineering company has been able to achieve mass customization across the globe for its tools based on very strong supply chain which insourced products components to meet diverse customer needs.

And the last aspect is how to keep the core manufacturing and internal control, while you might disperse rest of the marketing to different countries different agencies, how do I keep the core manufacturing under my control so that the control over quality is maintained.

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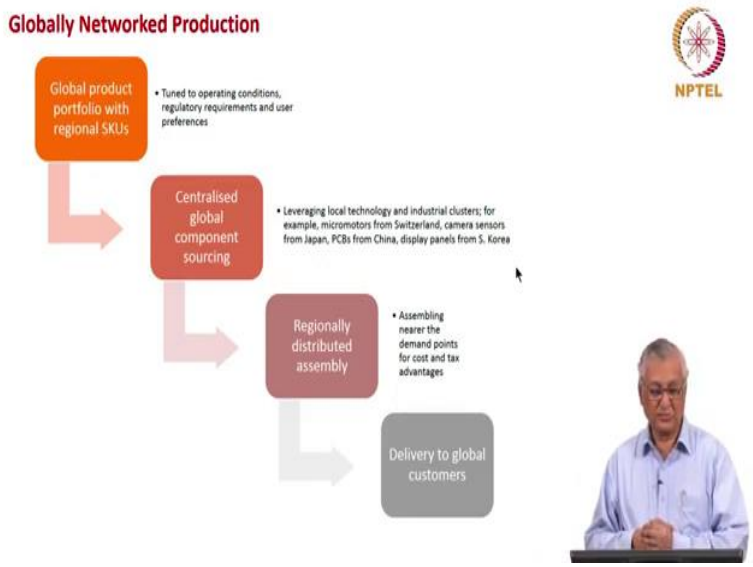

The third aspect is globally networked production. What is the global product portfolio with regional SKUs? How is it tuned to the operating conditions, regulatory requirements and customer preferences in different countries? How do I centralize global component sourcing? It is easy to say that we should source out components globally but how do I centralize this process so that there are no double purchases or triple purchases?

And how do I understand which country is very specific? If you are looking at watches obviously micrometers are a speciality of Swiss if you talk about camera sensors, Japan is the core for that. When you talk about display panels, probably Korea is the country for that so how do I understand the global supply competencies and then source my products accordingly.

And how do I distribute my assembly regionally, so that the product manufacturer is closest to the market, which I serve and how do I deliver to the global customers.

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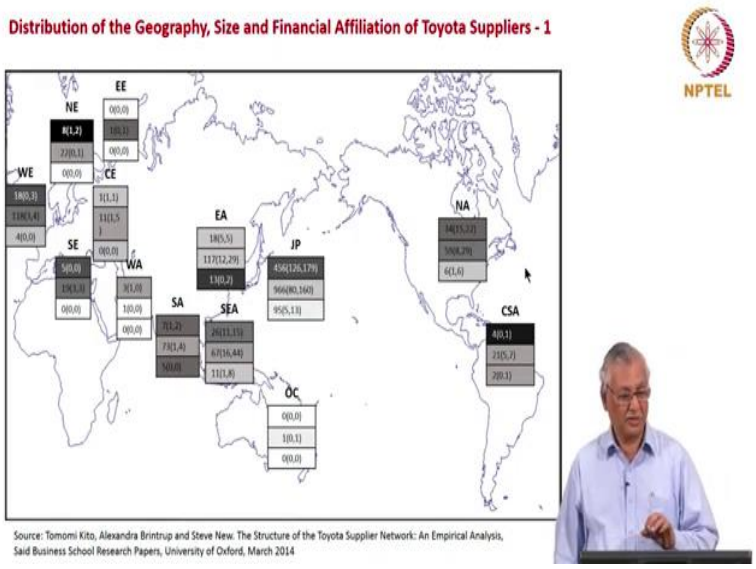

So, we have here a map of how Toyota distributes its network, production network across the world. And you can see that in all these strategic continents, Toyota has got its production infrastructure and also has got its own supply sourcing activities. This is taken from the article by Kito and Brintrup as well as Steve and people who are interested in how Toyota supply network excels are advised to go through this article, research paper.

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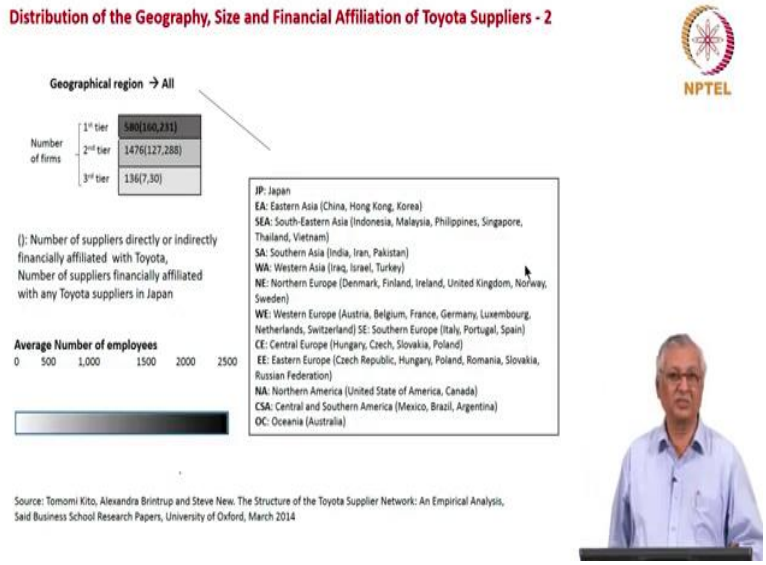

And there are at least 15 countries which are used for specialization and also the labour intensity. The employee intensity across the continents varies depending upon the industrialization of those countries.

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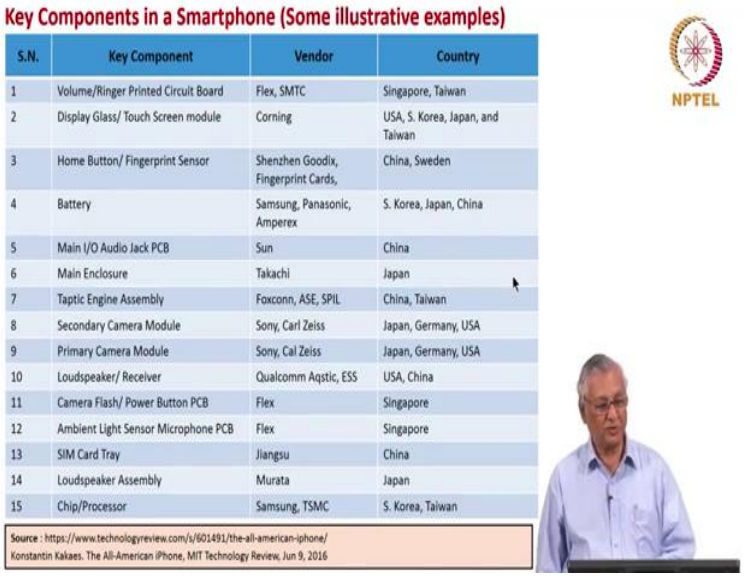

And when you look at the smartphone, you will see that different companies from different countries are specialized. And volume ringer, printed circuit board for example is a specialty of Singapore and Taiwan. On the other hand, the fingerprint sensor is a specialty of Sweden. You have batteries coming from South Korea, Japan and China.

Whereas, primary camera module is as much Carl Zeiss phenomenon as much as Sony is phenomenon. So, you got different countries which are specializing in different aspects of smartphone componentry network and the companies are different too.

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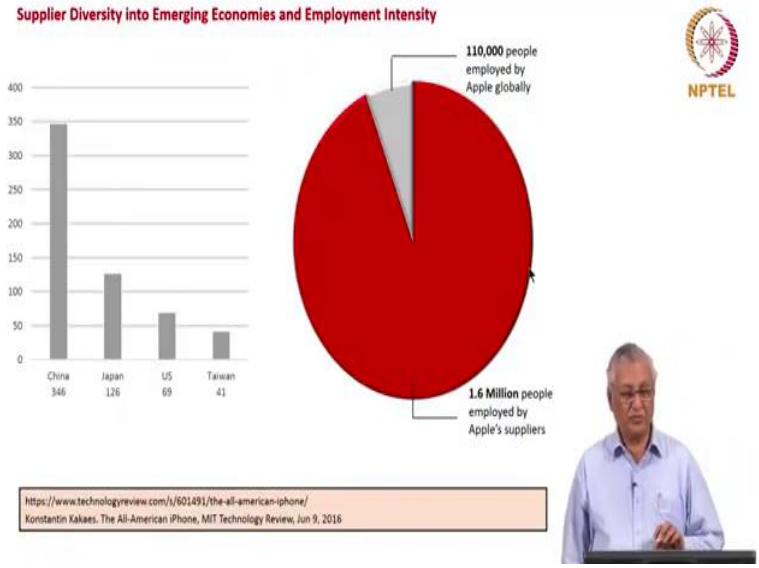

And when you have a globally distributed production structure, you will see that Apple which is the leading smartphone producer has 110,000 people employed within the apple ecosystem of its own organic. On the other hand, the entire supply network has 1.6 million. So, 0.1 to 1.6 is the ratio.

So that is the level of globalization of production that the Apple ecosystem been able to achieve over the years. And out of that you will find the China has got 346 suppliers, Japan 126, US 69 and Taiwan 41.

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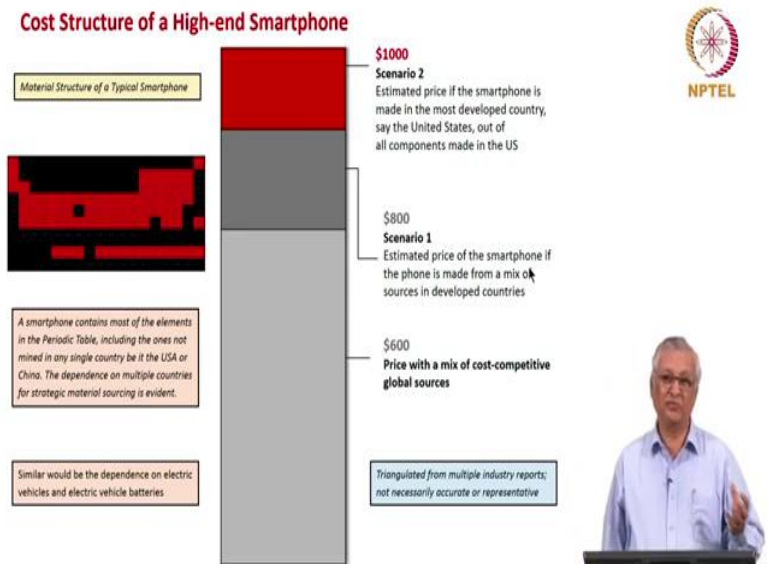

And it is possible also that you can produce everything in one country, you can produce the product globally in different countries. And this research paper also addressed, how by manufacturing in different countries, you can get a cost structure, which is, let us say at 600 dollars assuming the overall cost of a smartphone being thousand.

But if you shift the production from let us say, a mix of emerging and developed economies to more source in developed countries how the cost structure go? And if you decide that everything shall be done in an developed country, how would the cost structure go. So, the way the operation strategy is designed, how the global production network is established has an impact on the cost structure of the product.

And again, a smartphone contains most of the elements in the periodic table, which means what? The company should have the ability to understand the material supply sources, the production centers, where exactly it would be optimal in terms of long range strategic arrangements for the company to be able to ensure sustainability of the production.

Similarly, when you come to the electric vehicles and electric batteries, which is the new wave of transformation, unless you have got a similar understanding of the global production structure, global component structure, global materials structure, you would not be able to have a very effective operation strategy for electric vehicles therefore, operational strategy is far beyond or far more than just having a plant being designed and established to manufacture. It is a global network operation which needs to be conceptualized, analyzed and designed.

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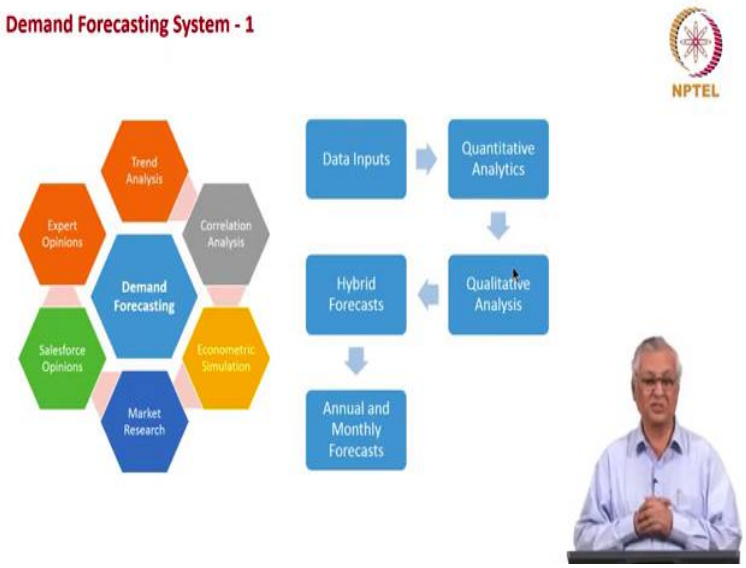

Then you have of course, the demand forecasting system, how would I do that, there are several aspects of demand forecasting which is available from trend analysis, correlation analysis, econometric simulation, market research, sales force opinion, expert opinion the bottom three are of one type, the top three are statistical in nature.

But the data inputs the quantitative analytics, the qualitative analysis, the hybrid forecasts, we develop and the annual and monthly forecast all of these need to be superimposed on the product portfolio additions which I alluded to earlier. When you combine these two you will get an effective input for developing the operation strategy.

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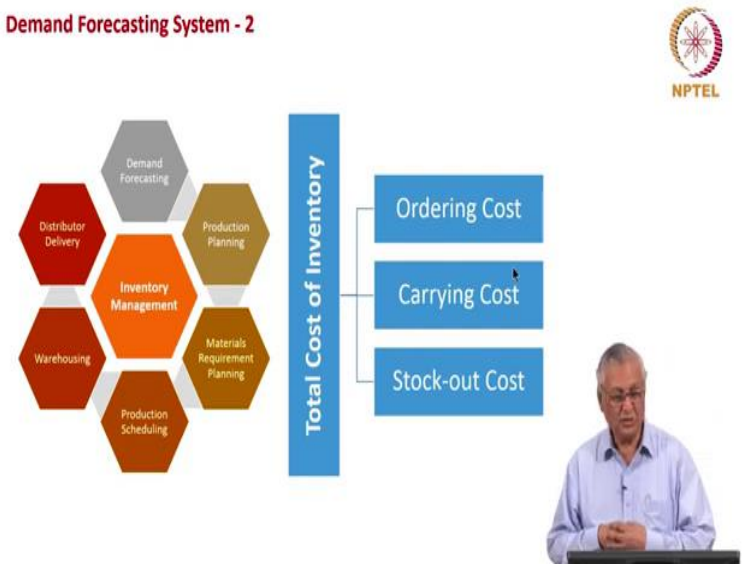

And when we talk about demand forecasting, we cannot ignore the impact of demand forecasting on inventory management. Because from demand forecasting, we get the production planning system then we get the MRP then you get production scheduling the warehousing the distributor delivery.

There are industries where warehouse space is far more than the manufacturing space for example, in the pharmaceutical industry, mainly because it has become difficult to predict which countries would be taking which products and what kind of supply shortages you would have in terms of either FDA regulations or other regulations.

Therefore the warehouse space becomes very important part of the total facility design however much we say that we should have just in time inventory systems and the total cost of inventory this is very well understood for people who have already gone through management, the ordering cost, the carrying cost and this stock out cost.

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What is enterprise resource planning? Enterprise resource planning takes an end-to-end view of a company's operations. It starts from the sales and marketing activity goes into the materials requirement, then understands the manufacturing aspects the distribution, the quality and the human resource.

And when all these aspects are considered as one singular module. Although comprising sub modules, it ensures that the operations are carried out in a tight and effective manner. And to be able to do that, we also require a lot of supportive elements added to the thing for example, finance and accounting is an important aspect of all of these things.

Similarly, project management how to ensure that the activities are carried out at the right time and in the right manner, that is the project management. Then sales and marketing will be effective only when you have a very effective customer relationship module, how we are servicing our products to the customers, how we are fulfilling the demand and what are the costs of delays, this is the customer relationship module.

Then, we also have to have an environment health and safety module because, as per understanding established by several studies, if one fatality has occurred in an industry or if one serious safety accident has occurred in industry, it has been preceded by thousands of very minor safety disruptions, which are left unnoticed.

Therefore, you need a enterprise level Safety, Health and Environment module which can detect these kinds of minor deviations to the safety operations and then record them and then

feed them into the overall safety system of the company. So, it should come as part of normal operational surveillance.

Then we need a module which relates the supplier relationship, what is the stability of supplies, what is the quality of supplies and what is the compliance with the orders which we have given. Similarly, what is the risk the company has in terms of business continuity in terms of governance and compliance. So, these are all the supportive modules on one hand we have got execution oriented modules on the other hand, we have got supportive modules.

So, in an enterprise resource planning system, we can think of at least 12 modules which are extremely important to make sure that the end to end execution of the operation of the company is effective and helps the company achieve its business strategy.

And we have got very powerful tools available, which has essentially ERP tools whether it is SAP or JD Edwards or others to be able to do the enterprise resource planning on end to end connected basis. And the goal of this is to ensure that the products are supplied on time without access to inventory and also ensuring that not a single sale is lost.

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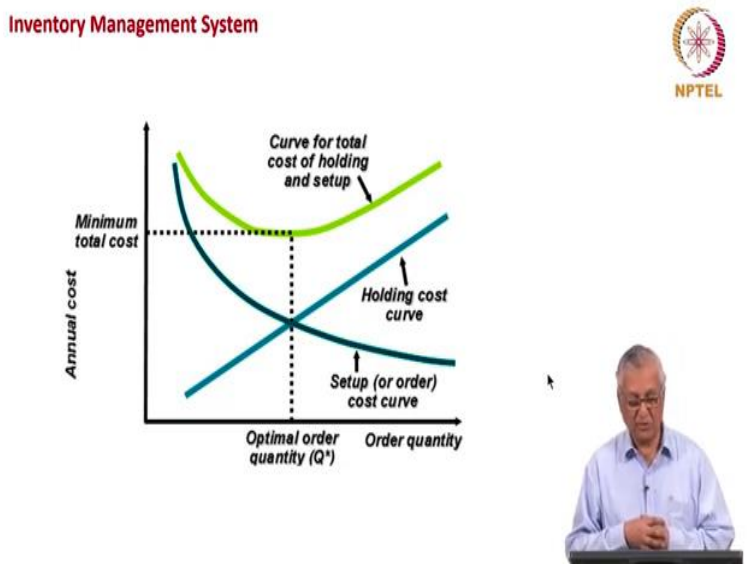

Therefore, when you have a graph plotted in terms of the optimal order quantity or the order quantity, and also the annual cost, when you try to arrive at the minimum total cost and when you try to arrive at the optimal order quantity, you have got a cost equation which works for the total cost of holding as well as setup.

As you have higher throughput the setup cost will come down that is if your orders are placed by the sales and marketing module at a high batch sizes, obviously the setup cost will be minimized.

But on the other hand, there is a possibility that the holding cost will go up. Therefore, we have to strike a balance between the holding cost as well as the set of cost which gives you the optimal cost for inventory management.

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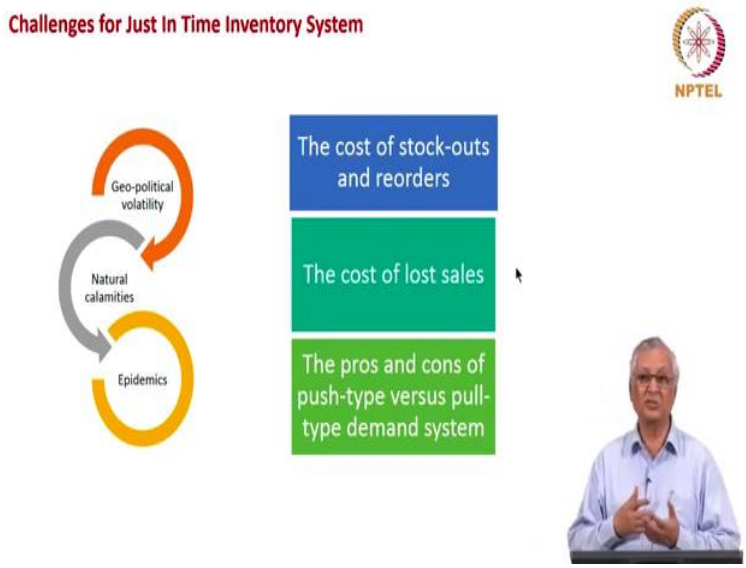

What were the challenges for the just in time inventory system? We are experiencing causes today, the entire Indian pharmaceutical industry is worried, how Corona virus that has broken out in China would affect the supply of intermediates, the API's for the pharmaceutical industry, we so far we thought that the Indian automobile industry is manufacturing all of its components in India.

But now it emerges that there are several components that are being imported from China. So, the vulnerability of the operation in one country to the flexibility as well as the disruption of the production of components in another country that affects the just in time inventory system. Therefore, we need to take into account the cost of stock outs and reorders the cost of lost sales.

And finally, the pros and cons of push type versus pull type demand system depending upon the firm, depending upon the industry context that we have.