

**Indian Institute of Science
Bangalore**

**NPTEL
National Programme on
Technology Enhanced Learning**

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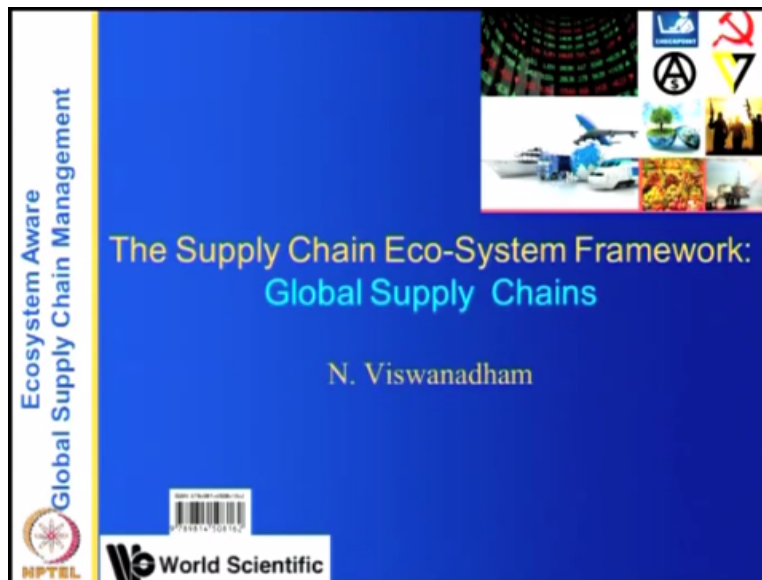
**Global Supply Chain Management
Lecture-05
Supply Chain Eco-System Framework:
Supply Chain & Resources**

Prof.N.Viswanadham

**Department of Computer Science and Automation
Indian Institute of Science
Bangalore**

And in the last lecture we have given the general world review of the supply chain ecosystem.

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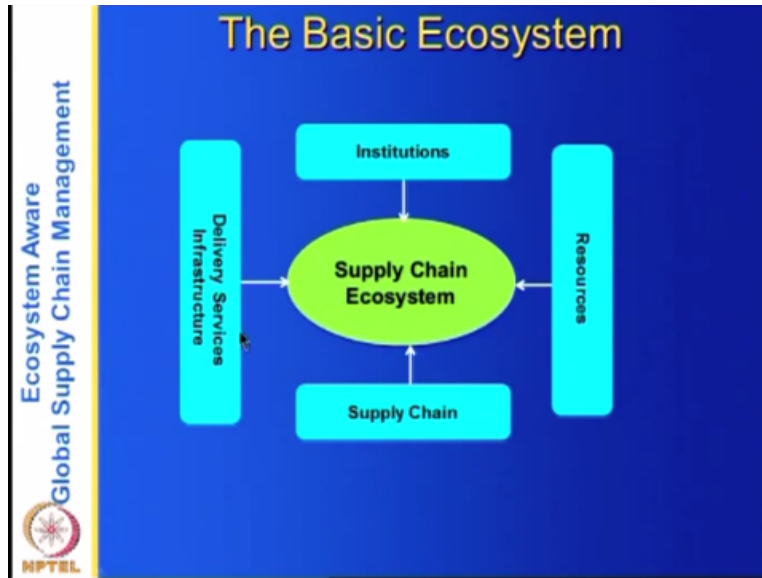


And the framework and as we saw the ecosystem.

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The ecosystem has four elements it is the supply chain the resources the institutions and the delivery and service mechanisms what we are going to do in the next four lectures is to take each one of these and study these in detail as a part of the supply chain ecosystem what is that you need to do study in terms of the supply chain in terms of the resources institutions and delivery mechanisms.

So after this four lectures you will have a an idea of what the supply chain ecosystem is and how to proceed with both analysis and design.

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So in terms of the contents I will present the ecosystem and then will talk about the global supply chains and also we take two examples and one are the electronics and other one is the

approve and look at what are the various types of contract manufacturing firms that have evolved because of the globalization of the manufacturing supply chains and finally we look at modular organizations. As we said as I told you before that this so-called globalization is because of modularization of the products instead of making an integral product you make modular products and you have modular products modular processes.

So is it possible to have organization structures which are modular that is what we will look at and finally conclude this lecture. So field of wanting.

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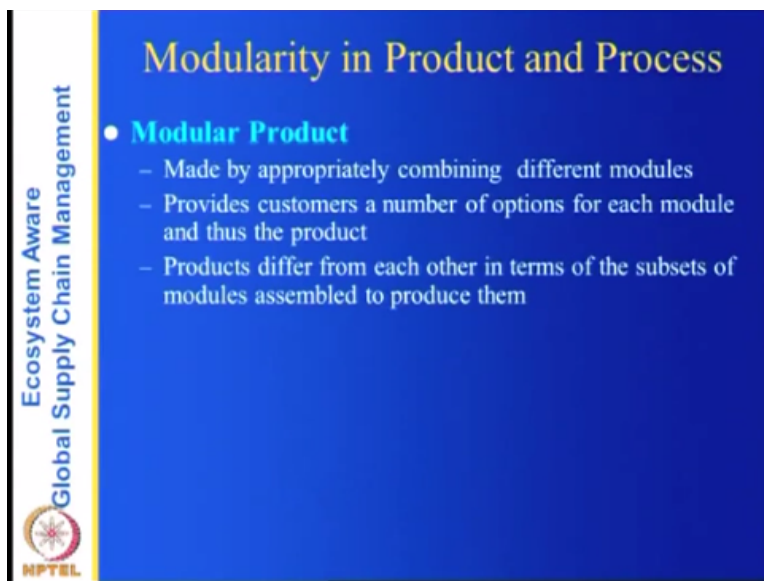


To look at the four forces that is the supply chain delivery service mechanisms institutions and resources.

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We will first study the global supply chains.
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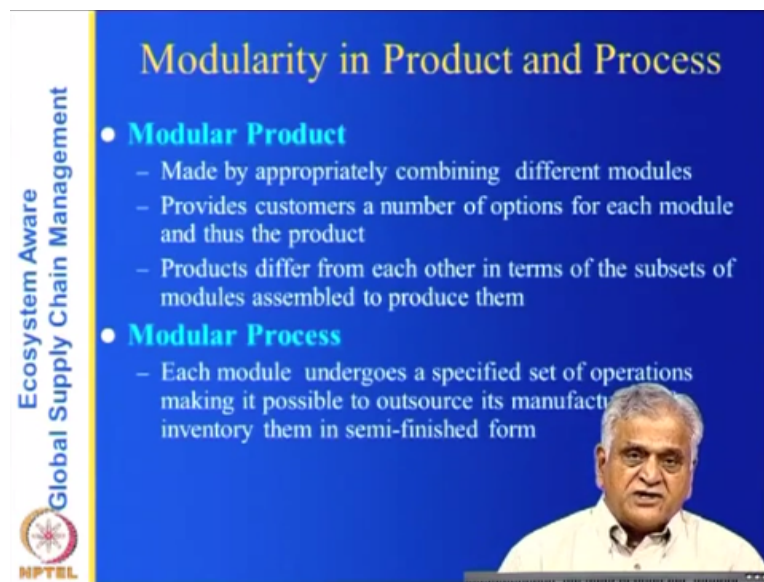


Now modularity in both products and processes so we have product any product behind every supply chain there is a product or the behind every product there is a supply chain a supply chain that is produces this product and the modular product is made by appropriately combining different modules instead of making one individual module you have the various electronic items to which you combine into a make into a PC or you make into a laptop or a cell phone .

And so on and it provides the customers a number of options for each module and that is the product in other words what happens is you can change the product specifications and then the product remains the same if PC is a PC but you can change its processor you can change its the memory size and other kinds of things and according to the customer options and products differ from each other in terms of the subsets of modules assembled to produce them.

So basically it is not the product is the same but the subsets of the modules that are used to assemble the produced them is different.

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The slide features a blue background with yellow text. On the left, a vertical banner reads 'Ecosystem Aware Global Supply Chain Management' with the HPTEL logo below it. The main title is 'Modularity in Product and Process'. Two bullet points are listed: 'Modular Product' and 'Modular Process', each with three sub-points. A video inset in the bottom right shows a man speaking.

Modularity in Product and Process

- **Modular Product**
 - Made by appropriately combining different modules
 - Provides customers a number of options for each module and thus the product
 - Products differ from each other in terms of the subsets of modules assembled to produce them
- **Modular Process**
 - Each module undergoes a specified set of operations making it possible to outsource its manufacturing and inventory them in semi-finished form

So and similarly like a modular product you know modular processes each module undergoes a specific set of operations making it possible to outsource manufacturing and inventory them in semi finished form if you if you make an automobile you have an assembly like a door or an engine or something and that is a sub assembly and the process on which this is manufactured.

The module is manufactured is a modular process and that is standardized and which is standardized means the equipment that is needed to manufacture that particular sub assembly is standard and the process and the designs everything is standardized so since because of the standardization we will be able to outsource but the sub-assembly and people can buy some equipment from some manufacturers and use the standard designs and standardized processes to manufacture some assemblies and sell them to big original equipment manufacturers.

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Ecosystem Aware
Global Supply Chain Management

Supply Chain Trends: Modularity and Outsourcing

- Modular Products, Standardized Production Processes, and Outsourcing lead to Modular Supply Chains.
- Standardized component manufacturers have become IP monopolies and wield global market power
(Intel chips, Windows OS, Auto components)
- Products have become commodities with the availability of Codifiable and Easily Replicable Knowledge about assembling the final product.
- The strategic competitive advantage for assemblers (Dell, GM, Nokia) moves from factory to managing the global supply chain and social capital with stakeholders.

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So if you look at modular products and modular processes you have modular and organization structures we will have a chance to look at the modular organization structures before the end of this lecture so we have various supply chain trends like modularity and out sourcing so we have modular products which means standardized production processes and outsourcing like to modular supply chains .

So you have the modular products so which are sub assemblies which are tier 1 and tier 1 outsources its particular components to tier 2 to tier 3 and so on and this the products are standard the components which are manufactured follow the standardized production processes and hence they are outsourced to low-cost countries and if you combine all this like I have shown in the first lecture a multi-tier supply chain diagram it becomes a modular supply chain and standardized component manufacturers have become IP monopolies and feel global market power .

Now what happens in a product if you take a PC you can assemble a PC by a various kinds of components assemble a PC in your house so and similarly it is possible to hire a wooden table or something whatever this one so but then the intellectual property will be in the in the hands of the component manufacturers .

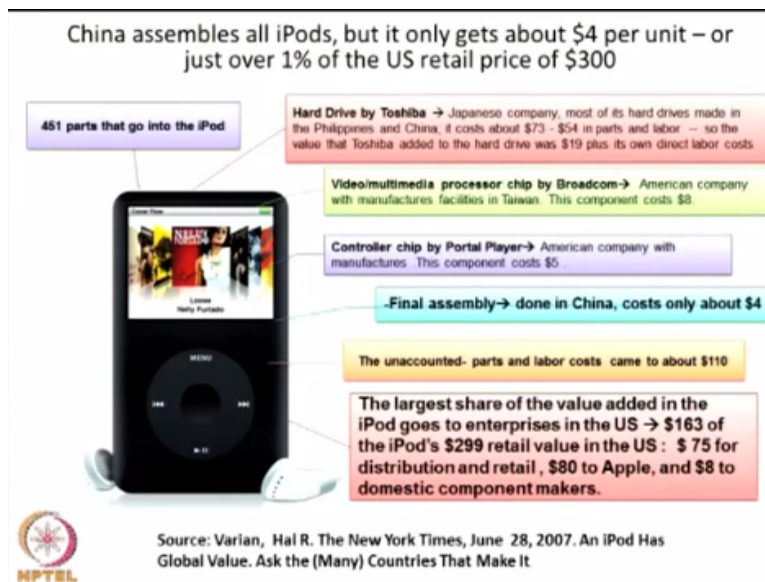
For example Intel chips, Windows Operating System, Auto components , Auto engines these are all the monopolies is the IP intellectual property is in these components. But anybody can take this particular components from right from their market and they can assemble them into a particular product products have thus become commodities with the availability of codifiable and easily replicable knowledge about assembling the final product.

So that is what I have been saying you can assemble the final product by buying the components in your house so the strategy competitive advantage for assemblers for example Dell ,General Motors, Nokia and others moves from the factory to managing the global supply chain and social capital with the stakeholders.

So there is your competitive advantage why should I buy from Dell or why should I buy from a car from GM or Maruthi or whatever so the they started to get advantage becomes or the brand for these manufacturers comes in managing the global supply chain and also the social capital with the stakeholders which actually means that the intellectual property for any particular product lies A in the tail end that is the components and B in managing the entire supply chain by the assemblers and also the connections that the global supply chain assembler or supply chain global supply chain owner or the OEM has with its stakeholders .

So you can see this change that has happened over the last ten decades from 1913 when Henry Ford has started a vertically integrated enterprise to a globally dispersed manufacturing system today the competitive advantage has moved from the word ownership of all the facilities to the managing the global supply chain or making the components the vital components that are needed for the particular products .

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So if you look at an iPod China assembles all iPods but it gets only \$4 of unit and just over 1% of US retail price of 300 you sell this for 300 or 299 in the US and say who outsourced to China and China gets only 4 percent so the largest share of the value in the iPod goes to the

enterprises in the US. \$163 of the iPods 299 retail value it goes 75 for distribution and retail \$80 to Apple and \$8 to domestic component manufacturers .So you can see how the how a low cost has become how much profit the US manufacturers can make from this particular diagram. (Refer Slide Time: 10:12)

The slide is titled "Types of Standardization" in yellow text on a blue background. On the left side, there is a vertical banner with the text "Ecosystem Aware Global Supply Chain Management" and the NPTEL logo. The main content consists of two bullet points:

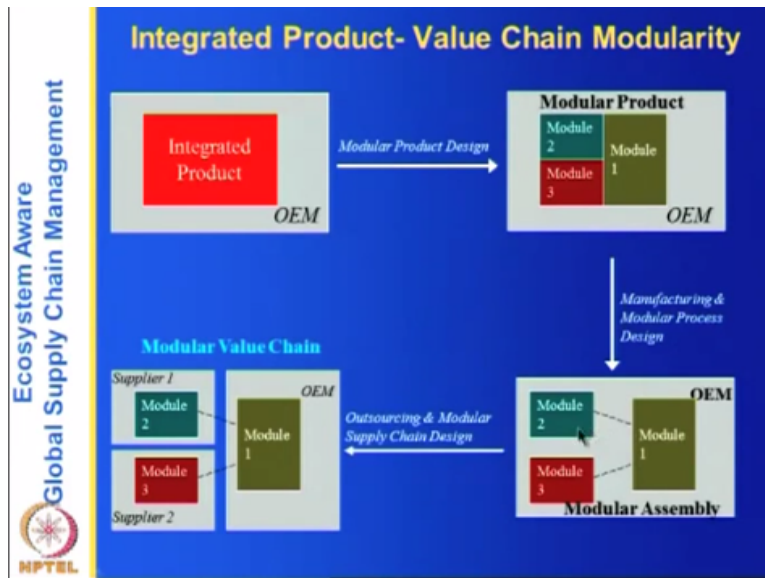
- **Part Standardization**
 - Common parts are used across many processes
 - Products redesigned as necessary
- **Process Standardization**
 - Standardizing as much of the process as possible, making a generic or family product
 - Final product assembly delayed until the customer order is received i.e. Called "Postponement"

So what are the types of standardization here that are required one is the standardization of parts common parts are used across many processes products redesigned as necessary so basically you can have the products you can use you know the particular product like a PC or a cell phone the memory can be different it can be a GB or it can be 16 GB 32 GB and the cost varies based on that and the memory strip can be fixed depending on that. So what happens is that they strips out of the same size but the memory capacity changes .

So common parts are used across many processes and products are redesigned if necessary and process standardization standardizing as much other processes as possible making a generic or a family product so if you standardize the processes and it is easier to outsource and also by standardizing that they are this one you can easily automate the particular process using IT and other technologies and the final product assembly is delayed until the customer order is received.

It is called postponement in other words the final assembly for example if you order a laptop from Dell they will wait until you have paid the money they get the cash and then they will assemble the particular product and deliver it to you within 24 or 48 hours for whatever it may be so this is called postponement and the process and product standardization modularization help in making this possible .

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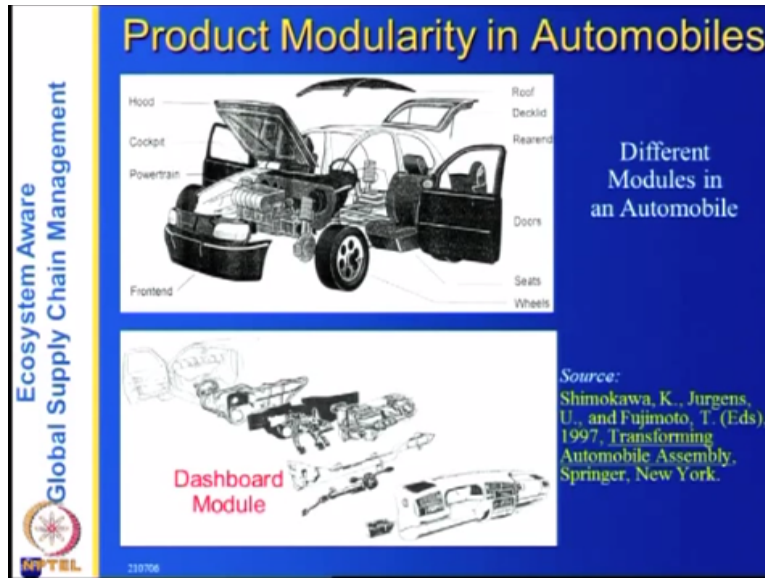


So if you look at the integrated product value chain modularity there are integrated products that means the OEM original equipment manufacturer manufactures the product and if there are screws and other things to be fixed and they fix it fix them but it is an integrated design and the next level we can have you can make the product into three modules so module 1 module 2 module 3 they are all made by the OEM but it is a modular product but they are assembled by OEM himself .

The third stage is that you have one and two modules one and two are made outside and you have module one and you have you make it as a modular assembly by the still at the OEM but now you can outsource supplier module 2 to a supplier and module 3 to another supplier and make module 1 out of this .So you are basically making a modular value chain by outsourcing and designing your supply chain properly.

So this is the effect of the outsourcing is the effect of modularization is shown in this diagram clearly.

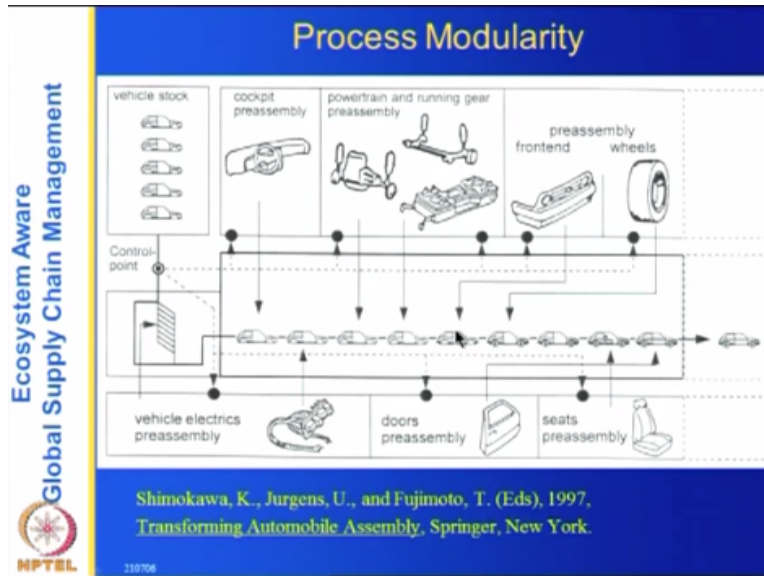
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Now if you want to look at some examples like automobile for example Auto has the car has different modules for example there is the roof there is the deck lid there at the rear end and there are doors there are the seats wheels the front end the power train the cockpit and the hood now each of this are manufactured by different manufacturers of course though you should not forget the tires now the dashboard for example if we take the dashboard module it has also several components.

So each of these modules are manufactured in different by different suppliers and you have also the dashboard module for example is done and it is assembled as a dashboard and supplied here so the product modularity you can see it very clearly in this diagram that automobile has four maybe five thousand different parts and maybe about 100 different assemblies so you can see how many different manufacturers an automobile manufacturer has to deal with in this.

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Now what about process modularity supposing you take the assembly line of the car here so in the assembly line for example the car comes they put the cockpit pre-assembly here and afterwards it goes here and then they put all the electrical pre assembly here and a power train assembly then and they put all the gears on all this here and the doors pre-assembly here and pre-assembly of a front end the wheels and seats and finally a car goes out .

So you can see that here the each of these modules have made the process modular and because the process and by which you manufacture these are standardized and they produce the same components with the same specifications when they put the cockpit assembly here it exactly fits and similarly for all this so many as depending on the number of components that you have it becomes mandatory that you make your assembly to specifications.

So that the final product does not has is not a loose assembly but it is a tight assembly of various kinds of parts and so on so here is it is buried these two diagrams the product and process modularity diagrams for automobile this basically shows both the product modularity as well as the process manufacture .

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So if you look at the manufacturing firms in electronics let us look at the electronics.

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And then you have the what electronics are called EMS forms the they are basically electronic manufacturing services or set of companies that design test manufacture distribute and provide return and repair services for electronic OEMs now here EMS firms grow through increased scope and scale now how does how do the how did this electronic manufacturing service or contract manufacturing services like Flextronics solution and other things have come because the OEMs earlier of electronic OEMs like IBM and others.

They were making losses because they were manufacturing products only for themselves and they did not have enough scale to make profits and similarly the electronics has a lot of scope a lot of variety of products and so EMS forms basically there are a lot of scope and so they were not able to manufacture all this they helped the manufacturing processes do not have the flexibility in all this .

So what do these people did the OEMs did was they have out sourced this they are manufacturing to contract manufacturers or electronic manufacturing services these firms and the other things that the EMS has EMS have is they have acquisitions of underutilized manufacturing assets of the OEMs and also SMEs in manufacturing and product design so the EMS firms have grown in the 80s and 90s through acquisitions of the underutilized manufacturing assets of the OEMs and also from the SMEs and they have thrived by the increased outsourcing of the OEMs .

So there are three kinds of electronic forms one is CM which stands for contract manufacturer the ODM original design manufacturing CDM contract design manufacturing or the three popular EMS segments.

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Business Segments: CM & CDM

- **Contract manufacturing (CM)**
 - Does Manufacturing and packaging, design supplied by OEMs.
 - Component suppliers are specified by the OEM
- **Contract Design and Manufacturing (CDM)**
 - CM + Product design + SCM +logistics + Eng services
 - IP for design is still with OEM
 - Does design changes resulting in higher margins
 - To improve manufacturability based on experience of producing similar products for several OEMs
 - Savings in sourcing and logistics by using same components for products from different OEMs

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Let us see each of them the contract manufacturing it does manufacturing packaging design supplied by the OEM so it is very clear that the designs are supplied by the original equipment manufacturer and the contract manufacturer does the manufacturing and packaging and supplies it to the OEM the component suppliers are specified by the OEM in other words the orders for the components from tier 1 tier 2 and other suppliers is all done by OEM.

So it months only the manufacturing and packaging are the two activities that are done by the contract manufacturing one should understand that the manufacturing and packaging this or I said intensive and commoditized activities it because these are these are well known activities and anybody can do it and so what happens here is these contract manufacturers usually suffer from commoditization of their products as well as the once the equipment is asset intensive you have to replace the equipment and you have to basically you have to basically replace as well as modernize your equipment and train your own staff and all that all that takes a lot of time and money .

So the other one is contract design and manufacturing which is CDM that is you do the contract manufacturing work which is manufacturing and packaging you know the product design also you do the supply chain management and you know the logistics you know the engineering services what are the engineering services in your area services of like packaging or transportation finding the finances and so on and I people design is still with the OEM .

So here the intellectual property is still what the OEMs so the design is supplied by the OEM the rest of it is done by the contract design manufacturing unit and so does design changes resulting in higher merchants so to improve manufacturability based on experience of producing similar products for several OEMs so what happens is in this CDM gains a lot because usually these contract manufacturers they work for several OEMs.

If you are taking a cell phone they work for Nokia they work for Motorola they work for Sony and lot of other companies so when the work for those kind of companies the same product there is a similarity in terms of producing similar there is there is similarity in terms of the products in terms of their manufacturing capabilities as well as also the components everybody uses the same the same hold everybody uses the same processor and so on same memory size and all that.

So what the CDM can do is to improve the manufacture ability based on the experience of producing products for several different people and savings in sourcing and logistics by using the same components for products of different OEMs in other words if you have say doing this for five different manufacturers you are producing a cell phone of different brands so by sourcing the components buy from the same supplier you can get more discounts by sourcing this from the same supplier same place either in China or India or whatever .

So you can transport all this by because of the scale you get same in logistics costs so the contract design manufacturing has thrived you know by Flextronics and others because of they were able to get the escape scale and scope by working with different manufacturers here so but the IP design is still with the OEM so what is happening here is the contract manufacturers can be a risk factor for the original equipment manufacturer then you are giving your design and

you are depending on the manufacturer for all manufacturing and everything else on the CDM then you are hollowing out your capabilities.

So the OEM suffers a risk unless they are careful so that will we will study a bit later.

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The slide is titled "Original Design and Manufacturing (ODM)" in yellow text on a blue background. On the left side, there is a vertical banner with the text "Ecosystem Aware Global Supply Chain Management" and the NPTEL logo. The main content is a bulleted list in white text:

- ODMs initiate designs , manufacturing, IP & licensing etc. and shop for Owner. They
 - Develop unbranded products and sell them.
 - Can alter product design for manufacturability and cost.
 - are co-located their design and manufacturing facilities to gain cost advantage.
 - Subcontract some activities to CMs.

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And the original design and manufacturing ODM original design and manufacturing here ODM initiates design manufacturing IP and licensing etc and shop for owner in other words we here there is an OEM who is giving you the contract now that all changes you are basically doing everything you are producing yourself one of your Brand then in other words you produce a cell phone and go to Nokia hey I have a cell phone it is of the brand here and I can give it to you for this particular price you want to label it as yours .

So if they agree there they develop unbranded product can sell them and can alter product design for manufacturability and cost they are co-located their design and manufacturing facilities to gain cost advantage and subcontract some of the activities to contract manufacturers so this is what happens supposing some big retailers like Wal-Mart or anybody so they can basically have their own brand like this original design equipment manufacturing company can create Wal-Mart cell phones or to have their design .

Wal-Mart need not have to do anything except give its name and then it will they sell on Wal-Mart this one so there are several products which are coming out and this is what is happening in the electronic designs.

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Risks involved in the Three Segments

- CM – Need to manage manufacturing risks only
- CDM – In addition to manufacturing risk, the design may need modifications adding overseeing costs. The OEM bears the market risk.
- ODM – Both the technical and market risks are borne by the EMS firm and hence more responsibility
 - Extensive market analysis and development of product architecture.
 - Future risks may come in the form of constant up gradation of design expertise and manufacturing capabilities.
 - Needs intra organizational coordination .

NPTEL 210708 H. Vikramakrishnan

So but then there are risks involved in each of them in contract manufacturing it is need to manage manufacturing risks only in other words the design is supplied by the OEM and the marketing is done by the OEM and you need to manage only your manufacturer risk in other words you are sourcing everything in the suppliers are all selected by the OEM so you are just doing the manufacturing so if there any defects in your manufacturing processes if you are there failure of your machines or something and because of that the product has some defects then you get into problems otherwise you do not have any other risks associated with this if you are CDM.

Then in addition to manufacturing the design many modifications adding over seeing costs so in other words when you are when somebody gives you with this one and you manufacture the product design and all that then the then you have you have to basically collaborate and coordinate everything and there some over side costs and the OEM bears the market risk and in the case of ODM then both technical and market risk are borne by the EMS firm hence more responsibility .

So you require extensive market analysis and development of product architecture future risks may come in the form of constant up gradation of design expertise and manufacturing capabilities we have seen particularly in electronics how things are changing it was from PC to laptop to tablet to cell phones so they there is a tremendous amount of technology change so you will have those risks and needs inter organizational coordination as I said earlier if you are a OEM and you have connections with all your suppliers and other stakeholders and but if you were in the ODM without any kind of a brand then it may be you need intra-organizational coordination to make your things happen so there is involved in all the three segments.

So if you look at the manufacturing firms in the apparel industry you have

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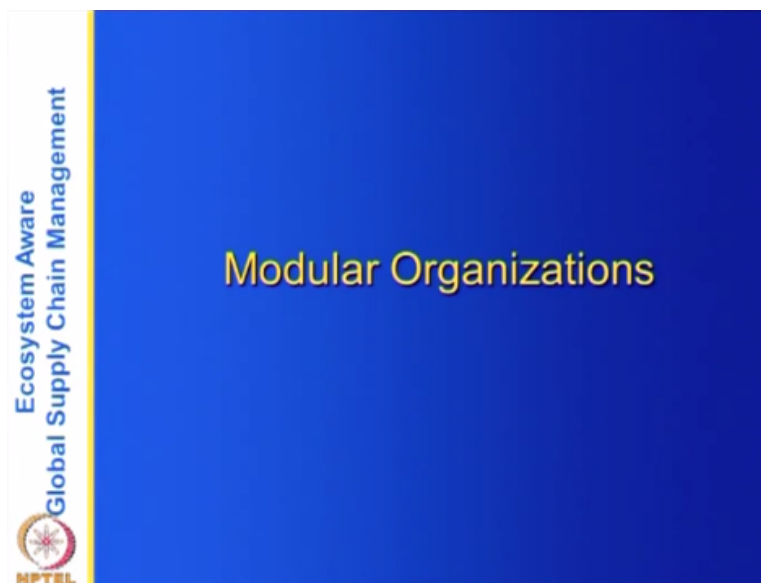
For example the assembler or CMT cut make and trim or the manufacturer for the first type of manufacturing and the contract manufacturer designs and fabric or the science and fabrics are supplied by the customer manufacturer customer manufacturer cuts and sews the fabric into the garments so here the fabric and the designs are supplied by the customer like whoever it is it

can be Reebok it can be Polo it can be Wal-Mart it can be anybody and the manufacturer cuts and sews the fabric into garments.

Ignore the design so it does the contract manufacturing work so original equipment manufacturing his customers provides the design and specifies the raw materials in other words customer says this is a sweater it has to be made of this kind of wool and OEM sourced and financed the fabric provide all the production and packaging services for delivery to the retail outlet .

So basically that is what the OEMs do so they have more responsibility here and original design manufacturing and ethanol is to organize and coordinate design of products selection purchasing of materials all stages of production such as cutting sewing trimming packaging and delivery of the finished product to the customer so you have various types of happening firms like in the case of the electronics you have the same kind of thing in the Aral firms.

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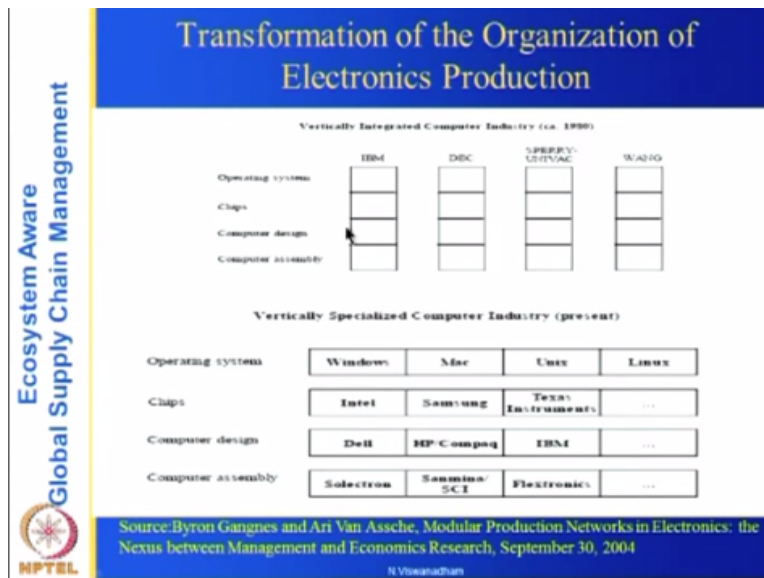
So we have seen so far that in the electronics and natural sections there are three kinds of organizations that is the contract manufacturing original design manufacturing and so on and similarly in the April's so but then what about other verticals you know if we take auto vertical is it possible to distribute it like this but Auto is a typical this one where the globalization has not to happen what happened was only a regionalization rather that is where horizontal outsourcing or horizontal integration has happened in the auto industry .

What is horizontal integration if you have a company like General Motors or Hyundai or somebody they will come to India they will go to China and set up their own factories there and they will source local components why that is because the auto components are more expensive

and see and to their regional in other words the auto the driving speeds and depend on the infrastructure the roads the quality of the roads earned and all that and also the left hand right hand drive and these kind of things and if you have auto steering or you know switching of the gas and all that depends on the driving habits of the people .

It also depends on the infrastructure and the also the part heaviness makes it has to be delivered via ships and it cannot be airlifted so because of all these reasons auto supply chain is more regional than global but on the other hand in the apparel as well as the electronic sections it has become more global so once you have products which are modular and then the processes which are modular this what is what about next what is an organization organization is the total company so if you take any of these big companies like Maruthi it has president and CEO board of advisors board of directors and also for each unit there is a general manager and so on.

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So basically there is an organization structure that is associated with this. so what about the modular organizations here so if you look at the electronic industrial the in earlier we have vertically integrated computer companies like IBM Sperry UNIVAC Wang and Dec and so on these are all the companies which were vertically integrated and they have their own operating system they make their own chips they have their own computer design and they have their computer assemblies .

Now this kind of organization in the electronics which is vertically integrated has now changed it to vertically specialized computer industry which means that operating system is Windows max Unix Linux and the chips are Intel Samsung Texas Instruments and others and you have

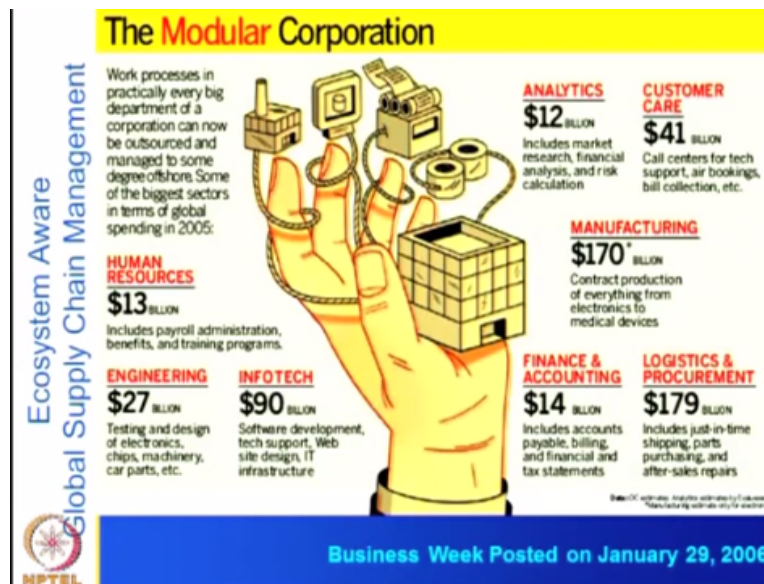
computer design Dell HP IBM and so on or Lenovo and computer assembly so electronics Flextronics and SEI and so on so it is all done by the contract manufacturers here .

So what happened by a single company is now replaced by several of these companies here so what has happened is the transformation of the organization here if you have a single company which is vertically integrated you have a CEO who is managing all the branches here on the floor managers and so on but here each of them Windows is Microsoft Intel is its own company making the chips .

DELL has its own Agilent assembly and flextronics is a contract manufacturer all are not co-located they are all basically in different parts of the world and they are independent they are financed by different people they have different stock exchanges and so on so that is where you have the transformation of the organization into electronic from vertically integrated to basically vertically specialized industrial and so on.

So now you are basically having a modular organization structure because you are basically having an organization structure which is not by authority but by collaboration so the authority now is transformed into sort of soft collaboration into this.

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Now let us look at it on the next leg so you feel look at any corporation this is a nice slide from Business Week in 2006 they the work processes in practically every big department in the corporation can be outsource Human Resources you can outsource engineering testing design of electronic chips and machinery and so on you can outsource software development tech

support website design to IT infrastructure you can outsource analytics market research financial analysis and risk calculation.

You can outsource customer care you can outsource manufacturing contract production everything of electronic to this one you can outsource finance and accounting there are lots of final firms which do your accounting like PwC Deloitte and others and you can outsource logistics and procurement which does which includes just in time shipping parts purchasing and after sales repair so if you have a corporation which is basically has all these things are outsourced then what is that you do you should have a capability to basically collaborate with all of them.

See that your work is done because if it is under one organization then you have a governance strategy which is vertically integrated which is the authority flows from top to bottom but here authority is everywhere each one is basically an independent corporation so you have to basically take all this and put them do and weave them into this one so that is where the governance of a corporation governance of a corporation which has lot of outsourcing here is an important issue that we are going to study in one of the lectures in the coming months .

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Modular Organization Designs

- Modularization of product designs paves the way for similar modularization of organization designs facilitating **coordination of activities via an “information structure” rather than managerial authority or hierarchy**
- The codification of knowledge and standardization (through technical standards and design rules) of the interfaces between organizationally separate stages of production has made **vertical specialization** (organizational modularity) replace vertical integration.
- Codification, together with shared interface standards and design rules **reduces the volume of information** and hence the amount of knowledge sharing, that is required for **inter-firm coordination**

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So if you have a modular organization design designs for example modular digestion of product design space to be a similar modular rejection of organized designs facilitating coordination of activity via an information structure rather than managerial authority or

hierarchy now what does this mean you have a product and what you did was in the stuff where you design the product as a set of modules .

Now each module is made by a different company there are different unit so if we have say ten modules and each are done by ten different companies and you have provides them the designs and you the OEM original equipment manufacturer gets these sub assemblies assemble them and I suppose them all right so the what is the organization structure here so each of these modules production have units of their own CEOs but the only thing that comes is what flows is the information.

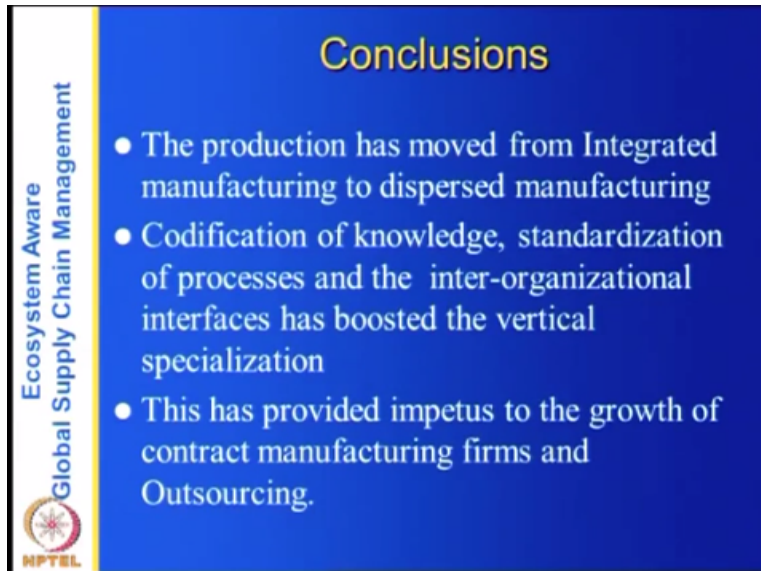
So that is where it comes to a collaboration structure which is the information structure or an orchestration structure where you tell people what to do when to deliver and what are the specifications what are the designs and so on and collected from them or ask some logistics provider to collect it and then deliver it to your assembly plant and in order to then assemble you so the coordination of activities why an information structure rather than Authority becomes an important thing and that becomes a modular organization structure.

Now what is codification of knowledge that is whatever knowledge you have it is not in the brains you can write down as a piece of paper it can be an algorithm or it can be an expert system which is based on some reasoning it or it can be a mission learning algorithm so once you have all the knowledge and is not in the brains of the people but it is in the computer rotational form of an algorithm and it is standardization of the interfaces that is when you have assembled several products the interfaces between the products and processes of standardized separate stages of production vertical specialization replace vertical integration.

So there are two factors which basically made this outsourcing or vertical specialization possible and one of them is the standardization another one is the codification of knowledge and standardization of the interfaces and finally codification together with still interface standards and design rules reduces the volume of information .

So if you have huge volumes of information that needs to be this one term in transmitted to each other then it becomes difficult though but the knowledge sharing that is required for inter firm coordination for this one is a sort of minimal it is because you have basically some kind of initial support system can handle the collaboration between organizations so that is the modular organization structure that we have here .

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Conclusions

- The production has moved from Integrated manufacturing to dispersed manufacturing
- Codification of knowledge, standardization of processes and the inter-organizational interfaces has boosted the vertical specialization
- This has provided impetus to the growth of contract manufacturing firms and Outsourcing.

So in terms of the conclusions of this particular this one on global supply chains the production has moved from integrated manufacturing to distributed manufacturing and codification of knowledge standardization of processes and the internal organizational interfaces are boosted the vertical specialization and this is providing impetus to the growth of contract manufacturing firms and outsourcing.

So what we will do next is to look at the delivery service mechanisms so now we will look at the second element of the supply chain ecosystem which is the resources so the resources are an important element of the ecosystem and that is what we are going to look at now. Now we go to the unless brief presentation we are going to look at the types of resources and the industrial resources like special economic zones industrial clusters and so on and conclude this presentation .

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Types of Resources

- Classical Economics define :
 - Natural Resources
 - Human Resources
 - Financial Resources
 - Capital Assets
 - Machinery, Warehouses, Trucks,..
- Modern View also includes
 - Knowledge, Intellectual Property
 - Social Capital Relationships with stake holders
 - Management of high value delivery processes

So the types of resources are the classical economics defines natural resources which are basically mines water and so on and the human resources they are basically both educated as well as the labor they white-collar blue-collar labor resources and nowadays the day labor becomes very important in the sense they had to be technology enabled in other words sometimes the technologies like automation replaces the human resources but the human resources may be needed to enable the technologies like the computers internet and so on internet gives you the connection but you require humans to connect .

So this human resources and the many interactions or interfaces between the humans and the computers are only machines becomes an important issue then the third one is the financial resources because when you are talking of companies which are either small scale or large scale they require financial resources financial resources as a part of the loans they are a part of you know to invest in their companies or as a part of the operational expenditure for letters of credit or for taking the loans for their customers and so on .

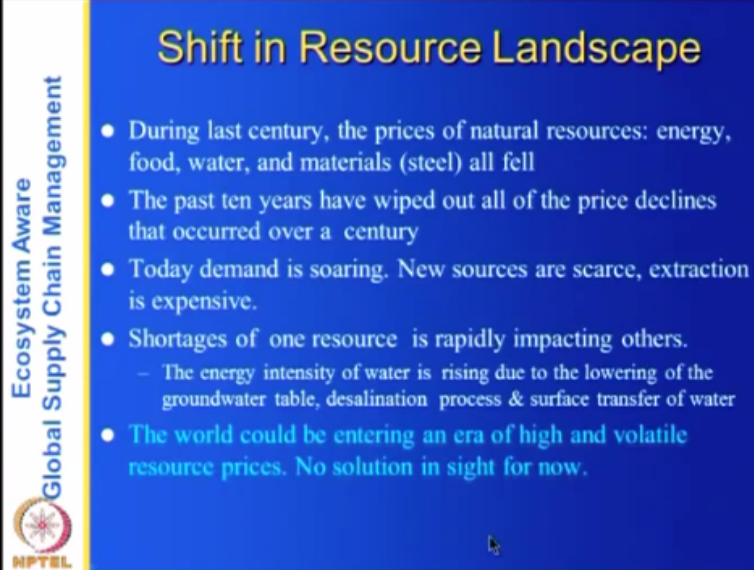
So and then you have the capital assets which are like machinery warehouses trucks and so on these capital assets are one-time expenditure but their maintenance and also the interest you have to pay they become the operating expenditures the modern view of course in the in terms of the resources it includes knowledge and intellectual property as the resource so if you have people or your employees who create employed intellectual property which you can patent and that generates money for these companies.

In our in the organizations as well as in institutions which concentrate on R&D the intellectual property becomes important there is also social capital our relationship with stakeholders it is not enough just to have your company but you have to have relationships with your stakeholders because if you're globally dispersed company if your spread all over the globe

then it becomes important to have a good relationship with people and also management of high value delivery processes is the management.

Like we said in the first lecture likes term becomes an issue when it is globally dispersed and all the high-value delivery processes had to be carefully managed.

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The slide features a blue background with yellow text for the title and white text for the bullet points. On the left side, there is a vertical white bar containing the text 'Ecosystem Aware Global Supply Chain Management' and the NPTEL logo at the bottom.

Shift in Resource Landscape

- During last century, the prices of natural resources: energy, food, water, and materials (steel) all fell
- The past ten years have wiped out all of the price declines that occurred over a century
- Today demand is soaring. New sources are scarce, extraction is expensive.
- Shortages of one resource is rapidly impacting others.
 - The energy intensity of water is rising due to the lowering of the groundwater table, desalination process & surface transfer of water
- The world could be entering an era of high and volatile resource prices. No solution in sight for now.

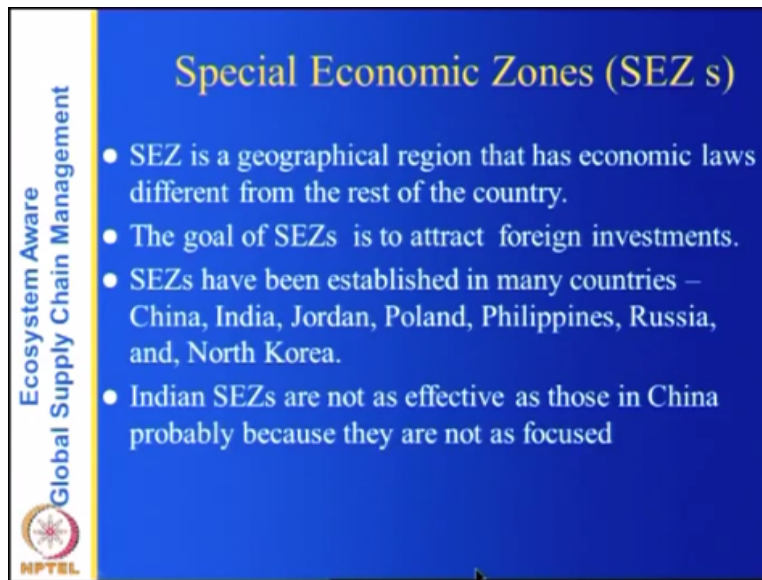
Let us say if you look at the resource landscape there is a change last century what happened when the prices of all natural resources like energy food water oil and the materials like steel also they came down very heavily that is because the use of technology but if you look at the past ten years they have wiped out all the price declines that have occurred over a century the prices have started increasing the food prices oil prices and energy .

We can scarce and so on so one has to be careful in terms of the resources today demand is soaring because the population has increased the countries the emerging markets are industrializing so with the more automation more industry expansions it becomes the resources like oil, energy ,water they are become very important new sources of scarce and extractions are expensive so shortage of one resource rapidly impacts other supposing you have water the water is the bore wells if you want to have water what you want to the ground water table is declining.

So to bring it up you require more power if you want to pump water from reverse to the water tanks in cities then required power so the shortage of one resource basically impacts rapidly with others so the world could be entering into the era of high volatile resource prices so but

people may think that like we have solved all the problems earlier we will solve this problem also but it is possible that there is lot of uncertainty in terms of finding a solution .

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Special Economic Zones (SEZ s)

- SEZ is a geographical region that has economic laws different from the rest of the country.
- The goal of SEZs is to attract foreign investments.
- SEZs have been established in many countries – China, India, Jordan, Poland, Philippines, Russia, and, North Korea.
- Indian SEZs are not as effective as those in China probably because they are not as focused

So let us look at some of the resources that the industry resources one of this what are called special economic zones the associates or geographical region that has economic class different from the rest of the country in other words it is a region where all the resources are provided and all the this is a cluster where all the industry stakeholders are also present the power water and there is no scarcity even the rest of the country may have scarcity and it has basically some tax incentives tax ops.

So some regions where you can manufacture you have to necessarily export in some other regions you can also sell inside the country at a price so basically these are regions which share which have economic laws which are different from the other country they grow enough most of these special economic zones that attract foreigners to investments this is for example China has lots of special economic zones which have been very successful for example they are established in China India Jordan Poland Philippines Russia North Korea and several countries .

Indian SEZs are not as effective as those in China probably because they are not focused but one of the very successful assets in India are the IT SEZs where there are there are electronic cities which were built in cities like Pune and Bangalore and Chennai and in Hyderabad and so on where SEZs will concentrate on the IT industry .

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The slide features a blue background with the title 'Clusters' in yellow at the top center. On the left side, there is a vertical white bar containing the text 'Ecosystem Aware' and 'Global Supply Chain Management' in black, with the NPTEL logo at the bottom. The main content consists of three bullet points in white text:

- Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions (universities, training) in a particular vertical
- The proximity of companies and institutions in one location fosters better coordination and trust lowering the transaction costs, minimizing the inventory, importing costs and delays.
- Clusters allow companies to operate more productively in sourcing inputs; accessing information, technology and human resources

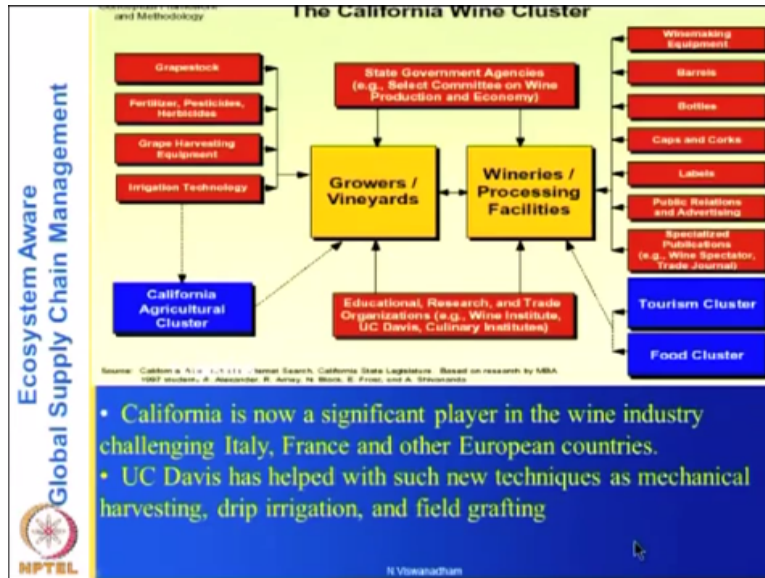
Well of course there are the clusters the industrial clusters which come in the industrial clusters are geographical concentrations of interconnected companies so you have specialized suppliers who have service providers and associated institutions like universities training institutions in a particular if you have a cluster say auto then you have all the auto component people and the logistics providers will provide the trucks to transport the components from the supplier to the manufacturer and so on.

And also you have training institutes in particular this one and also close by it may not be necessarily in the cluster but you have close by universities where research is being done or that particular vertical and the proximity of companies and the institutions in one location fosters better coordination and Trust lowering the transaction costs minimizing the inventory importing costs and delays.

So if everybody is at one place then of course you do not have the delivery costs delivery costs become minimum so the coordination cost also because you need not have to have a coordinator people can deal directly with the other companies and that is where you will minimize the coordination costs that are involved so if you are basically sourcing from a cluster which is nearby then you can follow just-in-time philosophy you transport costs are minimal your inventory costs are minimal and also your coordination costs are minimal .

So that is where the clusters are suggested by as one of the things one of the innovations in the supply chains and clusters allow companies to operate more productively in sourcing inputs because you know the clusters are nearby so they can transfer now information as well as the employees and can accessing information technology and human resources also becomes very easy.

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So this is where we have these clusters there are several examples of these clusters one of the examples of the clusters is the California wine cluster which is this is taken by from waters book and so and so but you can see that the diagram here which is you have one yards you have wine reprocessing facilities that is the in terms of the supply chain and also you have the educational and research and trade that is the educational resources .

You have the institutions here which are the state government agencies and you have the equipment barrels bottles caps and coils labels public relations and advertising and so on so if you take all this water what are the elements of all these diagram you can rearrange them into the supply chain the institutions and then and the resources and the delivery mechanisms here .

So you can see that the California is now the significant players in the wine industry challenging Italy France and other European countries so I mean the one of the important things here to recognize is that people have this cluster has become very famous and efficient and has become an a cited as an example of a cluster and you can see that the ecosystem framework is embedded in this cluster you have not only the supply chain the government rules you have educational institutions and so on.

So everything is there in this and University of California def Davis which is the education Institute which is associated and this wine growers they will have child professorships in this University and they help with lot of innovations that are needed like mechanical harvesting drip irrigation and fill crafting .So the other kind of clusters that we have.

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Indian Auto Clusters – Small car Hub

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The map shows major auto clusters in India, with callouts for various states and companies. Key clusters include:

- North:** Manesar (Haryana), Delhi (Delhi)
- West:** Pune (Maharashtra), Mumbai (Maharashtra)
- South:** Chennai (Tamil Nadu)
- East:** Jamshedpur (Jharkhand), Kolkata (West Bengal)
- Central:** Indore (Madhya Pradesh)

- Indian automotive industry has grown in clusters, Manesar in North, Pune in West, Chennai in South, Jamshedpur-Kolkata in East and Indore in Central India
- Location advantages such as infrastructure, access to pool of educated workforce and supportive state government policies are some of the factors that play a role in attracting auto investments.

Is the clusters in India which is in years now nowadays is called a small car hub and if you take India is a large country with 28 states but you will find the auto clusters are located in the east west north and south in the South it is Chennai or Madras it is in the in the north it is Delhi in the West it is Kolkata and in the in the West it is the Pune Bombay region you can find in this diagram all the state names where they are located .

You have some exceptions to this where in the state of Madhya Pradesh you have some clusters but most of these clusters are in Indian or in Manesar in north which is near Delhi Pune in West which is near Bombay and Chennai in South and Jamshedpur in Kolkata in east and Indore is a central India . Indore has become has some and so on.

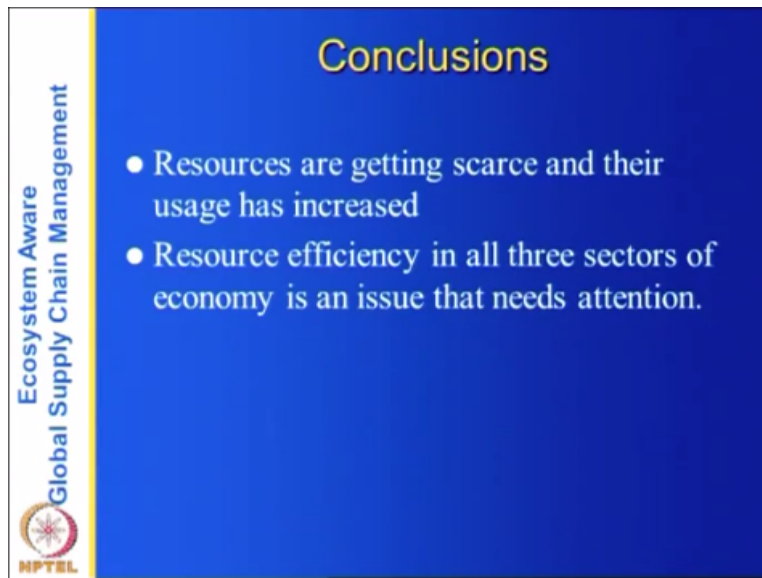
So the location advantage of has such as infrastructure access to pool education force and support of state government policies or some other factors that play a role in attracting auto investments here so why is India is now is called a small core hub but that is because of several innovations like Tata Nano and Hyundai has made a small car and so on .

So you have lot of supportive environment for making India small hub and in terms of these clusters so the whole all the manufacturing in India is concentrated in four places so I mean it depends that if somebody who is located in Delhi in this region has to sell basically to do somebody in South then you have to transport those cars in special vehicles to the dealers in the south.

So there is a transport cost that is that is in word but I think that is usually done similarly if there is a car manufacturer in the south and he free wants to sell in North then the finished products the automobiles have to be had to transit from south to north and similarly this happens from west to east or north or south .

So basically but there is the cluster advantage of this.

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Conclusions

- Resources are getting scarce and their usage has increased
- Resource efficiency in all three sectors of economy is an issue that needs attention.

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So if you look at the kind of things that are happening and the resource area arena one thing one has to be extremely careful is the resources are getting scarce particularly the natural resources if you look at the mines the oil is getting scarce and the other aluminum copper and iron this or the mining is becoming expensive and the food which is the agriculture that is also becoming expensive which is becoming which is leading to the inflation another factor .

That one need to observe is when you are resources are getting scarce or they are making me expensive it is important to have improved the efficiency of these resources now in countries it becomes once you make a resource efficiency then of course it leads to some money problems like jobless growth and so on but it is important to improve the efficiency in all three sectors of the economy in other words in agriculture where you use less water less power and you know improve your fertility of the land and so on.

In the manufacturing you improve your labor productivity you use less power you try to change the processes so that you use less natural resources and in services of course where which is IT and others then you have to basically it is a highly power intensive and one has to need to carefully this one so in my view the next decade well who has to concentrate on not resource exploration but resource efficiency .

Programme Assistance

Guruprakash P
Dipali K Salokhe

Technical Supervision

B K A N Singh
Gururaj Kadloor

**Indian Institute of Science
Bangalore**