Leadership for India Inc: Practical Concepts and Constructs
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Week - 08
Functional Leadership Models
Lecture - 37
Operations Leadership

Hi Friends, welcome to the NPTEL course Leadership for India Inc: Practical Concepts and Constructs. We are in week 8, discussing Functional Leadership Models. In this lecture, we will focus on Operations Leadership

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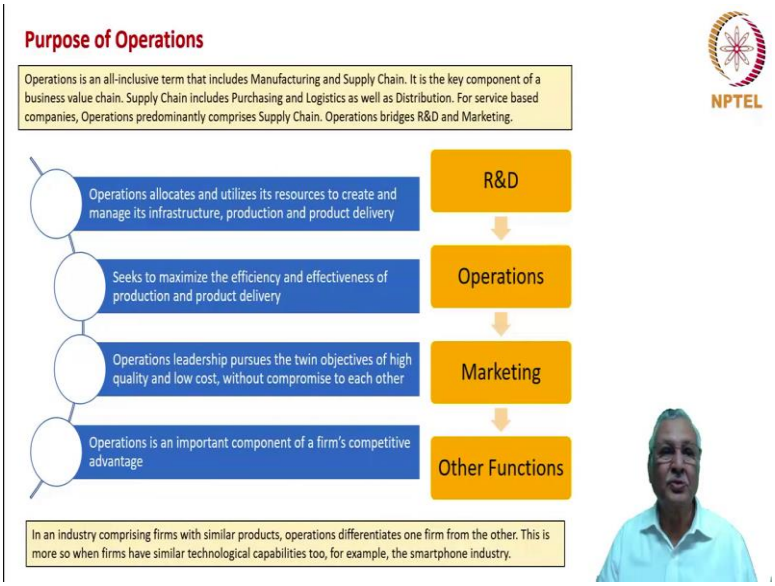

Operations is an all inclusive term that includes manufacturing and supply chain. It is the key component of a business value chain. Supply chain itself includes purchasing and logistics as well as distribution. For service based companies, operations predominantly comprise supply chain. Operations is the bridge between R&D and manufacturing.

Operations allocates and utilizes its resources to create and manage its infrastructure, production and product delivery. It seeks to maximize the efficiency and effectiveness of production and product delivery. In fact, it optimizes resource conversion in a company.

Operations leadership pursues the twin objectives of high quality and low cost without compromise to each other.

This is the winning combination for any firm having high quality and low cost. Operations is an important component of a firm's competitive advantage. In an industry comprising firms with similar products and similar technological capabilities, operations differentiates one firm from the other.

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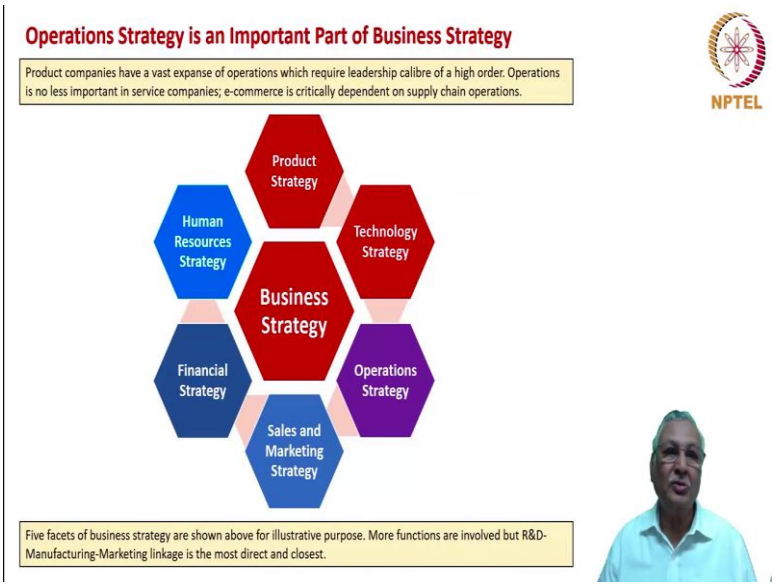

Operations strategy is an important part of business strategy. Product strategy and technology strategy are together represented by R&D strategy. We are considering in this lecture operation strategy. The other three important strategic dimensions of business strategy are sales and marketing strategy, financial strategy and human resource strategy which we will consider in the forthcoming three lectures.

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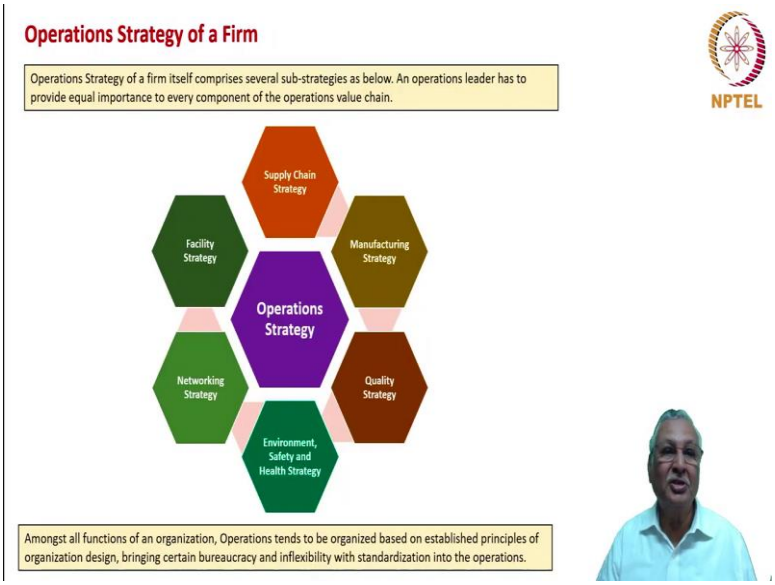

Operation strategy of a firm itself has many strategic components; supply chain strategy, manufacturing strategy, quality strategy, environment safety and health strategy networking strategy and facility strategy are all important components of the operations value chain.

Amongst various functions of an organization, operations is the one which is most organized and most systematic. It is established on the principles of scientific organization design by and large. Along with such standardization, operations brings certain bureaucracy and inflexibility into its own way of functioning.

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Let us see how the operations leader could contribute to business growth. There are four aspects of that contribution. One, operations must enable accomplishment of business goals and in that process the operations leader has to be business driven. Secondly, operations must enable fulfillment of customer needs and from that perspective an operations leader must be customer centric. He is not producing products to specifications. His role is to satisfy the customer with his products.

The third role is that of focusing on leading edge competencies that is the operations arena must provide the highest levels of productivity, quality, efficiency, effectiveness resource, conservation, resource conversion and so on. Therefore, there is a need for competency focused leadership for operations leader.

And finally, operations must build a unique competitive advantage for the firm. It could be the sole differentiator for the company when other attributes are common across the different firms in an industry. How does one build competitive advantage for the firm through operations?

Let us say a company has many SKUs to produce, but still has the ability to produce the variety at a low cost then that would be the competitive advantage. By having that competency that operations group is able to provide versatility to the marketing team, but also providing the low cost advantage to the finance team that way the operations group builds a competitive advantage for the business and for the company.

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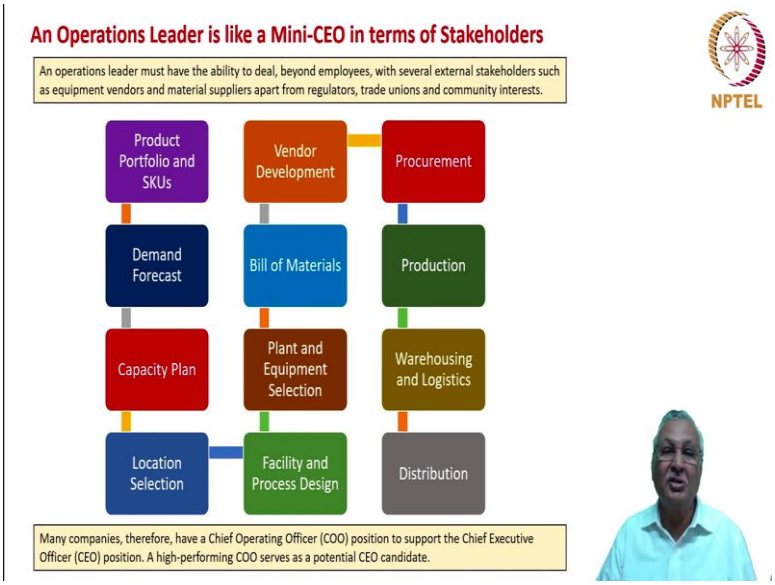

An operations leader is like a mini CEO in terms of the stakeholders. The operations leader must have the ability to deal beyond employees several external stakeholders such as equipment vendors, material suppliers, regulators, trade unions and community interests. And, why does such external stakeholders become important?

Because the whole operations activity or the value chain begins with the product portfolio and SKUs portfolio that is provided to the operations and based on the demand forecast there is a capacity plan which an operations leader needs to draw up. There is also a location selection when the project is a green field project.

Simultaneously, you need to look at facility and process design, that includes plant and equipment selection. The bill of materials is completely drawn up and vendors are selected to provide various components and materials. Then the actual process of procurement of materials brings then production happens.

After the product is manufactured, it goes into warehousing and thereafter the logistics takeover for distribution to the dealer points or directly to the customers. Given this vast expense of activities under the operations domain many companies typically have a position of chief operating officer to be able to manage this wide spectrum and a COO is typically seen as the successor to the CEO.

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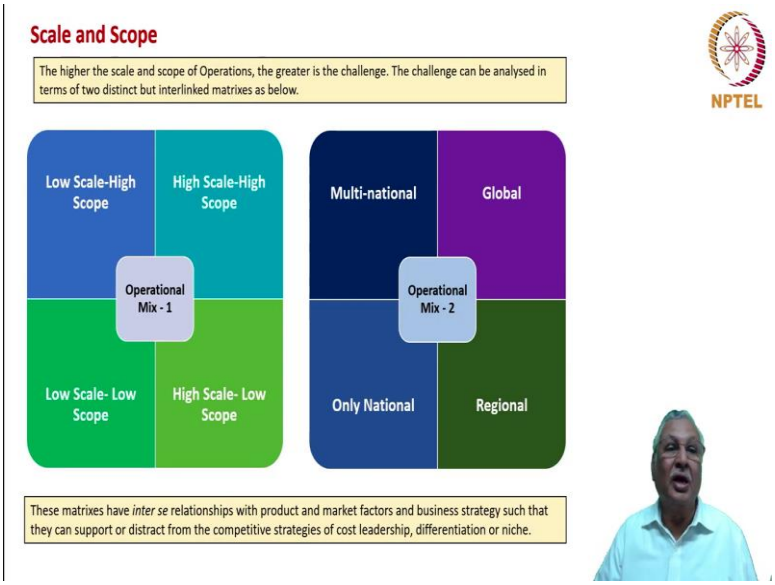

The higher the scale and scope of operations the greater is the challenge. The challenge can be analyzed in terms of two distinct, but interlinked matrices as below. One is the operational mix matrix. You can have low scale and low scope or you can have high scale and low scope. When we say low scope the product breadth is narrow and when we say high scale it is probably higher than the industry average kind of scale.

Similarly, you can have low scale and high scope that is everything is produced in small quantities, but the product variety is huge. And the best operations setup is one which can handle high scale and high scope, that is the operational mix. You can also have another operational mix based on the site positioning, that is the manufacturing sites that exists, the supply chain sites that exist and the distribution sites that exists. So, this is the second operational mix.

It could be only national, it could be regional, it could be multinational and finally, it could be completely global. These matrixes have inter se relationships with product and market factors and also with the business strategy so that all of these can support each other.

But, if they are not organized in a harmonious manner they can also distract each other from the competitive strategies and the competitive strategies as we know are cost leadership, differentiation or niche and each of it has a particular role for operations. If

the competitive strategy of a firm is cost leadership, the operations group has to produce the products at the lowest possible cost with the highest possible quality.

If the competitive strategy of the company is differentiation, it has got little more latitude in building premium features and even if it takes little less productivity, but higher level of premium building that could be acceptable for that situation.

On the other hand, if you are looking at niche which is a combination of cost leadership and differentiation, it is a balance between scale and scope, quality and cost and the throughput levels as well as the delivery levels. Operations has therefore, a strategic perspective in managing its operations.

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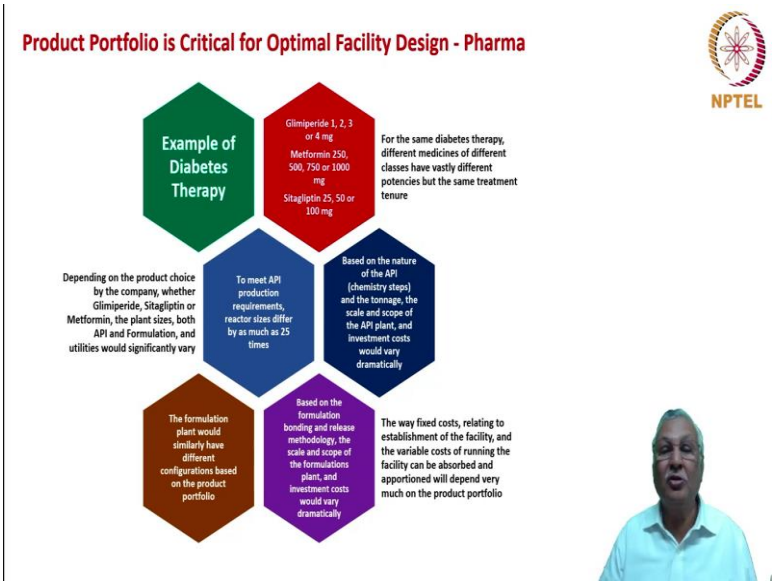

Product portfolio is critical for optimal facility design. Let us take an example from pharmaceutical industry. Let us take the example of diabetes therapy. We will take the example of insulin stimulator glimiperide, it is available in 1, 2, 3, or 4 mg form.

We also have another insulin resistance modulator called metformin, which is available in 250, 750 or 1000 milligrams. There is also a new pathway DPP for inhibition; sitagliptin is a product in that class 25 mg, 50 mg or 100 mg. As you can see from this, for the same diabetes therapy different medicines of different classes have vastly different potencies, but the same treatment tenure.

Mostly all of these things have to be taken twice a day, whether it is metformin 750 milligrams or sitagliptin 50 milligram they have to be taken both times morning and evening. And that means that, this is a lifelong therapy which means also that the facility must be designed for a range of products.

But also for the highest possible tonnage assuming that the demand is much more for metformin which is of 1000 milligrams in the highest dosage strength, then the facility should be capable of producing metformin tablets of the highest milligram strength, which again means that if that capacity has be switched to glimiperide which is of just 1 mg, 2 mg or 3 mg nature then there will be so much excessive capacity in the plant and how do we manage this?

So, the ability of the plan to manage a product mix and the different throughput levels is also an important consideration in operations planning. Then if you look at the corresponding API requirements or there is the bulk rate production requirements, reactor sizes differ by as much as 25 times.

If it is glimiperide, it will require very small reactors and if it is metformin you require huge reactants and the tonnages could be in thousands of tonnes for metformin and it could be just a few hundred tonnes in respect of glimiperide or sitagliptin. So, depending upon the product choice by the company whether glimiperide, sitagliptin or metformin the plant sizes both for API and formulations and the utilities would differ significantly.

Again based on the nature of the API that is the number of steps involved in the chemistry of the product and the tonnage, the scale and scope of the API plant and the investment costs would vary dramatically. The formulation plant would similarly have different configurations based on the portfolio because some of these products could be also sustain release some of these could be combination products as well.

Therefore, the capacity planning, the processes that are deployed whether it is wet granulation or dry granulation, whether it is sustained release or extended release or immediate release they also have their throughput considerations. Based on the formulation bonding and release methodology the scale and scope of the formulation plant and investment costs would also vary dramatically.

And finally, the way fixed cost relating to the establishment of the facility and the variable cost of running the facility can be absorbed and apportioned only based on the volume that is put into the market place. And what formulation does in respect of such diffusion into the market place, the API also has got mirror effect. This is the crucial drive that happens through product portfolio for operational planning.

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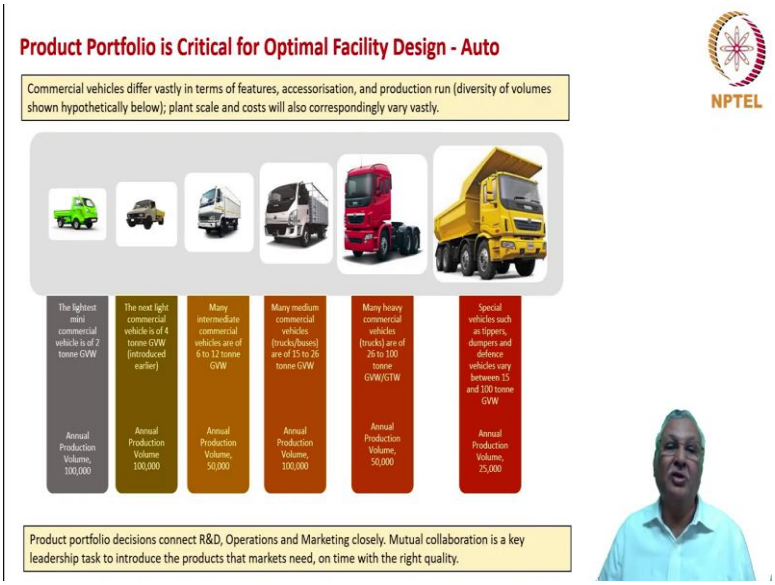

Let us look at another example automobiles. Commercial vehicles differ vastly in terms of features, accessorisation and production run that is diversity of volumes shown hypothetically below. Plant scale and costs also will correspondingly vary significantly.

Let us take a small commercial vehicle which is a mini commercial vehicle which has maximum gross vehicle weight GVW of 2 tonnes. Then comes the light commercial vehicle which is of 4 tonnes GVW. Then come intermediate commercial vehicles which are of 6 to 12 tonne GVW range. Then many medium commercial vehicles are available trucks as well as buses which are in the 15 to 26 tonne GVW.

Then we get super heavy trucks which are heavy commercial vehicles which 26 tonne GVW to 100 tonne GTW. And finally, you have special purpose vehicles such as tippers, dumpers, defence vehicles and their capability could vary from 15 to 100 tonnes. As you can see, some could come with cab, some could come with cabin body, some will come with only cowl, some will come with the tipper bodies and so on and the annual production volume also could vary substantially.

The smallest vehicle would have the highest volume maybe 100,000; same in the case of light commercial vehicle. Together small and light commercial vehicles would be 200,000 almost the same as the all other models. Given this diversity in volumes and the diversity in product range the facilities have to have the capability to produce different types of engines.

4 cylinder engines, 6 cylinder engines, 6 cylinder turbo charged inter cooler engines and also have the matching gearbox configurations and also the ability to make different kinds of body structures. Therefore, product portfolio decisions connect R&D, operations and marketing closely. Mutual collaboration is a key leadership task to introduce the products that markets need on time and with right quality as well as with the right cost.

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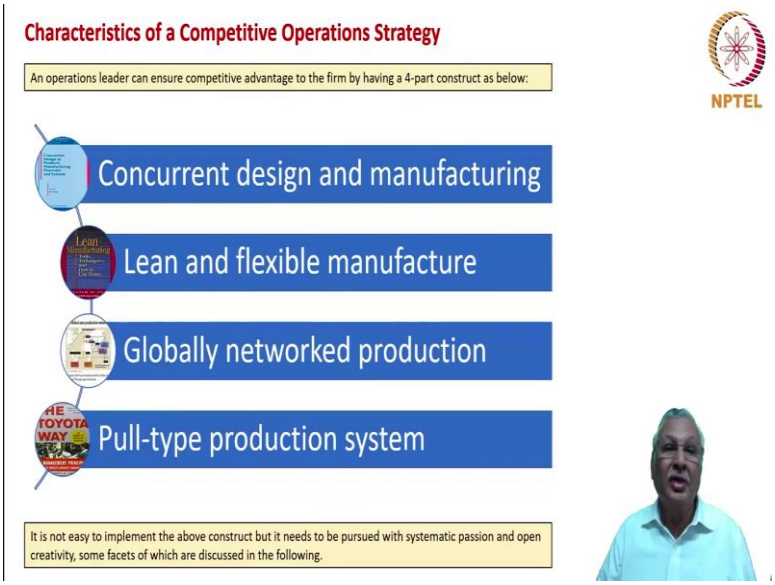

So, the characteristics of a competitive operation strategy could be seen in terms of a 4-part construct and I would say that there are 4 critical parts of this construct which by themselves are a challenge because they involve the best of management principles that can be put through the manufacturing value chain and also on the shop floor.

These 4 principles are concurrent design and manufacturing, lean and flexible manufacturing, globally network production and pull type production system. And you will see that I have put some books relating to these topics in the circles which you have here and worthwhile to read those books at some point of time.

It is not easy to implement the above construct, but it needs to be pursued with systematic passion and systemic procedures of achieving these 4 components and it also requires open creativity. Let us discuss why it is such a challenge to have these 4-part construct operating in the operations area.

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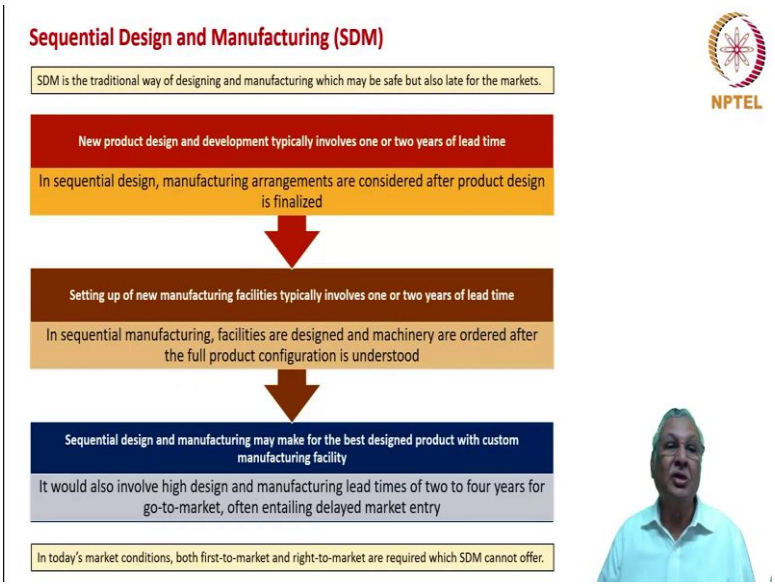

Generally, we have sequential design and manufacturing in a traditional design and manufacturing system. New product design and development typically involves one or two years of lead time. In sequential design, manufacturing arrangements are considered only after product design is finalized. Setting up of new manufacturing facilities again typically involves one or two years of lead time.

In sequential manufacturing, facilities are designed and machinery are ordered after the full product configuration is understood and signed off. Sequential design and manufacturing may make for the best design product with the least instability in the manufacturing system. However, it would also involve high design and manufacturing lead times of two to four years and therefore, longer go to market lead time, it entails delayed market entry.

In today's market conditions both first to market and right to market are equally important. We need to have speed with quality, speed with timeliness for us to succeed in the market place.

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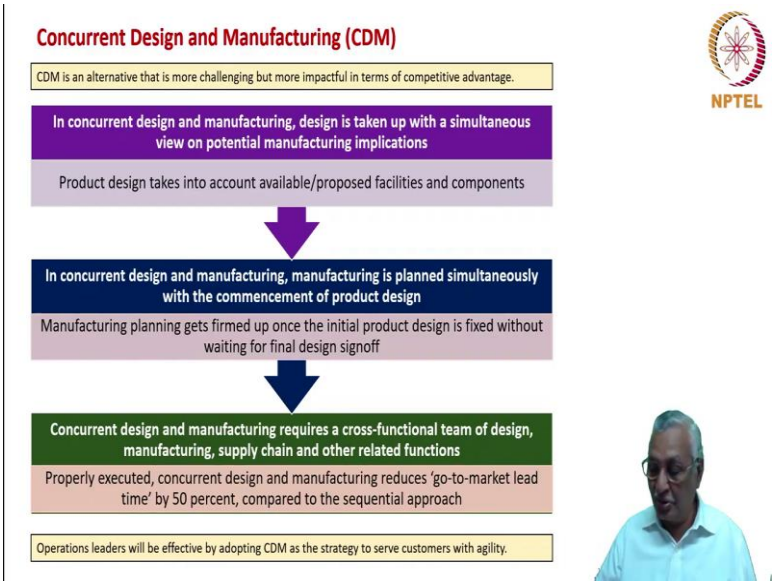

As opposed to sequential design and manufacture, we therefore, need concurrent design and manufacturing which is the first part of the construct. CDM is an alternative that is more challenging, but more impactful in terms of competitive advantage for the firm. In concurrent design and manufacturing, design is taken up with a simultaneous focus on the potential manufacturing implications.

Product design takes into account available proposed facilities and component. Similarly, any proposal for manufacturing will take into account the developments that are taking place in the product development arena. In concurrent design and manufacturing, manufacturing is planned simultaneously with the commencement of product design.

Manufacturing planning gets firmed up by the time the initial product design is signed off without waiting for the final designs sign off that is the crucial difference between sequential design and manufacturing and concurrent design and manufacturing.

The other crucial difference is that in concurrent design and manufacturing you have a cross functional team of experts from design, manufacturing, supply chain, quality and various other related functions working together on a project right from the time the product concept is visualized.

Properly executed, concurrent design and manufacturing reduces go to market lead time by at least 50 percent compared to the sequential approach.

Operations leaders will certainly be effective by adapting CDM that is concurrent design and manufacturing as the strategy to serve the customers with agility and therefore, build value for the company compared to other competitors.

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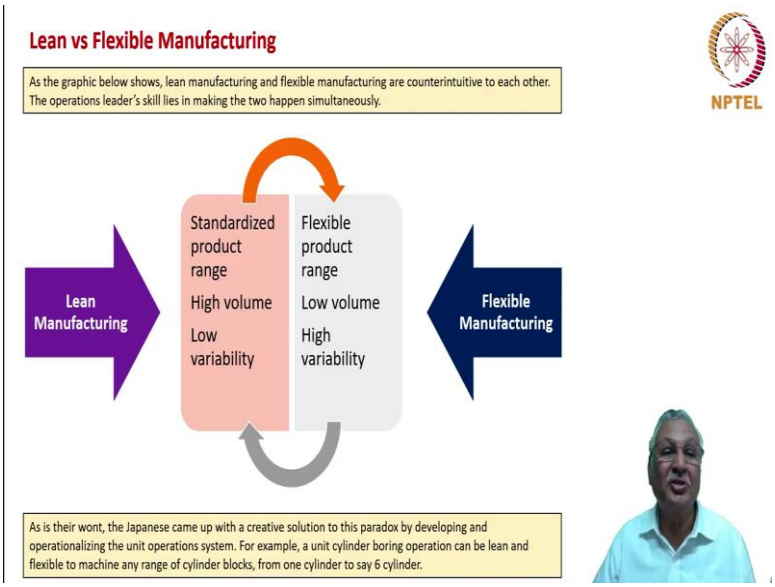

The other part of the construct is lean versus flexible manufacturing. As the graphic below shows, lean manufacturing and flexible manufacturing are counter intuitive to each other. The operations leader skill lies in making these two happen simultaneously. In lean manufacturing, you have a standardized product range, you require high volumes of that standard product range and there is low variability.

Whereas, in flexible manufacturing you have a very wide variety of products, each product would be required in low volumes and there will be also high variability. So, the way the manufacturing facilities are designed, the way manufacturing scheduling is done and the way the materials procurement gets done there is a huge difference between lean manufacturing and flexible manufacturing.

As is their wont, the Japanese came up with a very creative solution to this paradox by developing and operationalizing the unit operations system. For example, you have a cylinder block that needs to be machined and cylinder blocks are typically of 4 cylinder or 6 cylinder type and they could be inline or v shaped cylinder blocks. In certain cases, where heaviest engines are required there could be even be 8 cylinder or 12 cylinder configurations.

What the Japanese system proposes is that the machining of these cylinder blocks must be on a unit concept which makes it creatively simple for having any configuration of 4 and 6, or 6 and 8, or 4 and 8 in the manufacturing system because the machining center has to do the machining of only one bore.

It does not matter to the machining center whether you have a 4 cylinder engine running or 6 cylinder engine running, that is the beauty of unit operations and Japanese have kind of improvised, innovated on this concept. Not only that they have combined it with a system by which if one operation is taking place in unitized manner in one machine couple of other operations are also taking place in a similar manner in another machines.

And one man is able to go across the various machines and standardize the whole system throughput with reference to that particular complex component that is lean versus flexible manufacturing and a way out of the dichotomy.

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For the manufacturing system and for the operations leader it is not a question whether it is lean or flexible, it has to be both lean and flexible and that requires significant challenge to be met. We need to have minimal equipment lines to meet the lean manufacturing requirements along with standardized production while flexible manufacturing requires certain redundancy in equipment to meet production variability.

Combining both obviously, provides great competitive advantage to firms. As I said, you need to have unit operations common for multiple products. You should have multiproduct flexible assembly, pragmatic maker by decisions, co manufacturing being under internal control. By adopting these 4 principles based on proven Japanese practices operations leaders can practice manufacture that is both lean and flexible simultaneously.

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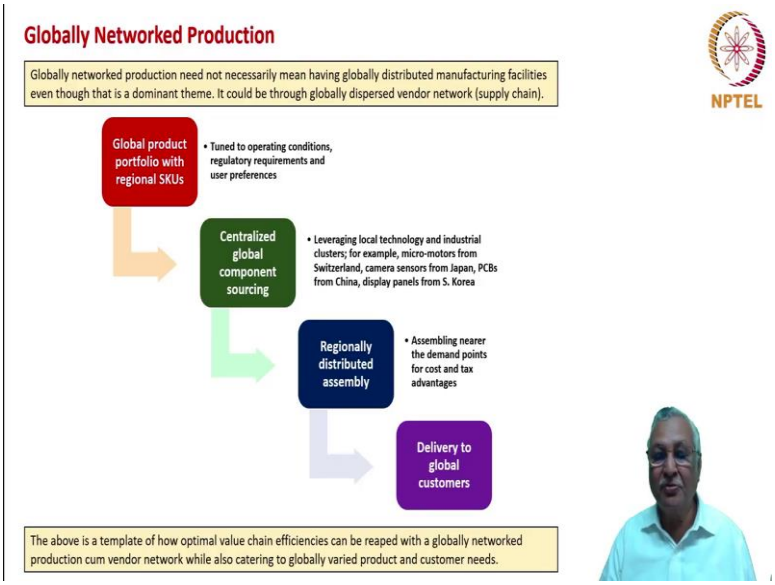

The third aspect is the globally network production. Globally network production does not necessarily mean having globally distributed manufacturing facilities even though that is a dominant theme. It could be through globally dispersed vendor network as well that is the supply chain.

So, typically it starts with a global product portfolio with regional SKUs, SKUs which are optimized for the local conditions that is in respect of India, higher ground clearance, different power and tork themes for the engines and matching transmission, whereas, for the European system or the American system high speed engines and low ground clearance and so on.

So, the global product portfolio with regional SKUs is tuned to the operating conditions, regulatory requirements and user preferences across different regions. Centralized global component sourcing thereafter comes up. It leverages local technology and industry clusters. For example, Micromotors from Switzerland, camera sensors from Japan, PCBs from China, display panels from South Korea in respect of a smart phone.

And then you have regionally distributed assembly. You can assemble nearer the demand points for constant tax advantages and finally, accomplish delivery to global customers in a way the products are customized to the local needs, optimized for the local cost structure and delivered with the least time possible.

The above is the template of how optimal value chain efficiencies can be reaped with a globally network production com vendor network while also catering to globally varied product and customer needs.

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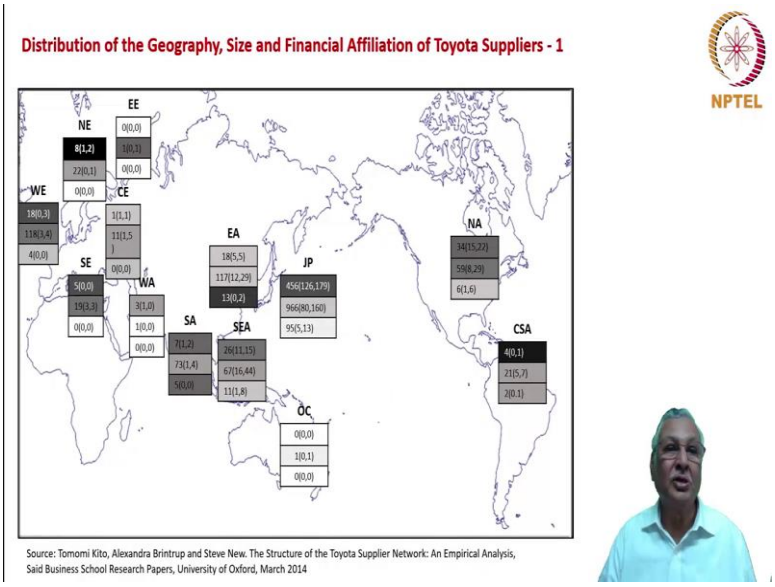

You can see the distribution of geography, size and financial affiliation of Toyota suppliers. This is the world map and you can see in different regions how the Toyota supply sources and manufacturing sources are located. The legend follows in the next video.

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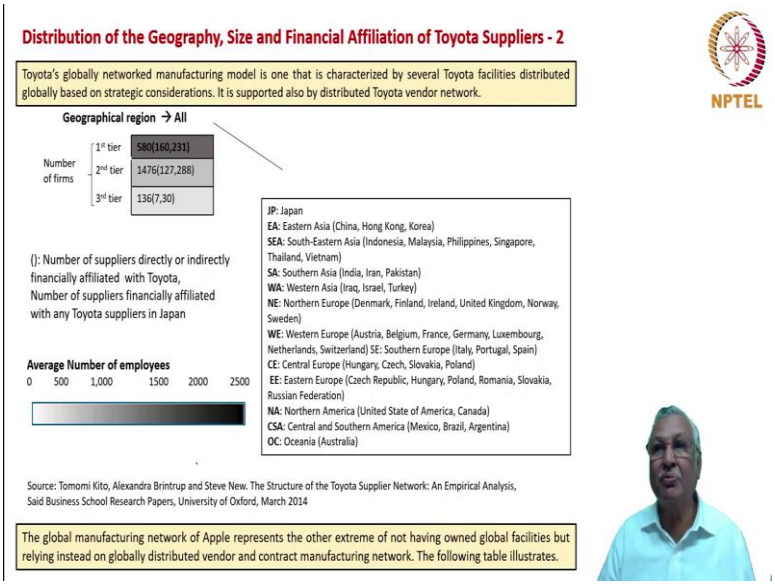

So, the number of firms of the first tier supplies are 580, in the second tier supply layer you have 1476 and in the third tier you have 136 companies and the average number of employees moves from 0 to 2500; obviously, 0 is the non exist number. It moves from 500 to 2500.

Similarly, the global manufacturing network of Apple represents the other extreme of not having any global owned facility, but relying instead on globally distributed vendor and contract manufacturing network.

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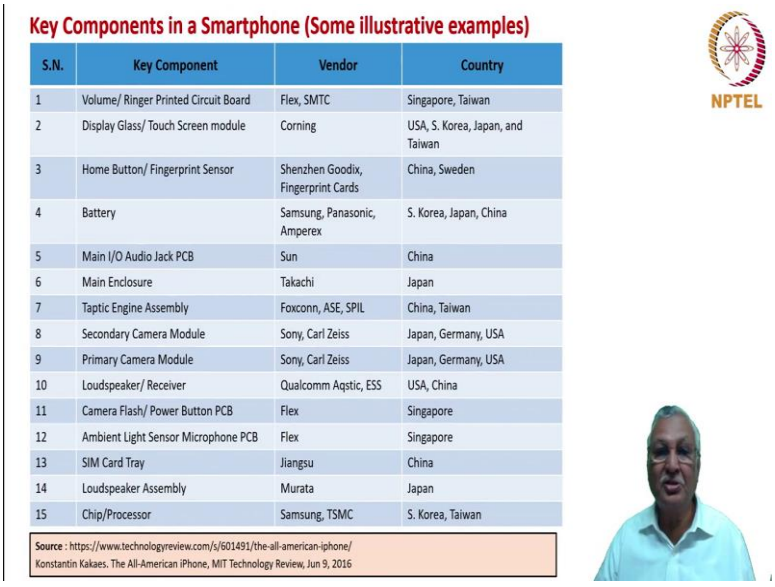

The following table illustrates. Again smart phone made by Apple would typically have volume ringer printed circuit board from Singapore Taiwan. Display glass corning USA, South Korea, Japan and Taiwan. The same product could come from any of the global factories which the company has.

The fingerprint sensors come from China and Sweden, batteries come from Samsung, Panasonic, Amperex all from South Korea Japan or China. Again you can see here Samsung and Apple are huge competitors yet they have their own collaboration in terms of certain components.

And we can go through the list completely and in some cases there could be a single source supply where the competence of the vendor is beyond question, like in the case of loudspeaker assembly, Murata of Japan is a market leader. And there are certain low cost items where China production could offer the lowest cost possible, SIM card tray for example, that is sourced solely from China.

So, this is the other type of globally network production wherein the company only does the research and development of the product, but gets the products manufactured in various locations, but with very strict control over the supply chain and assembly process all across the world.

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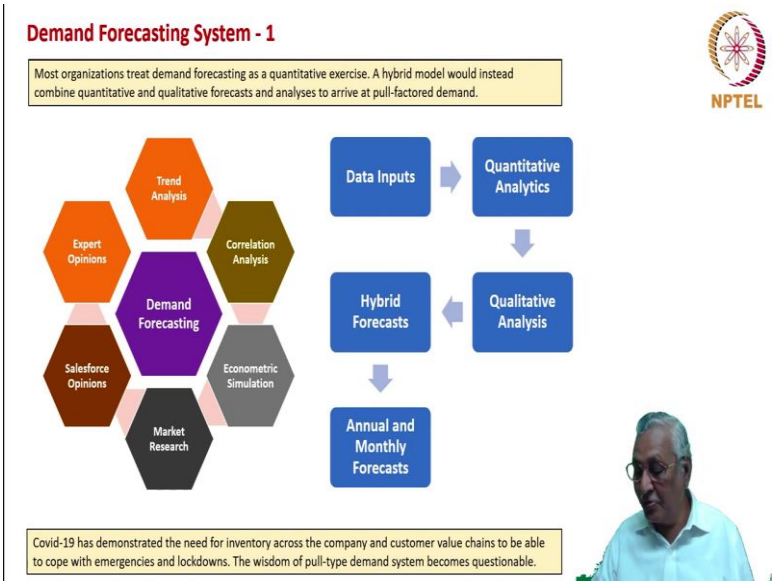

Given this complexity of managing a globally distributed and network system you need to have a strong demand forecasting system. Most organizations treat demand forecasting as a quantitative exercise. A hybrid model would instead combine quantitative and qualitative forecast and analysis to arrive at a pull factored demand. So, the components of demand forecasting or trend analysis, correlation analysis, econometric simulation, market research, sales force opinions and expert opinions.

So, data inputs lead to quantitative analytics and this is superimposed with qualitative analysis and you develop hybrid forecast and finally, release annual and monthly forecast for the operations. Operations team cannot think that it is just a number which is coming to the department of operations or department of production schedule.

Operations must understand the overall forecasting system that is adapted by the company and therefore, the operations leader at his strategic level will have an understanding of how the business would vary from time to time and how the operation cycle also would need to keep pace from time to time.

Covid-19 was an emergency which no operations leader forecasted and it has come in the last month of March as far as the lock down is concerned in India and most of the production is done in the March month and distributed towards the last week of March. There is no wonder therefore, that there has been a huge downturn in the production in the Q1 of the new financial year that is 2021.

But, COVID-19 also has demonstrated the need for inventory filling all through the pipeline from the incoming materials to shop floor safety stocks and in process inventory to inventory in the warehouses and in finally, at the dealer points, same applies to the fast moving consumer goods system.

If the retail sales do not have any stock, if the distribution warehouses do not have any stocks, the ability of the system to cope with sudden emergencies and pandemics or natural disasters would be severely tested. In COVID-19 times and in the lock down times, India could keep the essential goods and essential products supplies moving because of the inventory management that was inherent in the operations planning of Indian firms.

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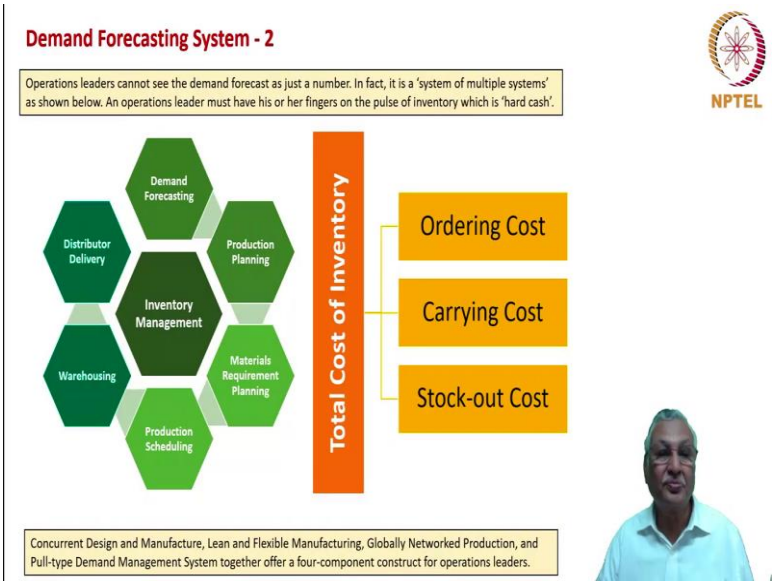

Another demand forecasting system variant is that it should not be just seen as a number, it should be seen as a system of multiple systems as shown below. You have an inventory management system at the core which looks at demand forecasting, then production planning, then materials requirement planning, production scheduling, warehousing and distributed delivery. This optimizes inventory across various subsystems that drive operations.

As a result of this, the total cost of inventory in terms of ordering cost, carrying cost, stock out cost is optimized. This is the requirement of a true and helpful demand forecasting system. That is projecting the demand both from the quantitative and qualitative aspects in a manner that the business imperatives and business considerations are understood and the other managed inventory in such a manner that there is never a stock out, but also the ordering cost and carrying costs are optimized.

Concurrent design and manufacture, lean and flexible manufacturing, global network production and pull type demand management system together offer a four component construct for operations leader and that construct we have just considered through the four components being explained.

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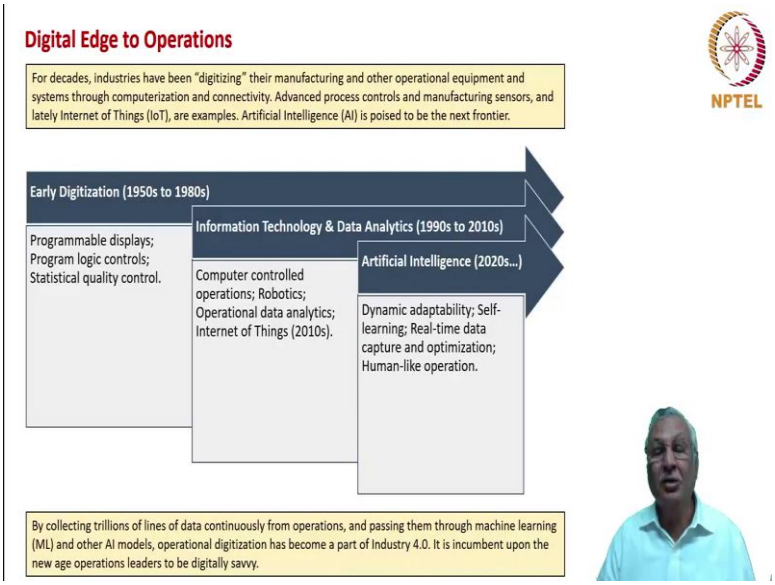

Covering all that you have this digital edge to operations: For decades, industries have been digitizing their manufacturing and other operational equipment and systems and that was essentially through computerization and connectivity. Advanced process controls and manufacturing sensors and lately internet of things are examples of the higher order of digitization. In future artificial intelligence is poised to be the next frontier.

Between 1950s and 1980s, operations leaders looked at programmable displays, program logic controls that is PLCs and SQC; statistical quality control. Between 1990s and 2010s computer controlled operations, robotics, operational data analytics, internet of things began surfacing and getting integrated into the manufacturing operations. Many embedded digitalized technologies got accompaniments in the machine tool technologies.

Artificial intelligence began appearing in 2020s onwards. Dynamic adaptability, self learning, real time data capture and optimization, human like operation all of these things are part of artificial intelligence now. By collecting trillions of lines of data continuously from operations and passing them through machine learning and other AI models operational digitization has become a part of industry 4.0.

It is incumbent upon the new age operations leaders to be digitally savvy. This is the all compassing challenge which the operations leaders have.

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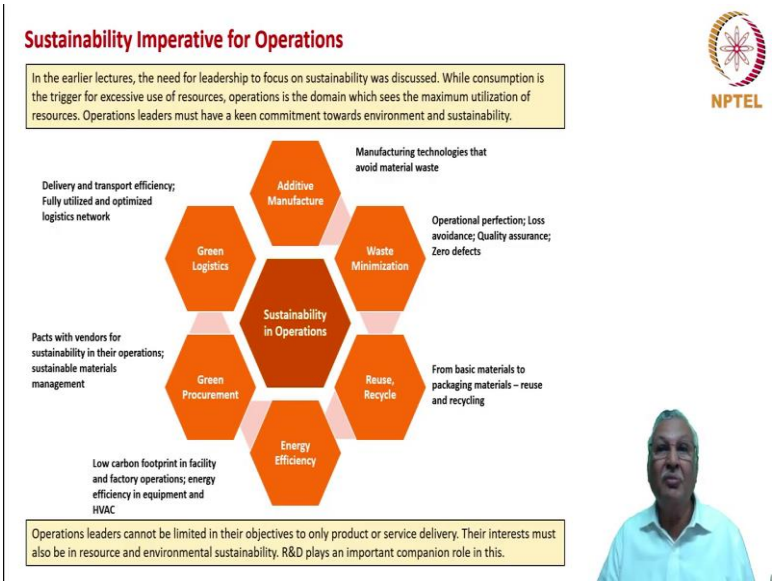

Operations leaders have also another imperative, the need for leadership to focus on sustainability. While consumption is the main driver for demand growth and therefore, company growth we have also recognized that it is resulting in an excessive use of resources.

Operations is the domain which sees maximum utilization of resources. Therefore, operations leaders must have a keen commitment towards environment and sustainability, how can that be achieved? Fundamentally, through additive manufacture, that is manufacturing technologies that avoid material waste, cutting, forming, removing of flash materials, pouring more metal than necessary these are all the things which can be improved upon in the existing process.

But, going straight away into additive manufacture where powder material is bonded together to manufacture the component exactly the way it is required that is additive manufacturer and it almost has zero material waste. Then you go to waste minimization that is operational perfection; loss avoidance, quality assurance, zero defects.

Then you get into reuse recycle from basic materials to packaging materials reuse as much as possibility cycle as much as possible. We have considered in an earlier lecture, how Apple is reusing its packaging materials, how it is reusing its rare earths, how it has got end of the line robots to recover materials which are wasted in the line. Again energy

efficiency: low carbon foot print in facility and factory operations, energy efficiency in equipment and HVAC, green energy certifications, lead certifications and so on.

Pacts with the vendors for sustainability in their operations so that the procurement is also green procurement in the overall sustainable materials management and the logistics itself must be green. That is delivery and transport efficiency must be based hopefully on electric vehicles and optimized and fully utilized logistics networks.

When an operations leader looks at all these 6 aspects, he would be contributing to sustainability in operations. Therefore, operations leaders cannot be limited in their objectives only to shop floor efficiency or the production volumes or the cost levels or even the quality levels. They got to look at interests far beyond the shop floor which includes sustainability in operations. R&D place an important companion role in this.

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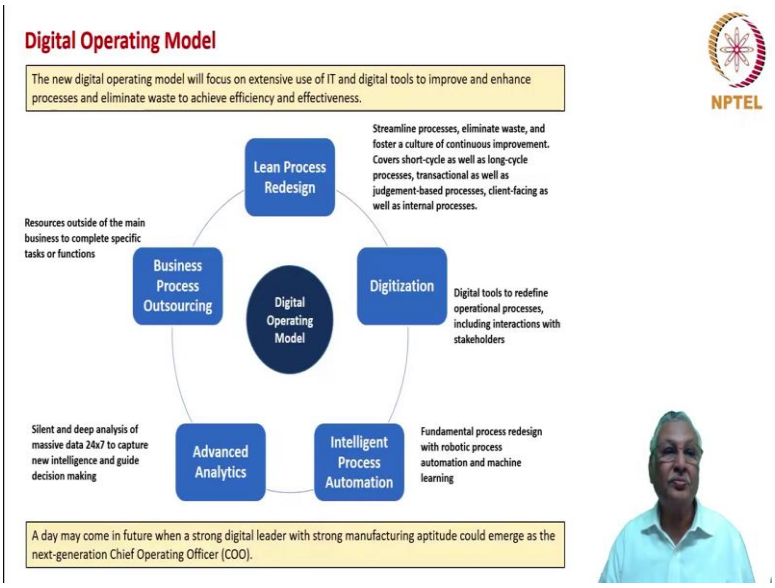

So, the digital operating model will be having an extensive use of IT and digital tools to improve and enhance process and eliminate waste to achieve efficiency and effectiveness. I propose a digital operating model where you have lean process design, you have digitization, you have intelligent process automation, you have advanced analytics and finally, business process outsourcing.

The details of these requirements are further elaborated and you can cover short cycle process as well as long cycle process, transaction as well as judgement based processes,

client faced processes as well as internal process through this lean process redesign. And digitization can redefine the entire spectrum of operational processes including interactions amongst the internal shareholders and interactions with the external shareholders.

Fundamental process redesign with robotic process automation and machine learning is also possible. We have seen again in another lecture how the number of robots have increased.

It is not merely the safety that is now being looked at, it is also being looked at from an efficiency and effectiveness point of view, where the human intervention is required human intervention will be used, but where the waste can be minimized where safety can be enhanced robots need to come in and these robots are going to be thinking robots as we go more and more deeper into the 2020s.

Similarly, advanced analytics; silent back room deep analysis of massive data on a 24 by 7 basis to capture new intelligence and guide decision making. And finally, business process outsourcing in terms of planning resources outside of the main business to complete specific tasks and functions. Day therefore, may come when a strong digital leader with technical capabilities and strong manufacturing aptitude could emerged as the next generation chief operating officer that also is possible.

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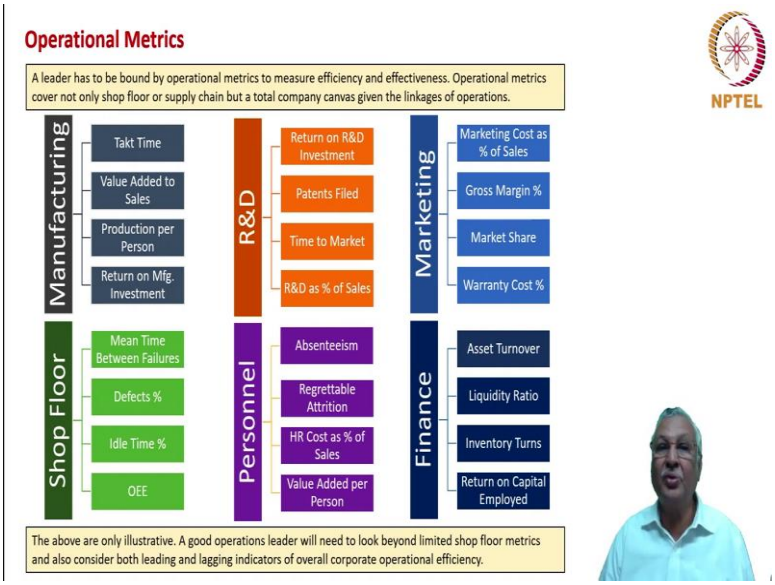

A leader has to be bound by operational metrics to measure efficiency and effectiveness. Operational metrics cover not only shop floor or supply chain, but a total company canvas given the linkages of operations. Amongst the various leaderships which we are going to discuss from a functional point of view, operations leader is the one who is measured the most in terms of matrix and his role and his canvas is also highly metricized.

Let us look at therefore, standardization of matrices across various operations because operations include R&D, operations include personnel, operations include marketing, finance. Therefore, finance operations, marketing operations, personnel operations, R&D operations, actual shop floor operations and manufacturing operations.

Let us look at all of these things as one whole gamut of operational excellence canvas for a company. So, if you look at manufacturing, you can look at things like takt time that is what is the time required from the time the first component comes for an assembly of car and the time taken to complete a car and value added to sales, production per person and return on manufacturing investment these are the manufacturing metrics on the shop floor.

Let us look at mean time between failures, defects percentage, idle time percentage, OEE. In respect of R&D, let us look at return on R&D investment, the patents filled, time to market, R&D as percentage of sales. As far as the personnel on the shop floor all elsewhere is concerned, let us look at absenteeism, regrettable attrition, HR cost as percentage of sales, value added per person.

Marketing; marketing cost as percentage of sales, gross margin percentage, market share, warranty cost and in respect of finance let us look at asset turnover, liquidity ratio, inventory turns, return on capital employed. These are only illustrative matrices. A good operations leader will need to look beyond limited of shop floor metrics and also consider both leading and lagging indicators of overall corporate operational efficiency.

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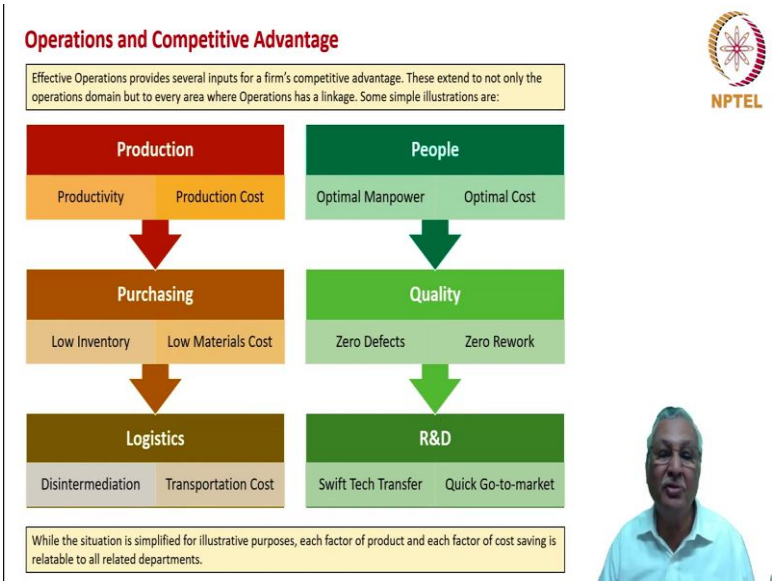

What is the relationship between operations and competitive advantage? Earlier I said that if everything else is the same. Operations is the one which will distinguish one firm from the other. Effective operations provide several inputs for a firm's competitive advantage; this extent to not only the operations domain, but every area where operations has a linkage.

Some simple illustrations are production. It has an impact in terms of productivity and production cost. Purchasing has an impact in terms of low inventory and low materials cost. Logistics has an impact in terms of disintermediation that is removing unnecessary layers in the channel between the company and the final customer and of course, along with that the lower transportation cost.

People have an impact in terms of the optimal manpower and optimal manpower cost. Quality zero defects and zero rework; you may get zero defects, but you could have considerable rework. So, you should aim at zero defects as well as zero rework. R&D in terms of swift tech transfers and quick go to market.

While the situation is simplified here for illustrative purposes, each factor of product and each factor of cost saving is relatable to all related departments. It is not that only HR is relevant in respect of people competitive advantage factors or that quality is the sole agency for controlling defects. No, every department is integrated in ensuring good operations matrices which will lead to competitive advantage.

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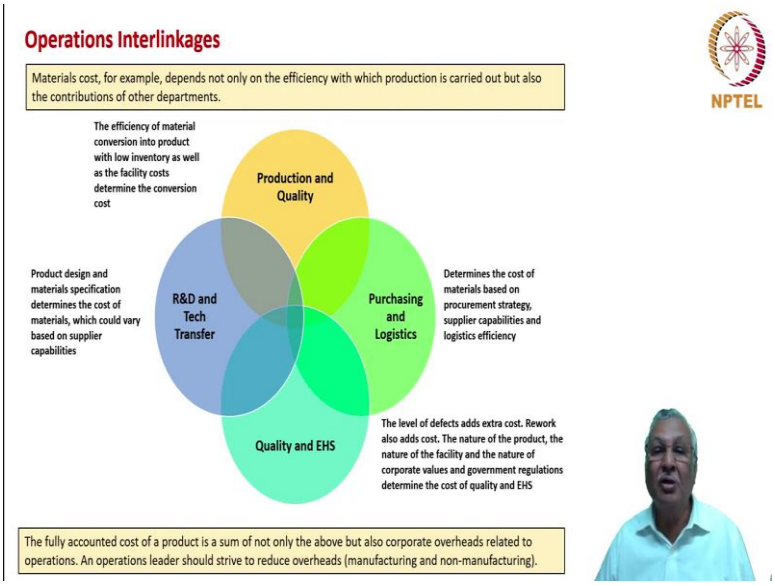

So, what are the operations interlinkages? Material costs for example depends not only on the efficiency with which production is carried out, but also the contributions of other department. The intersecting circle model, production quality is one cluster, purchasing and logistics is another cluster, quality and EHS third cluster, R&D and tech transfer other cluster.

R&D and tech transfer ensures product design and material specifications at the beginning of the whole product journey. It determines the cost of materials which could vary based on supplier capabilities, but inherently based on the design of the product itself; the safety factor that is built into it, the life factor that is built to it, the kind of materials that are chosen for making the product and so on.

The efficiency of material conversion into product with low inventory as well as the facility costs determine the conversion costs and that is handled by production and quality circle. Purchasing and logistics determines the cost of materials based on the procurement strategy, vendor capabilities and logistics efficiency and finally, the level of defects adds extra cost.

Quality has to ensure that there is no rework and there is no defect. The nature of the product, the nature of the facility and the nature of corporate values on government regulations determine the cost of quality and EHS.

If you have your manufacturing processes in such a manner that there are no effluents coming out of the system; obviously, the environmental sustainability is ensured. For the same type of bulk drug between two companies I have seen, the effluent outgo being at variance by tonnes and that is the quality of the chemistry that is being applied by the companies.

Many companies have too many steps, have too much of washing with solvents and as a result they develop such huge quantities of mother liquor which go waste. Even if they recover the recovery process themselves are very costly and over and above that there is the safety element involved when you have so many chemical reactions.

So, short number of steps, effective productivity in each of these steps and also a kind of in situ continuous seamless manufacture as opposed to transfer from reactor to reactor. These have made a significant change in how the bulk drugs are produced with the least material wastage and with the highest productivity and quality.

The same happens in respect of several other product groups. The fully accounted cost of a product is a sum of not only the above, but also corporate overheads related to operations. An operations leader should strive to reduce overheads manufacturing and non manufacturing.

The leaner the manufacturing structure with the concomitant ability to produce the product variety then the greater would be the overhead absorption in such a company. And operations should not be a loggerhead with the corporate nor it should corporate be a kind of superimposing system on the operations.

When the operations leader has got the capabilities as we discussed in terms of the four components, definitely you will have the strategic outlook to forecast, to plan, to schedule, to manufacture and finally, deliver as per the highest levels of efficiency and effectiveness.

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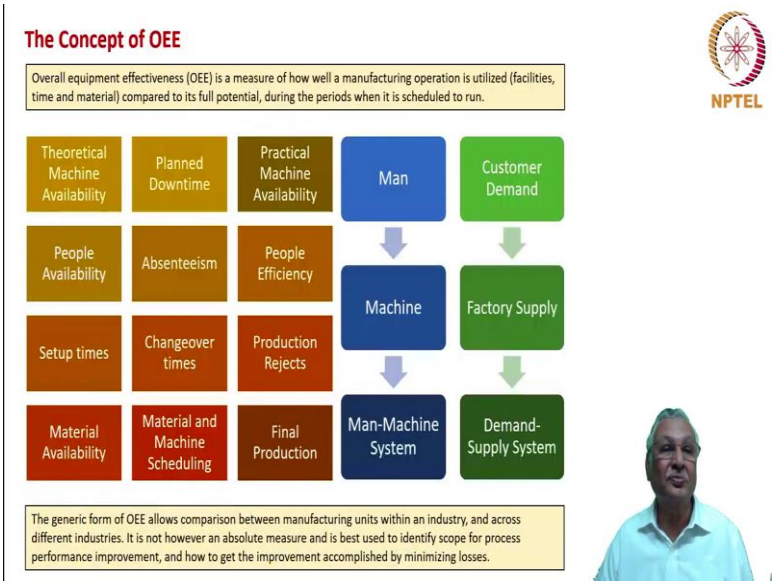

While on this topic of operations leadership we should focus on OEE. OEE is nothing but overall equipment effectiveness. This is the most common and popular as well as authentic measure to understand how well the manufacturing operation is utilized. It could be facilities, time and material compared to its full potential during the periods when it is scheduled to run.

So, the components of OEE are theoretical machine availability, then the planned down time, therefore, the practical machine availability, people availability, the planned absenteeism, people efficiency then the set up times, the changeover times and the production rejects, then the material availability, material and machine scheduling and final production.

From this that is from the time you start from the theoretical machine availability based to the final delivery point of final production, you also see that there are potential areas where the gaps exist reducing the OEE. By planning to eliminate all of these parameters and reducing those unproductive activities to the minimum the OEE can be improved.

So, optimization of man-machine system and optimization of customer demand and factory supply system is the core of manufacturing efficiency and operational excellence and for that the concept of OEE stands as a meaningful reckoner to understand the plant efficiency.

The generic form of OEE allows comparison between manufacturing units within an industry and across different industries. It is not however, an absolute measure and is best used to identify scope for process performance improvement and how to get improvement accomplished by minimizing losses.

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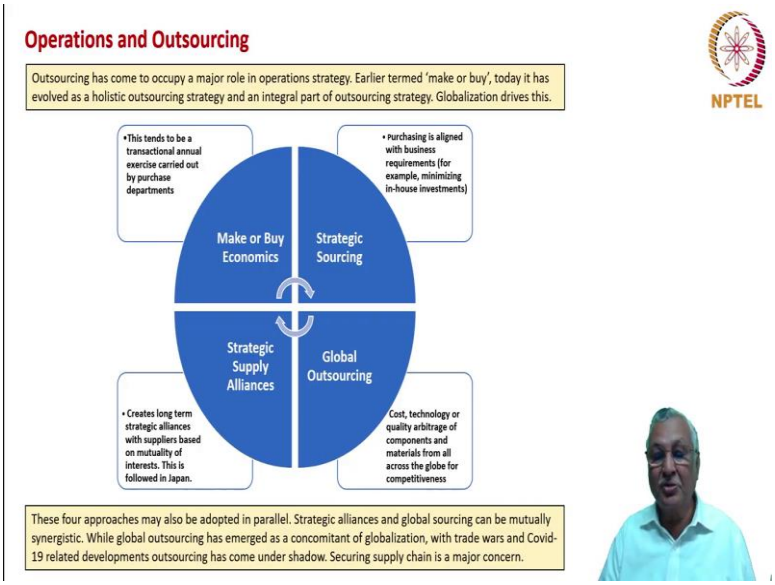

Then also operations and outsourcing. We have seen from the point of view of the 4- part construct how the globally networked production, the globally networked R&D and how the globally network distribution are the challenge for the modern operations leader. And this has happened because outsourcing has come to occupy a major role in operation strategy.

Earlier it was termed make or buy, but today it has assumed a more holistic outlook, it is part of a broader out sourcing strategy. Globalization drives this. There are four components. As before there are make or buy economics. It is a transactional annual excise carried out by purchase departments, but that does not meet our current purpose, we need to move into strategic sourcing.

Purchasing is then aligned with business requirements. For example, minimizing in house investments and strategic sourcing also could involve having at least two sources of supply. So, that you are not caught on the wrong foot if some emergency strikes one of the vendors.

Then you get into global outsourcing which is what we saw with Apple. Cost, technology or quality arbitrage of components and materials from all across the globe are evaluated and an appropriate choice is made for competitiveness. And finally, you have strategic supply alliances which creates long term strategic alliances with suppliers based on mutuality of interest, this is followed in Japan.

These four approaches may be adopted in parallel. There could be a few components where make or buy economics could be appropriate. You could go in for strategic sourcing in respect of certain other components. Global outsourcing could be the way to go in respect of certain items, but strategic supply alliances could be the most important factor when the technology and the supply assurance desired are of the highest order.

Strategic alliances and global sourcing can be mutually synergistic while global outsourcing has emerged as a concomitant of globalization with trade wars and Covid-19 related developments outsourcing also has come under shadow. Everyone wants to improve the national stability to have their own components their own materials produced within the nation, but there are limitations to that.

There is significant opportunity even in today's context to be a global supplier of components, end products and materials that move cannot be reversed. And the only way it could be strengthened is to have a wise globalization strategy along with a wise self aligned strategy and nations can actually collaborate rather than try to become withdrawn or introverted with reference to outsourcing.

And in that if supply chains have to be secured they should be secured but they should be secured based on strong supply chain alliances that is my recommendation. And making this happen, the operations leaders play great role if the end product manufacturers have got faith in the operational system.

If in the operational integrity and in the operational excellence of the nation which is supplying the components, definitely outsourcing off-shoring would continue to play a big role and India has a nation has still huge opportunity to participate in the global outsourcing and off-shoring in paradigm.

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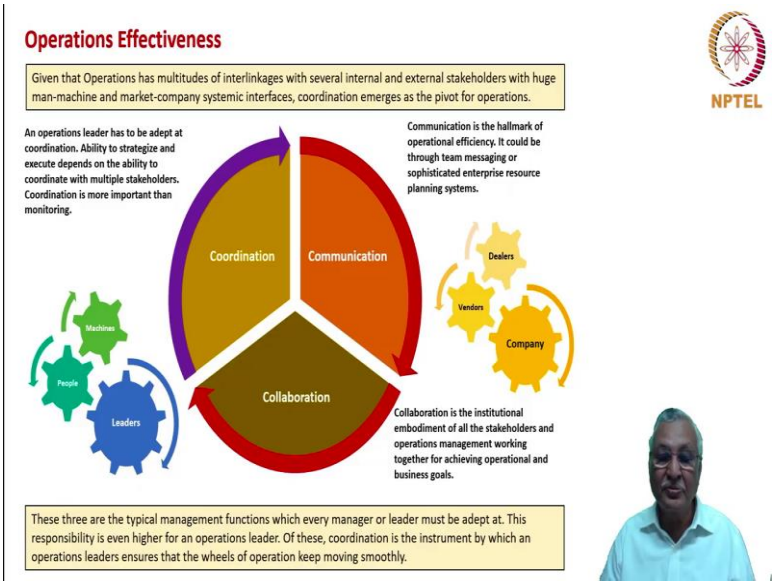

So, how do you judge the final level of operational effectiveness? Given that there are multitudes of linkages with several internal and external stakeholders all with huge man machine and market company's systemic interfaces, coordination emerges as the pivot for operations excellence.

Coordination, communication, collaboration these are the three pivots for the operations effectiveness of any system in the company which produces products or services. An operations leader has to be adept at coordination. Ability to strategies and execute depends on the ability to coordinate with multiple stakeholders. Coordination is more important than monitoring. Seeing the shortage lists, chasing suppliers that is not the way to go.

Coordination between multiple interest to make sure that everybody is aligned for timely delivery that is more important than monitoring. Communication is the hallmark of operational efficiency. It could be through team messaging or sophisticated enterprise resource planning systems. If you see any factory in Japan or Korea, the real time production and the real time quality situation is displayed very prominently in a highly visible manner across all the production lines.

Even way back in the 1970s when I was in Tata motors as we enter the main gate you can see that we have produced 27000 vehicles, we have 3000 more vehicles to go before

we hit the goal for this year, that is the level of communication that used to be there decades ago in Tata motors that is Telco at that point of time.

And today the whole communication messaging has become much more digitized and much more efficient and operations leaders must ensure transparency and rapid communication so that everybody could collaborate with each other and collaboration is the institutional embodiment of all the stakeholders and operations management working together for achieving operational and business goals.

The days when you increase your material requirement by 20 percent and the vendor says that I cannot supply that much I will supply 20 percent lower as a kind of negotiating strategy and also as a kind of idea to under promise over deliver in respect of the dealers or over pressure and be happy with lower delivery on the part of the OEMs these approaches or historically relevant approaches, but not contemporarily relevant approaches.

Today transparency, collaborative planning should be the way to go for operations leaders when they meet with other companies or when they interact with other companies. Leaders, people and machines have to work together; company vendors and dealers have to work together.

This is the mantra. And we also have seen operations; R&D, marketing, finance and various other departments have to work together. Operations effectiveness is judged by the way in which operations division works with all the internal and external stake holders.

These three are the typical management functions which every manager or leader must be adept at, be it operations or R&D. However, this responsibility is even higher for an operations leader because of the multiple stakeholders involved and the rigor of day to day production and you cannot afford to lose time. In respect of operations, time is lost is production lost and therefore, business loss for the company and again therefore, revenue and profit loss for the company.

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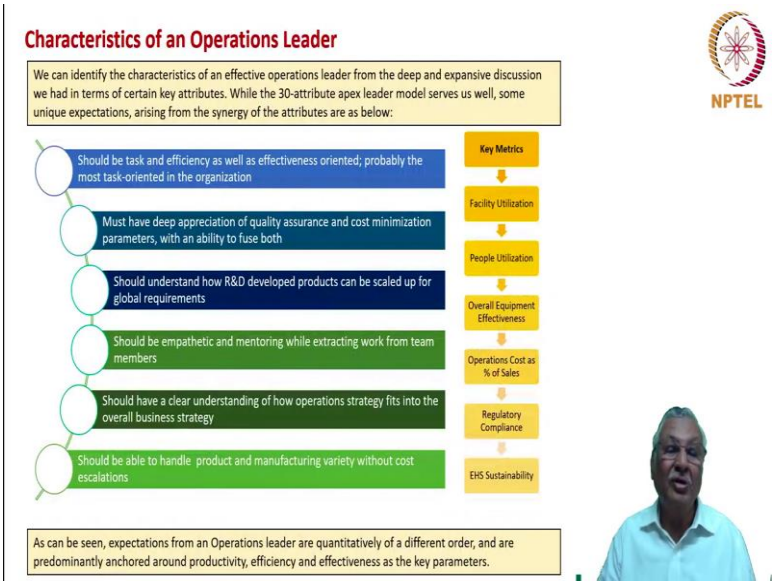

Having looked at this vast canvas, which an operations leader has to perform on it is evident that the 30 attributes which we discussed earlier as part of the top leaders' attributes are very much required. And these are as I said ten developmental attributes, ten performance attributes and ten apex leader attributes.

But these can be synergized to express some very critical characteristics of an operations leader. The operations leader should be task and efficiency oriented as well as effectiveness oriented. Probably, the operations leader must be the most task oriented leader in the organization.

Just as the R&D leader I said must be the most knowledgeable leader in the organization. The operations leader must be the most task oriented leader in the organization. He must have deep appreciation of quality assurance and cost minimization parameters with an ability to fuse both. There is a huge cost of bad quality. It could be in terms of reworks, lost production, recalls from the marketplaces, loss of brand, loss of reputation that is never fully assessed.

And if someone want to assess all that the cost of bad quality is enormous per contra the value of good quality is also enormous. Brand reputation, product reputation, corporate reputation will go to the zenith. The wastages will be 0 and the cost levels will be the least possible cost levels and there will be confidence within the system and outside the system on the operations integrity.

Therefore, a deep appreciation of quality assurance and cost minimization parameters with the ability to fuse both is essential for an operations leader. The operations leader also should understand how R&D developed products can be scaled up for global requirements. R&D products are always done at a small scale.

They are all simulated environments which enable sign off of certain products, but when they are put into the big manufacturing environment there are bounds to be some technology transfer issues. So, working with R&D and also having on the fly manufacturing innovations, R&D developed products can be technology transferred and operationalized for high throughput and that is the skill of an operations leader.

The operations leader deals with huge number of people on the shop floor as also in the marketplace or in the R&D labs across the company huge number of people are met by the operations leader and managed also. He should therefore, be empathetic and mentoring while extracting work from team members because again as I said production cannot be lost.

The operations leader should have a clear understanding of how operations strategy fits into the overall business strategy. Demand is not a number, demand is actually a phenomenon of creating a customer experience and that perspective the operations leader must have; the operations leader should be able to handle product and manufacturing variety without cost escalations.

So, some of the key metrics we have seen earlier from a macro perspective how well the facility is being utilized, how well the people are being utilized, what is the overall equipment effectiveness, what is the operations cost as percentage of sales, what is the regulatory compliance that is implicit in the way the operations are being run and what is the EHS sustainability.

These are some of the key strategic metrics that are relevant for the operations leader. As can be seen, the expectations from an operations leader are quantitatively of a highly different order and these are predominantly anchored around productivity, efficiency and effectiveness as the key parameters.

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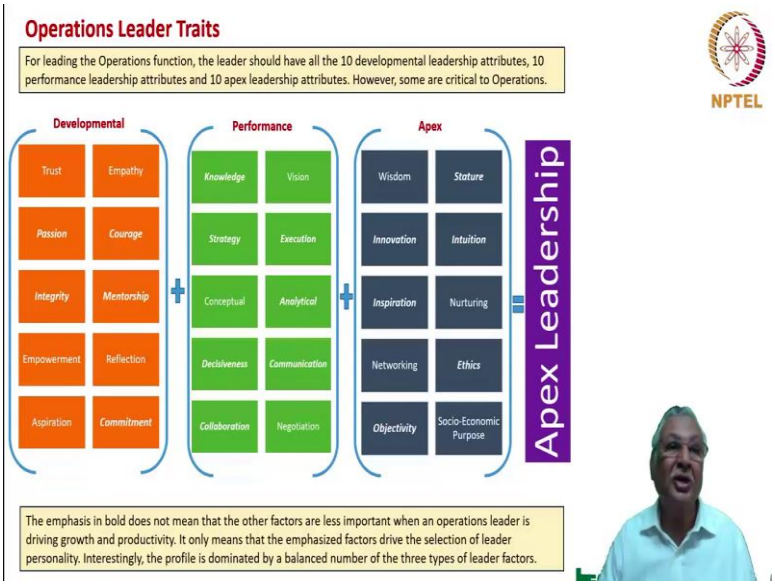

So, let us look at these 30 traits and see how operations leader fares on them and where he should differentially emphasize a little more to be able to fulfill those characteristics that I have mentioned. From the developmental cluster, you need to focus on passion, courage, integrity, mentorship and commitment. These are essential.

In respect of performance most of the performance parameters are required probably except vision and conceptual and negotiation because we are saying that you do not have to really negotiate in your operations mission if you are able to collaborate and if you are able to communicate and coordinate well.

Therefore, performance traits are extremely important, but a few things could be at a normal level. And from the apex leadership traits, you require stature, you require innovation, you require intuition, inspiration, ethics, objectivity. These are required to a higher degree. Together all of these things make a great operations leader.

As I said to you in respect of the R&D leader, the extra emphasis on certain factors does not mean that the others are not important. Each and every leadership attribute whether developmental, performance or apex is equally important. But, depending upon the domain you need to emphasize a few things a little more and that emphasis must also result in the special characteristics of the domain specific leader as we say in each case.

In case of R&D we said a few things and in the case of operations we said a few things and when this happens, the operations leader would be a great strategic leader and would be contributing to the company's competitive advantage. That brings us to the close of this lecture and we will meet in the next lecture.

Thank you.