

**Indian Institute of Science  
Bangalore**

**NPTEL**

**National Programme on  
Technology Enhanced Learning**

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**Global supply chain management**

**Lecture-04**

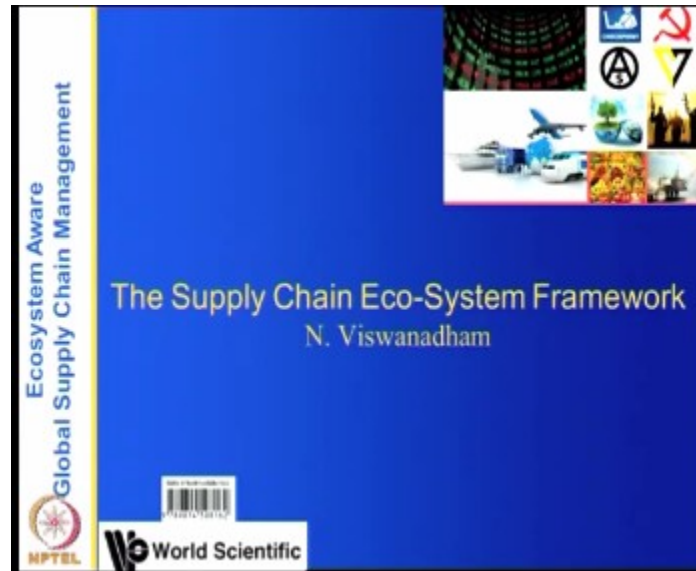
**The supply chain eco-system framework**

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**Department of computer science and automation**

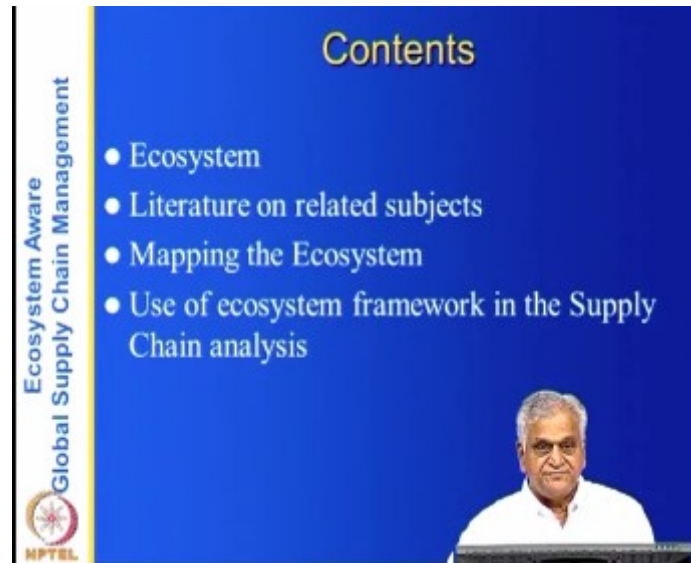
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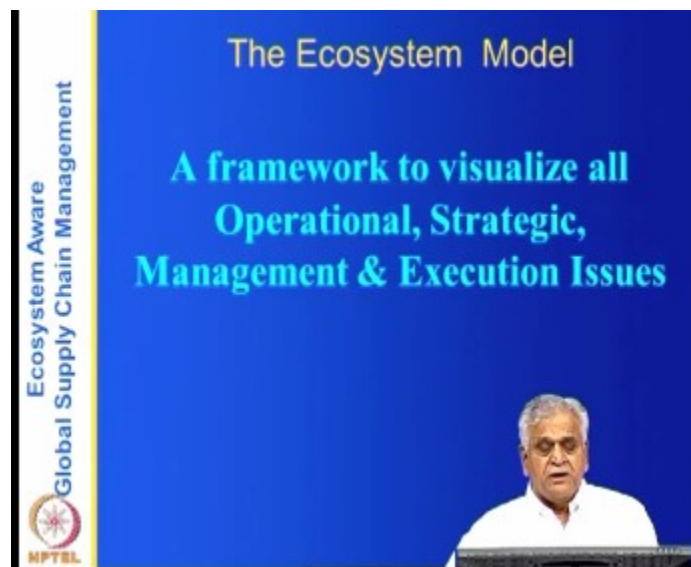


Today's lecture is an important one. I am going to present the fundamentals of the ecosystem framework for a supply chain or a service chain. The basis for this lecture is from my book with the Dr Kameswaran and the picture here shows the ecosystem. It shows the logistics, it shows the government and the environment etc. This picture was designed to show that the supply chain or a service chain is affected by the factors that are extraneous to the supply chain. The book entitled the **ecosystem aware global supply chain management** is published this year 2013 by world scientific.

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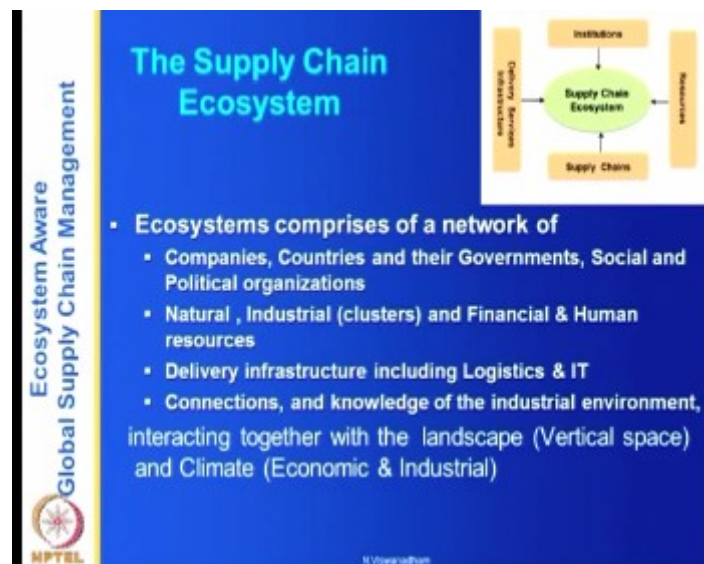
This slide shows the contents of this lecture on the ecosystem. First I will describe the ecosystem and then afterwards the literature on the related subjects. The ecosystem Concepts are from my book. We will review the literature from World Bank and other agencies on the related topic called investment climate. I will give you examples and show how to map the ecosystem and finally we end this lecture with the use of ecosystem framework for supply chain analysis.



An ecosystem is a framework to visualize all operational, strategic management and execution issues. Why is this important? It is important because as we have seen in the previous lectures this supply chain is affected by extraneous factors other than the value chain partners. In earlier

studies people were talking about supply and demand matching and partnership with the suppliers, the manufacturers, the logistics providers and the retailers and the customers. That was the most important thing. But the supply chain is also affected by other factors like the location factors, environmental factors, the government rules and regulations and the infrastructure that is available and so on.

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Definition (Supply Chain Ecosystem): An Ecosystem comprises of networks of Companies, Countries and their Governments, Other Industrial, Social and Political organizations, Logistics and Information Technology Services Infrastructure and the third party service providers that connect the companies and the countries to the external economic and social environment and Resources including natural, financial and human resources with talent, connections and knowledge of the industrial environment, Industry clusters, Universities, etc interacting together with the Landscape (space or vertical) and Climate(economic and social).

The Resources, Institutions and the Delivery service infrastructure together define the Investment Climate of a region or country.

The supply chain ecosystem consists of all these four factors and that is what we are going to study and given any particular example like auto or even a service chain like logistics. You map your supply chain, identify all the resources needed for your auto supply chain , and the government regulations for your supply chain and what are all the delivery mechanisms that have needed what is their status in various countries.

**The Four Forces in the Ecosystem**

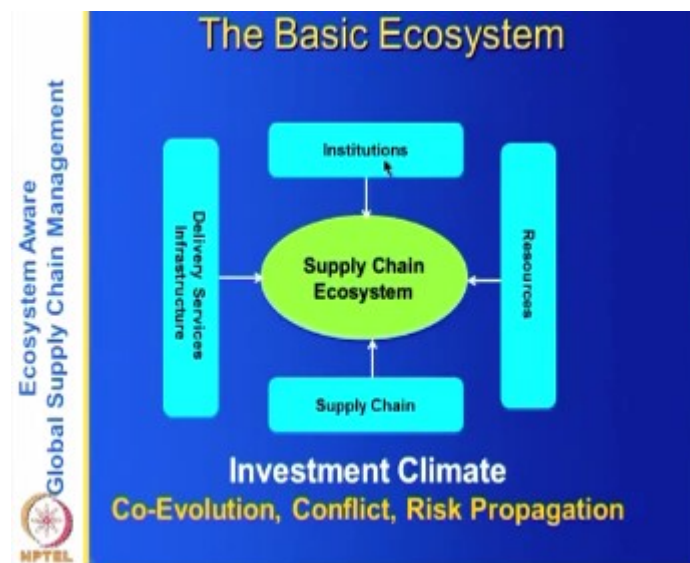
- Supply Chains
- Delivery Services Mechanisms
- Institutions
- Resources



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The four forces in the ecosystem are the supply chain, delivery mechanisms institutions, institutions and the resources which stands for the human financial natural resources and industry clusters.

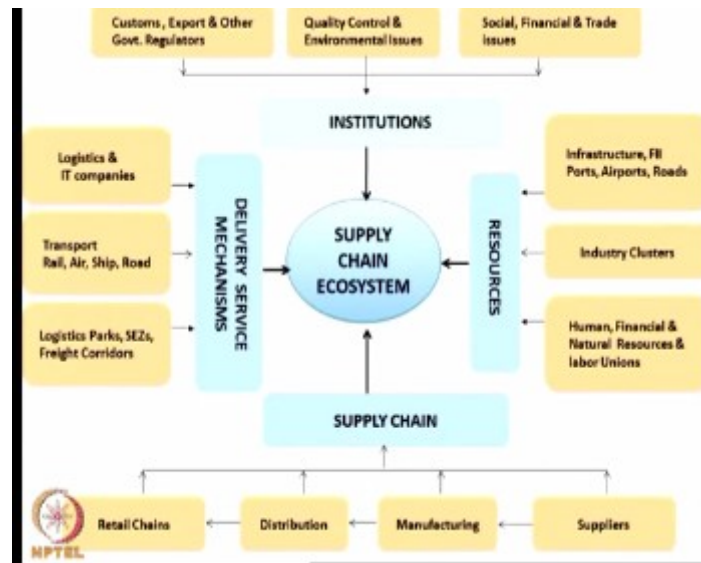


The supply chain ecosystem consists of the multi-tier supply chain starting with the raw materials and ending up with the product delivered to the customer, the resources, institutions

and delivery mechanisms. The three factors, the resources, the institutions and the delivery mechanisms are called as the investment climate. Investment climate of a country or region has been defined by the world bank and lot of studies have been done in various countries concerning their infrastructure, their government regulations and policies.

The investment climate as defined by the World Bank is for a country or region but here we are talking of the investment climate for a particular vertical such as auto supply chain or oil and gas supply chain.. The institutional regulations and the delivery infrastructure that is needed for oil and gas are different from other verticals.

We talk about three properties concerning the supply chain ecosystems: co-evolution, conflict and risk propagation.



The Ecosystem approach is comprehensive and integrated and depicts all the stakeholders involved with the vertical on a single platform and involves analysis that looks at the location, planning, performance, risk, governance and innovation from a systemic view point.

**The supply chain** consists of the suppliers, manufacturers, distributors and retail chains. This is the map of the supply chain given any vertical, food or electronics or oil or gas.

**The resources arm** includes clusters for collaboration and partnership, Universities for work force, R & D labs for Innovation, FII for financing, LCs etc, Labor Unions and problems, Land acquisition and the risks. They also include the resources such as mines, land, water and management skills.

**The delivery service infrastructure** is very important for on time delivery. The logistics and IT Infrastructure, the availability of logistics service providers and software developers, soft infrastructure at ports and airports, data banks form the parts of delivery service infrastructure.

**Institutions:** Customs, Trade, Tax Policies, Industry and FDI incentives, Labor Unions, Foreign exchange, Legal enforcement form the government side of the Institutions. Government policies that directly affect global economic competitiveness need also to be studied. The social groups, farmers and their welfare, NGOs all form the societal side of the Institutions.

**Virtuous Co-evolution**

- Product and Process modularization led to outsourcing to low cost countries.
- LCCs liberalized their economies and reduced tariffs
- The Internet enabled secure man-machine & machine-machine communication
- Hard (Ports, Airports) and Soft (Trade facilitation, Trade financing) logistics infrastructure developed.
- Contract Manufacturers & Third Party Logistics providers, Consultants, Software Cos have sprung up
- Global Supply Chains have proliferated

**Virtuous Co-evolution:** the evolution of global supply chains is the result of modularization of products and processes, development of standardized machines, outsourcing, rise of logistics infrastructure and development of software packages. Product and Process modularization led to outsourcing to low cost countries. Countries liberalized their economies and reduced tariffs. The Internet enabled secure man-machine & machine-machine communication. Physical (Ports, Airports) and Soft (Trade facilitation, Trade financing) logistics infrastructure was developed. Contract Manufacturers & Third Party Logistics providers, Consultants, Software Cos have sprung up. Global Supply Chains have proliferated



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### Risk Amplification & Transmission

- Connectedness transmitted risks across Verticals, Countries and finally towards Trade collapse.
- Home loan crisis resulted in credit squeeze and raise in interest rates for LCs & homes, cars loans
- Credit squeeze lead to drop in demand of products, Cancellation of orders to suppliers, Closing down of plants in LCCs, Loss of demand for logistics players
- Countries turned protectionist
- This lead to Trade collapse, Slowing down of Global GDP, Unemployment ,...

**Risk Amplification & Transmission** is the main risk associated with global supply chain and its connectivity. Connectedness transmits risks across Verticals, Countries and finally results sometimes in Trade collapse as happened in 2008. Home loan crisis resulted in credit squeeze and raise in interest rates for LCs & homes, cars loans. Credit squeeze lead to drop in demand of products, Cancellation of orders to suppliers, Closing down of plants in LCCs, Loss of demand for logistics players. Countries turned protectionist. This lead to Trade collapse, Slowing down of Global GDP and Unemployment etc.

There are a lot of articles in 2009-11 which blame the global supply chains and their risk amplification and transmission through connectedness to the global trade collapse.





Here we talk about the evolution of global supply chain networks. We have all the four ecosystem factors. In olden days, the products were locally produced. Resources are all vertically integrated and localized to enterprises

Local manufacturers and controlled export and delivery mechanisms, which are paper communications and truck transport and service This circle above shows is what was prevalent in the 60s and 70s.

But now we have a global supply chain network. Now we have a transition from local production to modular global production Network and similarly from vertically integrated to globally distributed networks. There is a transition in terms of the resources as well. Basically all the resources become globally distributed Network. The institutions have to deal with free trade enabled global markets, a shift from local markets. Similarly the delivery infrastructure has moved from paper communications and truck transport serving local markets to Internet enabled third-party logistics providers serving global markets. The global supply chain has made an the evolution. Our ecosystem aptly describes these changes

**Drivers of Supply Chain Competitiveness**

- **Resources: Labour, Materials, and Energy**
  - Talent: Managers, researchers, engineers & production workers
  - Availability and cost of Materials, Energy & Finance
  - Connectivity Infrastructure: Ports, Roads, IT
  - SEZs, Clusters
- **Government Policies & Investments on Institutional, Environmental, and infrastructural elements**
  - Economic, trade, financial and tax systems
  - The Legal And Regulatory system
  - Investments in Manufacturing, Software And Innovation
- **Delivery Mechanisms: Logistics & IT**
  - B2B, B2C Logistics players, Trade facilitation, Software Cos
  - Distribution centres, SEZs
  - Sensors, Cloud, Software for planning and execution

There are several drivers for Supply Chain Competitiveness. Some of them are mentioned here.

**Resources: Labour, Materials, and Energy:** Talent:, researchers, engineers & production workers; Materials, Energy & Finance; Ports, Roads, IT; SEZs, Clusters

**Government Policies & Investments on Institutional, Environmental, and infrastructural elements in particular** trade, financial and tax systems, The Legal And Regulatory system and Investments in Manufacturing, Software And Innovation

**Delivery Mechanisms: Logistics & IT including** encouraging B2B, B2C Logistics players, Trade facilitation, Software Companies, Distribution centres,etc. Recent trends include Sensors, Cloud, Software for planning and execution

Manufacturing competitiveness reports they talk about various factors may give least about 10-15 factors. I have added my own here in this and there are lots of reports from consulted companies.

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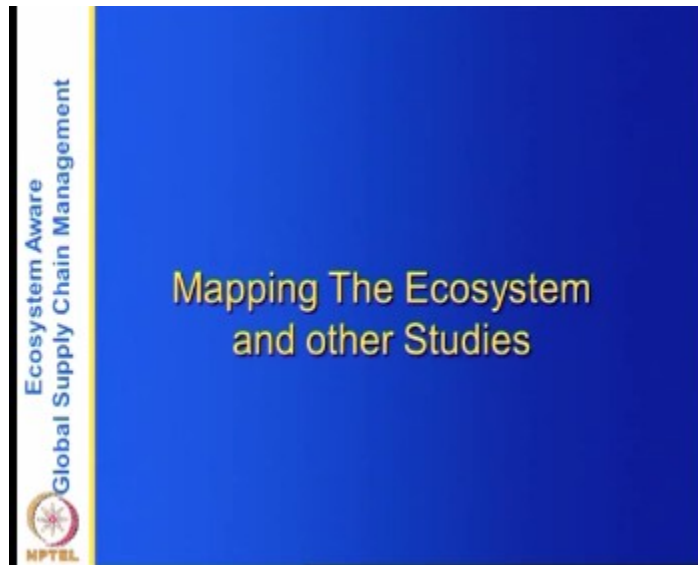
### Comparison with Global Indices by WEF

- **The Global Competitiveness Report**
  - Rankings depend on elements of the macroeconomic environment, the quality of public institutions, and the level of technological readiness and innovation.
- **Global Information Technology Report**
  - The Networked Readiness Index (NRI), is a measure of the degree of preparation of a nation to participate in and benefit from ICT developments
- **Investment Climate**
  - Macroeconomic, fiscal, monetary, and exchange rate policies and political stability
  - Regulatory framework: entry and exit, labor relations, finance and taxation
  - Physical and financial infrastructure: power, transport, telecommunications, and banking and finance

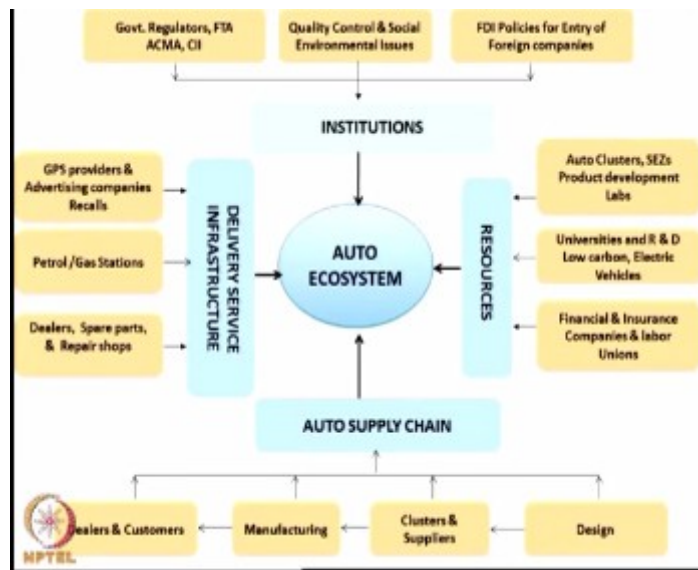
Empirical and Data Driven

Comparison with Global Indices by World Economic Forum . They include

- **The Global Competitiveness Report:** Rankings depend on elements of the macroeconomic environment, the quality of public institutions, and the level of technological readiness and innovation.
- **Global Information Technology Report:** The Networked Readiness Index (NRI), is a measure of the degree of preparation of a nation to participate in and benefit from ICT developments
- **Investment Climate** is determined from Macroeconomic, fiscal, monetary, and exchange rate policies and political stability, Regulatory framework: entry and exit, labor relations, finance and taxation an Physical and financial infrastructure: power, transport, telecommunications, and banking and finance.



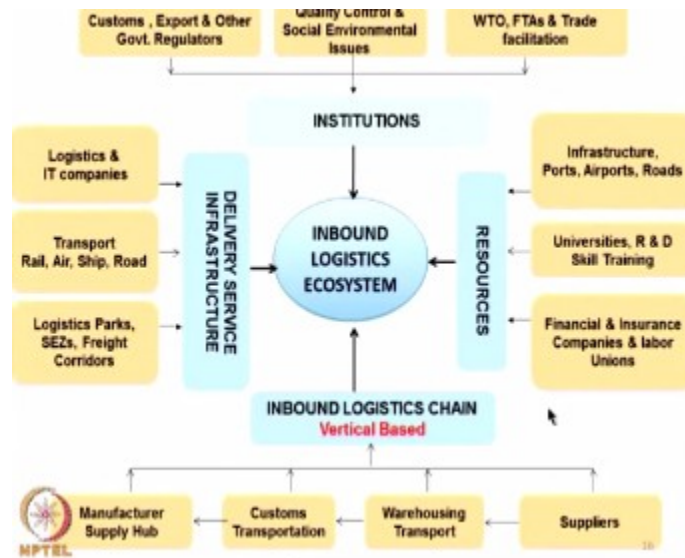
So before we precede let us see how to map the ecosystem for some examples. Let us take an auto and logistics



The auto supply chain consists of the design, suppliers, manufacturers dealers and customers. The resources that are needed for the auto clusters are the special economic zones research and product development labs become very important. Near the auto clusters and the universities and R&D in low-carbon and electrical vehicles . Banks, Insurance companies are involved. Labor unions and industry associations play a key role in the ecosystem governance.

The delivery infrastructure involves GPS providers, advertising companies and product recall companies, repair and maintenance companies etc. You need infrastructure and petrol and gas stations and also dealers spare parts and repair shops .

Now we map the Ecosystem for Inbound logistics



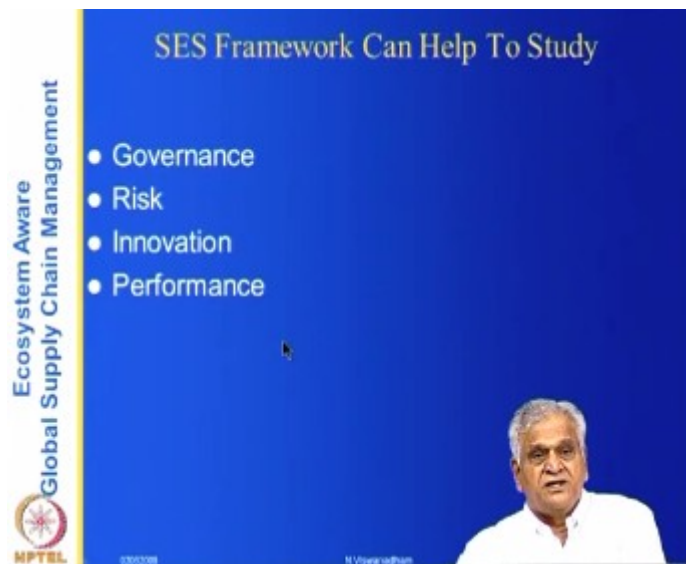
*Inbound logistics* which refers to the management of material movement and integration from component suppliers to a manufacturer/assembler. This is a part of the procurement function which has in recent times has gone global. The inbound logistics function therefore includes warehousing at the supplier and manufacturer ends and also transportation from supplier to warehouse and to international transport via sea or air. It is an important function that effects the inventory held, the timeliness of the manufacturer’s schedules, etc.

Inbound logistics is a logistics that is involved in transfer of materials from a supplier to a manufacturer. The manufacturer product production depends on the supplier’s reliability. All the components that are needed for the assembly of the automobile or any particular product are supplied by the logistics player. In global supply chains, the goods need to cross the customs authorities at both the sending and receiving end countries This is very briefly the service chain that is associated with the logistics.

Government regulations, quality control, social & environmental issues are important. World Trade Organization, free trade agreements and trade facilitation that affect the time that is taken at the port for customs clearance. The institution rules and regulations affect the transit time at the port.

The delivery function is executed by the logistics players called the Third party logistics companies. Some companies own their own logistics departments. There were several innovations such as supply hubs, where the component or subassembly inventory is held by a third party at the suppliers cost nearer to the assembler site.

The resources such as the infrastructure (ports, airports and roads), the universities, and skill training Institution for education and research, financial & insurance companies, logistics clusters and IT companies .



### SES Framework Can Help to Study

**Governance :** The global supply chain is fragmented, it is challenging for the diverse interest groups within the network to align themselves with the global objectives of the supply chain and the end-customer. Supply chain governance and leadership are critical for achieving competitiveness.

**Risk:** The global supply chains are highly connected logistically, informationally and financially. These connections can become sources of risk. Risk in global supply chains can emanate from several sources including the supply chain and its partners

**Innovation:** There are two types of innovations: new to the world or new to the market. In the emerging market context, we need new-to-market innovations that can result in block buster industries for producing products affordable and delivering them at places accessible to the populations.

Performance: The performance analysis of global supply chains depends on several factors beyond the elements of the supply chain and the properties such as inventory and production lead times

We study these four in the coming lecture

**The Five STERM forces**

- **Science** research generates new and or improved products
- New **Technologies** (Internet, Search, Solar) emerge at a rapid pace
- New **Engineering** materials and designs come out every day
- Globalization brings new challenges of following **Regulations and policies** of several countries the intermediate products visits. Regulations such as Climate change require attention
- New **Management** techniques and business models such as outsourcing, sell direct, supply hubs are invented to face competition and enable growth.

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It to say that now as far as now this framework can help you study all these four factors there for another thing that is from a strategic perspective. This particular perspective gives you their five factors people with five storm forces

The ecosystem of the supply chain is based on the five forces emerging from science, engineering and management The Five STERM forces: **Science** research generates new and or improved products: New **Technologies** (Internet, Search, Solar) emerge at a rapid pace: New **Engineering** materials and designs come out every day: Globalization brings new challenges of following **Regulations and policies** of several countries the intermediate products visits. Regulations such as Climate change require attention: New **Management** techniques and business models such as outsourcing, sell direct, supply hubs are invented to face competition and enable growth.

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## A Question using STERM framework

What types of policies and programs to create, what tax reforms are needed or what general education policies and programs to introduce so that the companies in a vertical can become highly competitive in the global scenario

Sterm framework needs to answer what type of policies and programs to create; what tax reforms are needed or what general education policies and programs to introduce so that companies in a vertical can become highly competitive in the global scenario.

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## Conclusions

- We presented the ecosystem Framework
- We have shown how to map the ecosystem for Auto and Inbound logistics verticals
- We have put the ecosystem in perspective of the current literature on Investment climate
- We have outlined the STERM framework and also the GRIP framework

We presented the ecosystem framework with four factors. The supply chain, the resources the supply chain uses and institutions the governments the supply chain visits and the social institutions within those countries and also the delivery mechanisms the supply chain uses. We have also shown how to map the ecosystem for auto supply chain and also for the inbound logistics vertical. Well you could map the ecosystem for the food supply chain or for a telecom supply chain. One exercise that you could do is, to choose the vertical that you are interested in, then map the ecosystem. While mapping you need domain knowledge. We also have outlined the stem framework and the GRIP framework.



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