

**Indian Institute of Science
Bangalore**

NPTEL

**National Programme on
Technology Enhanced Learning**

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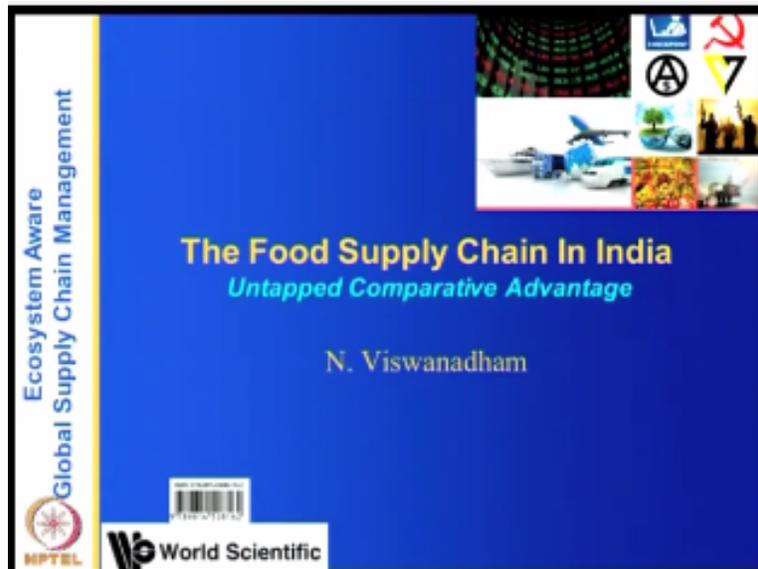
Global Supply Chain Management

Lecture-32 Food supply chain in India

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There is three other lectures we are going to talk about the food supply chain in India.

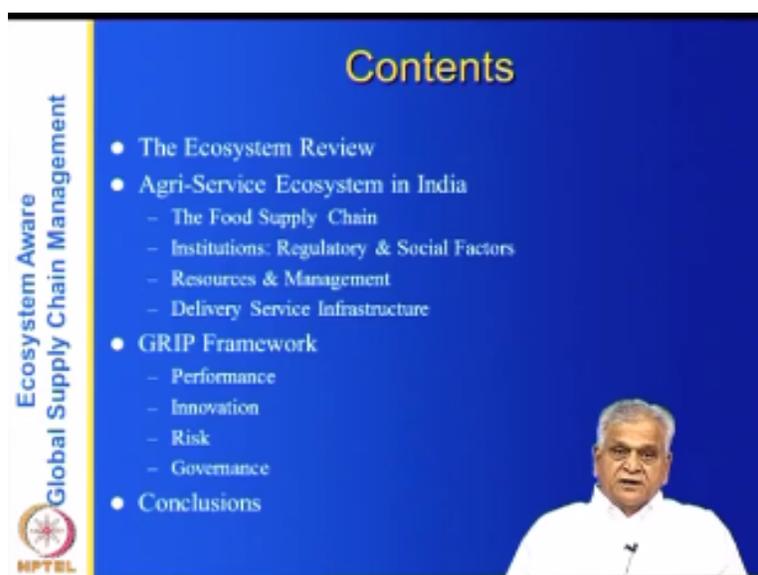
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This is a very important subject because India has 1.2 billion population 800 million people there live in villages whose preoccupation is this agriculture and 50 percent of the employment is in agriculture and added to that India has comparative advantage in terms of Agriculture but this has not been tapped or successfully attacked, so what we are going to do in this two or three lectures is to map the ecosystem for the food supply chain.

In India and find out what are the pitfalls and how they can be improved so first what we will do is too basically.

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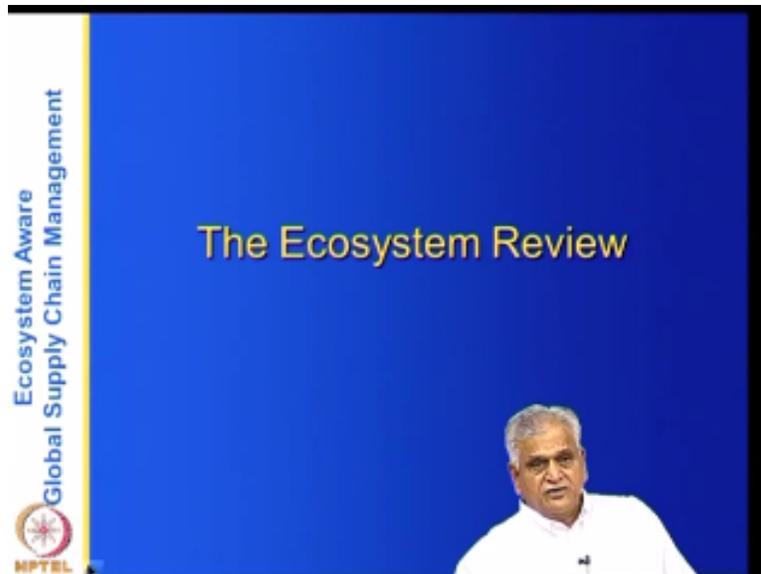
Review the ecosystem literature we have done so far and look at the agriculture service ecosystem in India and I will map the food supply chain and look at the institution's regulatory and social factors because in agriculture in any country is such an important factor then the garments are always involved and also it is because it involves everyone and in India in particular in India because a lot of about 400 million farmers so there are a lot of social factors that are involved and then we also look at what are the resources that are required for agriculture apart from seeds and water human financial and other resources.

And how they are managed and look at the delivery service infrastructure in other words for the forms and from forms to the customers what are the kind of logistics and in first you know an IT that are available today and other too that we will do the drip framework that is this is the he will study it hard to do the performance of a using a supply chain ecosystem so we will do the same thing for this supply chain this food supply chain and then talk about innovation what are the kinds of innovations that are possible in the food supply chain in India.

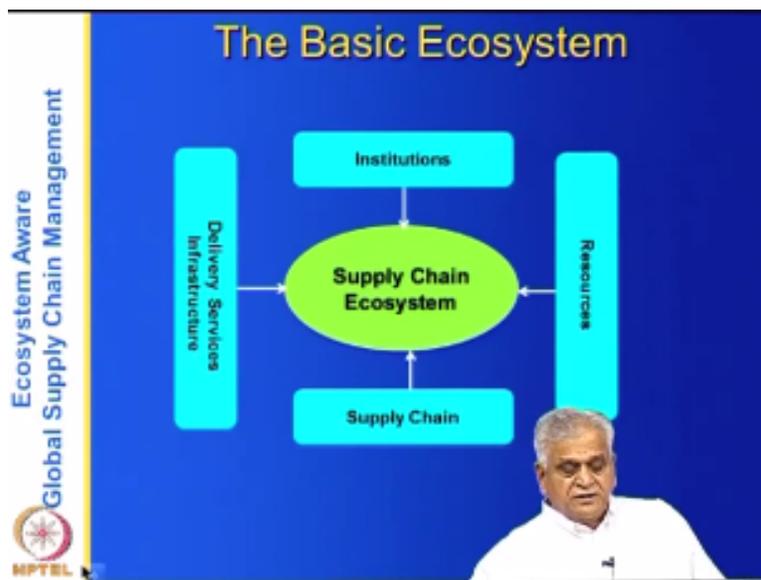
Now we have talked about innovations earlier the innovations need not have to be neuter to be neuter to the world kind of innovations, but which are happening even in agriculture there are neuter kind of innovations happening but here we are going to concentrate on new to the market kind of innovations how India can improve the efficiency of agriculture supply chain how can it should prove its performance and so on.

And then we look at what are the risk factors there is so many risk factors here because if you consider the ecosystem that is the government there are the social groups which are basically the factors and there is also a resource crunch and so let us look at all these factors what are causing resources and of course the governance governments of small form agriculture is a very difficult task so let us look at what are the kinds of governance structures that are available and then finally concluded so this may take two or three lecture. So we will see how much you can do in one lecture today.

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Do the equipped systems as applicable is in general and I do not see how it is can be applied to.
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The agriculture or the food supply chain so what are the basic ecosystem we have the supply chain and we have the resources the institutions and delivery service infrastructure in other words here we the Uni- supply chain is a very complex interacting system it requires resources it is dependent on the government's the places where the supply chain in Felicity and also it requires you know just anxiety and other kinds of infrastructure because they finally the

outcome or the product of any supply chain is a product or a service and then to be delivered to the customer.

So we also looked at what are called the investment climate and we said these three are called the investment climate for the supply chain and the investment climate depends on two things one is the country where these are this one and also the vertical of the supply chain so the investment climate is dependent on these two factors one is the vertical another one is the country and anything that happens you know if within the supply chain if you want something to happen either an innovation or a risk transmission then all these things are involved in other words the risk updates.

From one to the other and finally it affects the supply chain or there could be conflict between creating the resources and creating the loss there could be Co-Evolution of the innovation in other words one saying one thing leads to the other for example a deregulation may boost up the supply chain and it may create more resources and so on so basically anything happening for example a creation of a new resource like first search engines by Google Yahoo and others that a fact at the supply chain in terms of the advertisement and also into various other factors like b2b exchanges and so on.

So this basic questions to be sort of a very important this one so one has to carefully map the ecosystem for the particular bet vertical for a particular company that is involved.

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Now what happens in the global supply chain networks is that this for supply chain and resources in situations and delivery service mechanisms, if you look at all times the products produced and integrated locally so that is that in other words you are going to manufacture only for local and even if you are exporting you are going to get export the fully integrated products and vertically integrated local enterprises.

So resources which are used are only for local this one because enterprises local and the resources of local and local manufacturing and control export so basically you can experts are controlled and manufacturing is all done local so the institution the local loss of manufacturing apply like labor laws in labor unions and so on and the advance of the communications it was paper communication structure a sport and service local Denver's but what happened yet we interpret another outsourcing on others.

You have created a global supply chain now global supply chain has transformed this integrated products into modular global supply chain and production networks in other words here they are modular global production networks in other words every product is produced in say ten different countries so it a not cut produced by any one company in any one country so that and then this resources are also globally distributed networks.

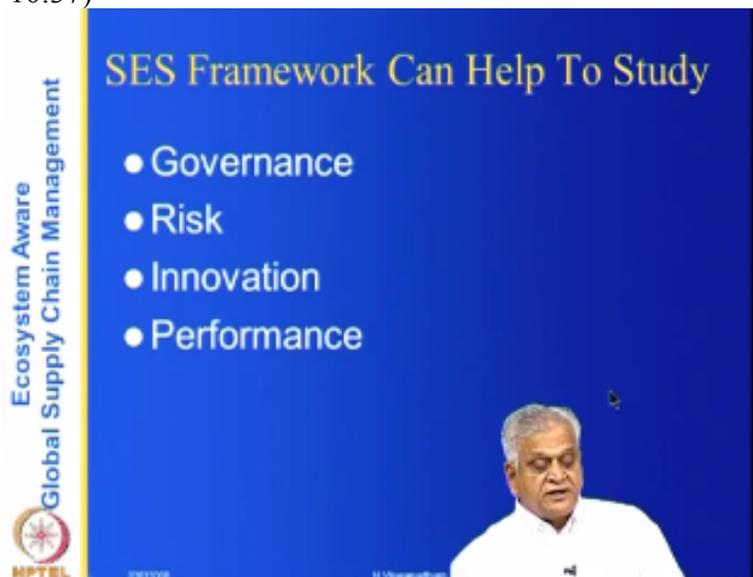
So they keep on using the resources so this has led to the modularity has led to outsourcing we have you are using global resource in other words whoever got it is low-cost you are going there and trying to reduce them that will try to produce the products there and free trade enable

global markets then this outsourcing has come then free trade has been enabled by the companies because they wanted investment they want jobs and I want economic prosperity and one country after another this free trade enable global markets form of course.

A delivery service mechanisms have been played and all mostly and they are interpretable three tiers serving global markets so but what has happened here is all the four factors this coalition here you can see modularity leading to global sourcing to free trade enabling and to internet and 3pl logistics and one after another it becomes a co-evolution here and similarly risk of us any resource like finance will affect the supply chain here it will make with the companies the countries protectionist and it will affect the logistics this war and so on.

So we can explain and we have done this already .I am just reviewing we can explain the risk propagation as well as the innovation co-evolution into all this and that could be conflict like you want to create a resource like a cluster or you want to allow people free a to FDI to FDI in the country and so on so where several thinks that that can happen in terms of the conflict.

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So what will you use this SES framework which is the supply chain ecosystem framework helps us to study four factors this is called the grip framework although we are going to study this and then the risk in the reverse order it is clear what Nets which is how the other one as globally dispersed manufacturing and service integrated system that is a big problem, so we have seen that there is several ways you know it could be a lead player who is doing it or it

could be by using the cobalt kind of thing all the members can elect a board and aboard the bunt systems or it could be an Orchestrator .

So there could be risk which are coming from all the four sides of the supply chain ecosystem apart from the supply chain it can come from resources due to resource crunch or it could come from the government's or it can come in so some factors or it could be through the delivery mechanisms and similarly innovations can occur in all the four things and the performance is dependent on all four so how this depends we already studied but this we are going to look at these four in the food supply chain.

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Supply Chain Redesign

- High Performance Supply Chains: Efforts of Stake holders for last two decades are highly risk prone.
- Tension between Weak and Strong Ties among Supply Chain partners
- New technologies are creating disruptive innovations
- Globalization has created long supply chain which are fragile and need monitoring
- Governance which involves partner selection, coordination and execution takes center stage

So using this you have to do anything to find the supply chain in other words this you map the ecosystem and you study the ecosystem all the four elements of any particular vertical and you do the grip analysis that grip analysis gives you what it gives you what is the state of affairs of a particular company of a vertical then look at delay design your supply chain so that it is more efficient so high performance supply chains efforts of stakeholders for the last two decades has been highly risk growth.

In other words the high performance supply chains efforts of stakeholders or highly risk prone because they all try to they were trying to do this apply the man matching we are trying to do lean manufacturing they were trying to do Ties and all that these are high performance all right but they leave a lot of less and there is a tension between weaken strong ties among the supply

chain partners today when you choose a supplier a supply chain partner a logistics provider you could do either have a permanent account with their and share all.

Your information with them have built up trust you can mutually finance each other and so on that is one way that with the strong ties or you can have weak ties you can go to the market and find out whoever is available you can use them so they are advantageous and both advantages are both at what is advantages of both so you can there is attention how to select what new technologies are creating disruptive innovations there are lots of new technologies which has come into play which are GPS RFID the sensor networks are in the Internet and that there is the big data or there is crowd sourcing and that is the cloud computing these are all.

The new technologies which have come into play recently and they are basically causing disruptions so you have to basically improve your supply chain design and use these new technologies and globalization has created long supply chains which are fragile I need monitoring one city of global this one if it is a local supply chain from Henry Ford Alford slowed and downwards we have hierarchical or a vertically integrated supply chain which is monitored by a hierarchical Network it is a highly bureaucratic network.

But still it is monitored and controlled but when it is a globally dispersed this one of independent companies then this becomes preside and this globalization needs more return of global supply chains and governments which involves partner selection coordination and executions takes the center stage, so you have other thing here but then for any given product who are they who are the partners how do you coordinate who does what and also how do you know whether everything that you have planned is happening so this takes center stage.

So if the question redesign of this we will consider for this example.

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Our Agenda

- We study the Food Supply Chain in India, model it using SES framework, conduct the GRIP Analysis and finally present the design of Food Security Network

So that we use this will study the food supply chain in India and we model this using the SES framework supply an ecosystem framework conduct drip analysis and finally preside the design of food security network so that is our agenda for the next three lectures so we will start with mapping the food supplies so they agree service ecosystem in India.

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Food and Groceries account for the largest share in Retail

- In 2011, 'Food and Grocery' accounted for nearly 59.5% of total revenues in the retail sector in India;
- 'Clothing and Fashion' followed with a share of 9.9 percent
- In 2011, 48% of total household income in India was spent on food and groceries

Market break-up by revenues (2011)

Category	Share (%)
Food & Grocery	59.5%
Others	16.9%
Furniture & Furnishing	9.9%
Electronics	4.0%
Beauty & Wellness	3.4%
Clothing & Fashion	3.4%

Source: Indian Retail Market, September 2011, Delhi: Aranca Research

What is the agree service system food and groceries account for the larger share and retail that you know the India and amateur market so if you look at the retail expenditure in the retail you have food is fifty nine point five and then comes then comes the others and then there is the clothing which is three point four nine point four and so on so basically beauty and wellness

clothing furniture and all this is given here but suffice it to say that market break up by revenues in 2011 that is the food groceries is almost like sixty percent of the retail.

In India so food supply chain is an important aspect for the retail industry so in 2011 food and grocery in context of fifty nine point five of the total revenues in the retail sector and clothing and fashion forward to this a share of 9.9 and 11:49 point for total 48% of total household income in India was spent on food bursaries so you can see the importance of food groceries in terms of the retail sector in India.

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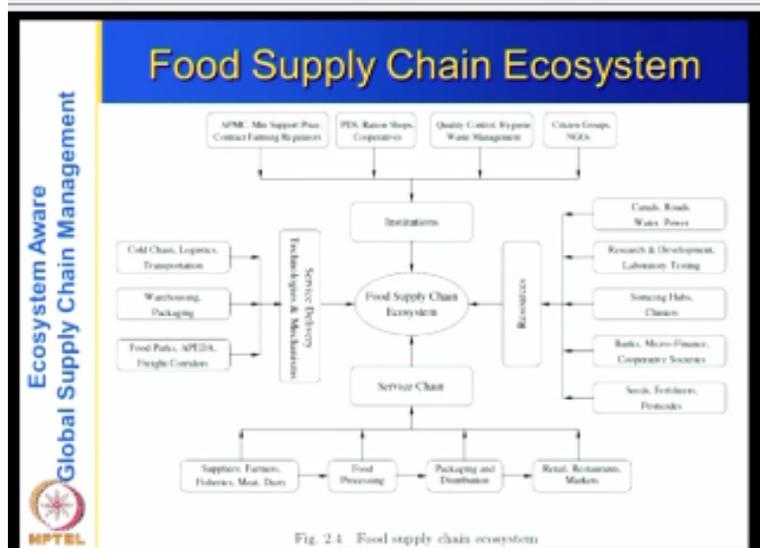


Fig. 2.4 Food supply chain ecosystem

So what is the food supply chain in India so let us look at what the service chain or supply chain here it is you start with the suppliers of seeds and fertilizers and so on and there the farmers who one deforms and or it could be fisheries meter diving and so on any of them so these are the categories of three of the farmers that we are considering and there are suppliers to this one of various kinds of things that seeds it is pet food and so on and all that and then of course.

The seeds to food processing now there is food processing the grains if you are talking about the processing of rice ,so we know something then there could be some processing involved and interests they are not very deep processing happens in India there are other words you do not bake ready-to-eat foods in the food processing industry only 5% is done in to ready to

make ate food kinds of things then of course packaging and distribution and packaging also in 98 is in an early stage but after watch it goes to retails restaurants and markets.

So you can see that the service chain from this is called farm to fork kind of supply chain that is the supply chain or service chain that you can see and then comes what have the resources you know sources are seeds fertilizers pesticides and so on of course we are a banks microfinance cooperative societies which gave loans to the to the farmers and their sourcing hubs and clusters of various food processing industries and so on that is of course the research and development in terms of how to improve the productivity of the line and also the laboratory testing soil testing and so on you have canals roads water and power because most of these irrigation requires water.

I mean that this one and the water usually comes either from the reverse through cannot or it comes through groundwater which is which requires power to move on earth the groundwater so you have all these kind of resources that are needed now these resources are important because if you want to have a good supply chain then you require laboratories laboratory testing the products and so on and let us look at the service delivery in other words theory you required most of these if there is temperature sensitive items then you require cold chain logistics and transportation and of course we are housing and packing there are foot parks iodized the check for agriculture and Freud called and so on so you can add if you want some other some other deliveries here mechanisms.

So you feel normally these are all the things that we consider for this supply chain that is the supply chain and resources and this but in the case of food supply chain the institutions play a big role in Andhra India there are several laws which make this supply chain highly complex what are these laws and why because India has a lot of poor people and a lot of people in the rural areas and this is called the 800, 800 million and so what the government does is to give them give them the grains at a cheaper rate these are called they have repeatedly few people who are eligible.

They have what are called the ration cards and from the ration card they get subsidized grace rice or wheat or kerosene or whatever and kerosene is her for this to use the to cook the food and basically you can see there is a way agriculture committee react and there is a minimum support price act and that is contract forming which are regulations and so on you know India

all these forms farmers are small farmers there are about 200 higher than forty hundred and forty million farmers.

In this in India and there are small formal homeowners that is maximum is about two head takers at us and they send the remaining 40 people forty percent or medium so you have these kind of regulations so that a small farmers are protected and we have PDS ,PDS is public distribution system public distribution system ration shops and cooperatives these basically are used to collect the produce from the farmers and so that they can be used in ration shops ration shops are the shops in a village or in a city where they guides or other rations are given to the card holders and so on.

So these you have there is a what is called Food Corporation of India and that basically collects all these grains processed with it and supplies it to the ration shops so public distribution system actually that gives some kind of a support Christ to the farmers which is usually higher than the market price then of course the air quality control has a in best management issues that are there you know .I see is both for the food and during for example and products like meat wealth comes on and so on becomes very important because but the adulteration or contamination can cause death and of course.

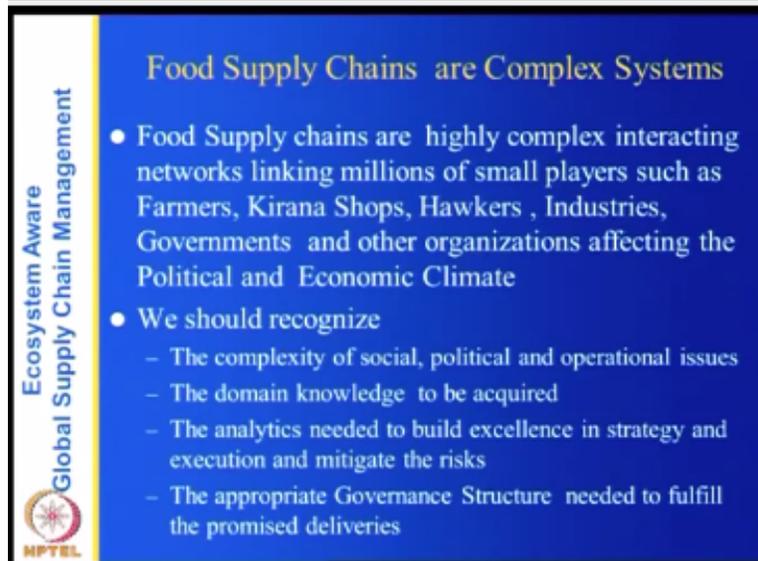
They are Syrian groups and anyone speaks this is because it was fought so that allies NGOs who are involved who supplied free food to the school children as well as there are also the city and groups which are involved which are this so you can see the complexity of the food supply chain here although it looks just if we just apply chain which we normally consider in our exercises we need to consider the data sources.

We need to consider the support a delivery mechanisms and more importantly the regulations from the government and the influence of the social groups in this now you can see how do you deliver a food to the people and in one of the resources here is the Guarani shops Guarani shop is a shop in your neighborhood then all these things are available the rice and other things are all available in the in the shop so then there are available in the shop these people are small they are 12 million get enough shops.

In India and they become a union and anything you want to do with reference to the distribution of food you have to basically they get involved so they make basically the citizen

groups which are involved in the distribution of food and similarly their hawkers street hawkers who and they may be illegal but they are 1.5 to 2 million of them in India and they basically supply food to poorer sections both in urban and rural areas and they have their unions so the issue of food supply chain becomes highly complex.

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Food Supply Chains are Complex Systems

- Food Supply chains are highly complex interacting networks linking millions of small players such as Farmers, Kirana Shops, Hawkers, Industries, Governments and other organizations affecting the Political and Economic Climate
- We should recognize
 - The complexity of social, political and operational issues
 - The domain knowledge to be acquired
 - The analytics needed to build excellence in strategy and execution and mitigate the risks
 - The appropriate Governance Structure needed to fulfill the promised deliveries

NPTL

So there are complex systems so food supply chains are highly complex interacting networks linking millions of small players like farmers, Kirana shops, hawkers industries come another organization organizations affecting the political and economic climate now how does it affect the political climate the farmers or you know 400 million of them on their word banks so if you try to play with them then in such a case then the big government get called out and similarly the economic climate because they far mainly the GDP about 13% of 14% of the GDP is agriculture contributes to the joy to the GDP of India.

If you used to be almost like 50% but it came now down to 13 14 percent and it basically affects the economic climate and we should recognize that the complexity of social political and operational issues in the food supply chain and the domain knowledge to be acquired in other what you should know when you are making noise or when you are divided designing the supply chain you should know what is the kind of things you are dealing with what is the domain knowledge and the analytics needed to be excellence in strategy execution.

And immediate arrest what is the kind of data you re-collect and what are the editions you need to make and what is how do you how do you make them and so on so this issue analytics is

becomes an important thing and they appropriate governance structure need a difference in the promise deliveries now hear this which be the governance structure becomes much more important in there. Put supply chain case.

Because you have farmers there are 140 million of them such a huge one in this country and you are talking of 12 million Kirana shops and so on these are very large numbers and there are 28 states for the union territories and several civil other groups so you have to deal with all this and you need to have a governance structure which is not only professional.

But also social in other words it has to deal with these farmers will speak only the local language it has to deal with the government's it has to deal with these associations like Farmers Association or the culture Association then you had to deal with the hawkers you had a deal with the corona shops and so on so basically it becomes socially highly complex issue so having set this map with this let us look one by one.

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Let us look at first their food supply chain.

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Global Supply Chain Management



The Plough-Plate Food Supply Chain



- The supply chain involves farmers, seed producers, fertilizer factories, financial institutions, millers, government, warehouses, fair price shops, retail shops, railways, truck transport companies, etc.
- **Does anyone orchestrate the relationship among all the actors**

The Plough-Plate supply chain you have this is the farmer the plough basically they do not use machines here and this is the distribution where people take it from the village to a Mandi or to a market place this is what is called the Mandi on a distribution center where for a farmers market may be all these things are all distributed than their small to the retailers and so on and finally these are the retailers strict hawkers who basically take it to the streets and there is deliver it to the house but finally this is the food that no probably cook so the issue is this is called plough to plate this is the plough.

And they set the plate plough to plate food supply chain and you can see how efficient or inefficient the supply chain he is here in other words there is lot of manual handling that goes on here because of that there are lots of vestiges and 30% of the food is wasted away that is because mostly and manual hand so the supply chain in one farmers seed producer fertilizers factories financial institutions Millers , governments, warehouses, favorite shops , retail shops railways ,truck transport companies ,etcetera is set right in there several of these people.

Who are involved does anyone orchestrate the relationship among the farmers now that is if you ask the question why is the formal producing something tomatoes or potatoes or something as we seen that there is a market requirement for that as we seem like other industries like when you are producing an automobile or we are producing a 2 wheeler or four wheeler whatever so in any industry you look at what is the advantage and whether what is a computation and so on

here is the farmer doing that the answer is no does he know what is the requirement whether it is carrots or potatoes or tomatoes or something yeah all cerise know.

So how does the farmer know hi sell his produce so he thinks he can produce something and then he can sell it if he cannot sell it then he will have you will have problems so the issue then is can you have demand even agriculture the answer is yes you can have but it does not exist today.

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The slide features a blue background with a white vertical bar on the left containing the text 'Ecosystem Aware Global Supply Chain Management' and the NPTEL logo. The main title 'Supply Chain Inefficiencies' is in yellow. A list of 13 inefficiencies is shown in white text, and a small photo of a man in a white shirt is in the bottom right corner.

- 106 M small farmers
- 400 M agri workers
- 12 M Kirana shops
- 1.5 Million Hawkers
- Too many intermediaries
- Manual handling
- Improper packaging
- Standards for Hygiene
- Not demand driven: No contract farming
- Subsidized pricing
- Public distribution inefficient
- Reach to customers is difficult

What are the inefficiencies they are higher and 6 million small farmers 400 million agriculture workers plural million Kirana shocked 1.5 million hawkers and there are too many intermediaries there are worse fit between the farm and the retail their intermediaries who will discuss you know, if you know talking to social network terms the farmers are in villages they are not socially connected to the big retailers they are not members of Linked In or social or other social networks so that creates the problem so there how to depend on.

An intermediary who can take advantage of them and remember any of this mostly the vegetables fruits and so on there are variable and one has to be careful they have to be stored in a temperature sensitive places or they have to be transported carefully but otherwise they will spoiled so because of all these reasons the intermediacy place the big hall that is manual learning handling improper packing and standard for Hygiene it these become important and

not demand-driven no contract forming language varies contract farming but in a less this one and it is not at all the Mandi.

You produce something you produce cotton because these they are demanding them in the market for this so and that is also subsidized pricing that is because they come and tries to procure and so on and that is a public distribution which is inefficient and reach to customers is difficult now reach to customers of the farmers are they retailers it is very difficult because they are not connected to.

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The slide features a blue background with yellow and white text. On the left side, there is a vertical yellow bar containing the text 'Ecosystem Aware' and 'Global Supply Chain Management' in white, with the NPTEL logo below it. The main title 'Food Manufacturing' is in yellow. The bullet points are in white, and the concluding statement is in cyan.

Food Manufacturing

- Only a small percentage of fresh produce or meat are processed.
- Post harvest research and food product testing are at a very nascent stage
- Negatives on Food manufacturing in India
 - Food Packaging is expensive
 - High import duties on Processing and Packaging machinery
 - High sales tax on packaged foods.
 - High protein food not available

Processed Food more expensive than freshly cooked food

I know but about food manufacturing in other words said most advanced countries you will find that the route the fluids vegetables and so on they are available but not the major this one eighty percent all most of the food is processed only a small percentage of food producers are meat or processed in India you will get all stuff push for less research on food production testing of our very nature research stage our agriculture has two stages now it is from seed to harvesting and from harvesting to the to the processed food.

Now tell you when you harvest something say bananas or something or any fruits vegetables if you clip it them in Sun then they basically get spoiled very fast in other words their lifetime becomes very small but on the other hand if you find them or remove the in so called latent heat inside them then their lifetime increases, so basically this is the there are a lot of post harvest researcher for each product you can have their post watch post harvest treatment but suffice it

to say the product after harvesting has to be carefully stored prioritize temper those temperature sensitive it has to be an either condition or this one and also.

While processing and packaging this becomes very important it should not get spoiled if there is too much of manual handling so that is where the post-harvest research becomes an important thing and that is neglected in India so negatives on foot naturally in India food packaging is expensive why is food packaging expensive it is expensive because most of the packaging is important and that is a stay to tea there is excise duty on the imported packaging this one and so in other words suffer for some things like potato chip packets and so on.

It can go anywhere to 20 to 30 percent is packaging cost and high import duties on processing and packaging machinery so you know there high import duties are processing and packaging machinery high cell stacks and packaged foods because they think packaged foods are the lightest items high protein food is not available so what does this mean this means processed food is more expensive than freshly cooked food this is the irony here that which one should be more expensive freshly cooked food right.

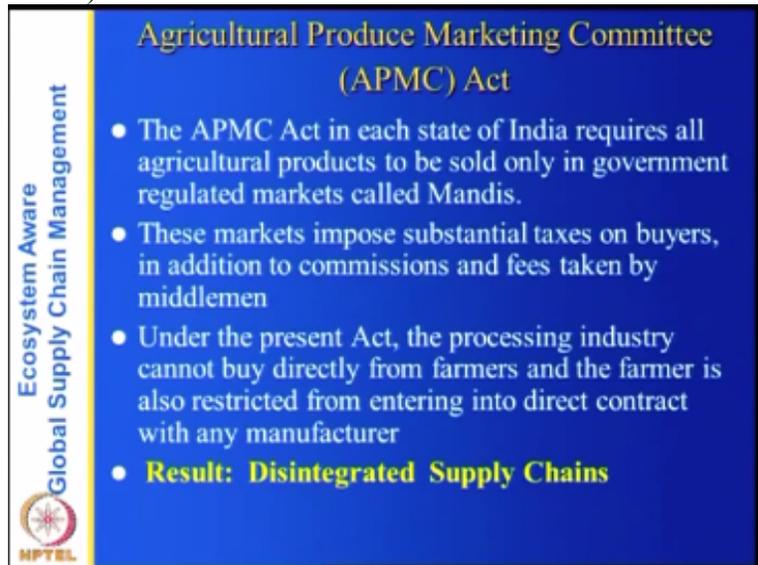
Because it is fresh but process what is here is expensive and this is because of this so. I mean although their packaging factories and laboratories and so on food packaging is it is an immediate contention here.

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So what are the institutions and regulatory and social factors that matter?

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The slide features a blue background with a white border. On the left side, there is a vertical logo for 'Ecosystem Aware Global Supply Chain Management' with 'HPTCL' at the bottom. The main content is centered and includes the title 'Agricultural Produce Marketing Committee (APMC) Act' and a list of four bullet points. The last bullet point is highlighted in yellow.

Agricultural Produce Marketing Committee (APMC) Act

- The APMC Act in each state of India requires all agricultural products to be sold only in government regulated markets called Mandis.
- These markets impose substantial taxes on buyers, in addition to commissions and fees taken by middlemen
- Under the present Act, the processing industry cannot buy directly from farmers and the farmer is also restricted from entering into direct contract with any manufacturer
- **Result: Disintegrated Supply Chains**

So there Agricultural produce marketing act which is APMC act APMC act in each state of India requires all agriculture products to be sold only in government regulated markets called Mandis in other words a farmer cannot sell directly to a retailer like reliance fresh or more or food bizarre or whatever so this act has come in because they. I think that this regular it is big players of the retailers there basically will be therefore there will hold hostile to the farmers and try to take advantage of the small players but that was the hay APMC act and some states of course this has been repelled.

But these markets impose substantial taxes on buyers in addition to commissions and fees taken by the middleman so what this also creates the middleman these markets impose substantial taxes on bias and in addition to Commission and so on under the present act the processing industry cannot buy directly from the farmers and the farmer is also restricted from entering into direct contact with any manufacturer so result what happens is because of these acts all this acts were made to protect the former so but this is the circuit disintegrate at the supply chain.

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Mandi: Farmer's Market

- The APMC Act, which regulates Mandis, was amended in many states.
- Companies still cannot buy but only can lease fertile land from the farmer.
- They can buy waste land or lease it
- Retailers find it difficult to work directly with the farmers and change the Mandi mechanism.
- The Mandis remain more price-competitive. Retailers source from mandis instead of developing their own supply chains.
- **Supply chain is as efficient as that of a Mandi**

That is Korea so there are what is let us look at the Mandi is what is called the farmers market and the APMC act which regulates Mandis was amended in many states and company still cannot buy but only can lease fertile land from the former they can buy Westland or lease it they tell us find it difficult to work directly with the farmers and change the Mandi mechanism the Mandis remind more price competitive all said and done so they tell a source from Mandis instead of developing their own supply chains.

So the I mean these are the options that people given the laws given the social factors so the supply chain is as efficient as their Mandi so this is the this is the state of affairs of the this one.

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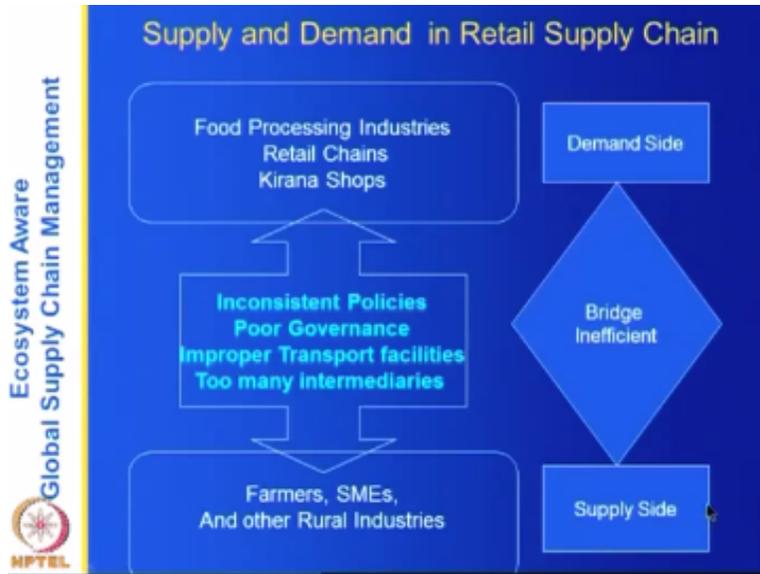
Government Intervention Policies

- The Minimum support price offered by the Govt. for 24 crops acts as insurance for farmers against price fluctuations and provides inputs to the PDS
- The essential commodities act empowers the Govt. to control production, distribution & pricing, etc to secure equitable distribution and fair pricing. This restricts interstate movement of goods
- **These regulations may have lost their utility and are hampering the growth & modernization of organized retail**

So what are the government intervention policies in women support price offered by the government what 24 crafts acts as an insurance for the farmer against price fluctuations and provides input to the public distribution system as I said earlier they said the minimum support price is offered by the government for 24 crops and it basically gives more price than a market the essential commodities Act empowers the government to control production distribution and pricing etc to secure equilibrant distribution and fair pricing this restricts interstate movement of goods in other words.

If you they have forms of where in India can you sell anywhere in India the answer is no so the government tries to control the production distribution and pricing etcetera to secure a equal distribution and sale pricing so that is another it is not a free market these regulations may have lost their utility and are hampering the growth and modernization of organized retail now if you look at since you know the food and groceries or 60% of retail so anything you do here in all this these laws are gone definitely going to affect the efficiency of the supply chain that you.

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So we want basically if you look at the supply side and the demand side you have to demand. I mean we have one you have to feed 1.2 billion people and here the supply side we are going to look at what other sources that we have and between them or if here are the farmers SMEs and other rural industries and you have food processing industries retail chains Kirana shops but inconsistent policies and poor governance improper transport facilities too many intermediaries they will affect your supply chain.

So you may see that how the policies of the government or the institutions are affecting the supply chain.

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This let us look at the resources and management.

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The slide features a blue background with a vertical sidebar on the left. The sidebar contains the text 'Ecosystem Aware' and 'Global Supply Chain Management' in white, with the NPTEL logo at the bottom. The main content area is titled 'The India Advantage' in yellow. Below the title is a list of seven bullet points in white text.

The India Advantage

- In India, 52% of land is cultivable & World average is 11%
- All 15 major climates of the World are in India (Snow bound Himalayas to hot humid southern peninsula)
- India has 20 agro-climatic regions & 46 of 60 in soil types
- Sunshine hours and day length ideally suited for year round crop cultivation.
- Mega centre for biodiversity in plants, animals, insects, microorganism and accounts for 17% animal, 12% plants and 10% fish genetic resources of the globe.
- Live stock sector: India has 16% of cattle, 57% of buffalos, 17% of goats and 5 % of sheep population of the world.

So resources has an advantage you know India is very lucky to have 52 % of the land is cultural whereas the world average is 11% you know from Himalayas to the southern lands southern states you know 52 % of the land is all 15 major climates of the world or in India snowbound Himalayas - hot humid southern peninsula in the 20 agro climatic regions and 46 of 65 types so enjoying our Sun daylight ideally suited for a year-round crop cultivation mega center for biodiversity in plants animals insects microorganisms and account for 17% of animal 12% of plants and 10% of fish genetic resources of the globe livestock sector India and 16 % of cattle 57 % buffaloes 17 % of goats and 5% of sheep population of the world.

So you can see that nature has been very kind to India so there is an India advantage in terms of this one they said the reason why I was saying that the food supply chain has a compacted comparative advantage it has the people who can do the farming it has the reverse it has a groundwater so basically what is it that is stopping the inefficiencies in efficiencies because of the government policies because of the unawareness of the people and no post-harvest research and so on.

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Indian Agriculture

- Agriculture contributes 13.7% to GDP, 43 B exports and employs more than 50.0 % of country's work force.
- India has more than 106 M small farm holdings
- Second highest fruit and vegetable producer in the world and cold storage available only for 10%
- Second highest producer of milk. Additional cold storage needed
- Fifth largest producer of eggs. Cold chain needs are more
- Sixth largest producer of fish

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So Indian agriculture contributes 13.7 % of GDP as I said before it used to be 50 % now it has come to thirteen point seven forty three billion dollars export and employs 50% of the country's workforce India has more than hundred sixty hundred six million small formal groups and second-highest fruits and vegetables producer in the only and second has produced from milk fifth largest producer of eggs and six the largest producer of fish and coach chain is needed for all these sectors to this and sea to feed value driven agriculture.

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Seed-Feed: Value Driven Agriculture

- **Current Scenario, Supply driven** : The farmer is unaware of the market, Crops something and tries to sell in a mandi or to an agent and expects a fair price & immediate payment.
- **Desirable Scenario**: The farmer crops to market demand the right (Optimal) grade of produce and sells to right customers to get maximum income
- **Need to transform the way agriculture works, create business orientation among the farming community**

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I think the kind of things that India needs today is current scenario is applied even the farmer is unaware of a market crop something and tries to sell in a Mandi or a NH or expects a fair price

an immediate payment so in other words this is not a business light at all because you do not know what is needed you produce something and that tries to sell and what is it desirable sin on you if farmer crops to market demand yeah right for optimal grade of produce and cells row to the right customers to get the maximum income.

But how does this happen so that is the kind of change who had to be from seed to feed to value driven agriculture and a need to transform the way of the culture works create business orientation among the farming community so this is basically a social education that one needs to give it any farmers

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Standards

- Standardization is a powerful tool for improving supply chain efficiency.
- Standards enable partners enables better compatibility and interoperability of their systems and processes.
- There are two kinds of standards in the food supply chain.
 - The food standard that concerns the manufacturing process, content and packaging etc for dairy, poultry, ready to eat foods
 - The logistics and IT systems standardization concerns the cartons, pallets and IT software so that seamless transfer of goods and information is possible.

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What about the standards the under digestion is a powerful tool for improving supply chain efficiency standards and able partners better compatibility and interoperability of their systems and processes under digestion of this one in other words you know based on the weather conditions and all that how do you how are you want to watch crop and how do you produce and if you want a better tomatoes or apples how are you going to do they what are the kind of standard practices and so on so there are two kinds of standards in the food industry the food standard that concerns.

The manufacturing process content packaging etc or diary poultry and ready-to-eat foods in other words there is it you know everything that you eat whether it is a milk or foods or something they are initially processed although it is like processing so that needs to be

standardized means what if you want to milk and if you try to add some preservatives so that it stays long or it stays in hot weathers and so on then he said safe so one way to look at and logistics and IT system standardization concerns cartons ballots IT software so that similar transfer of goods and information is possible so in other words if you look at any of these standardized warehouses whether WMS this one warehouse management systems transportation management systems.

Cartons all the standard sizes how these are transported stored and so on what are the temperatures pressures and so on but in India most of these things are stored in the Sun so that will actually make it this file and so on.

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So basically if you look at this one the standards that that count here so if you look at what you need to do in terms of the resources so if you want to use the India advantage then you need to standardize these procedures and that requires a lot of this one so that will come to delivery service and then afterwards we are going to look at this one let us recap what we are trying to do what we are trying to do here we have taken the food supply China and India so what happens of this supply chain.

You have 120 million or 106 million small farmers less than 2 hectares and their 400 million workers which has 50% of working population you have you have to feed the 800 million people or 1.2 billion people for all this and is the agriculture efficient in other words here there

are several problems associated with the cropping patterns and also once you crop something random bring go before it comes to the market the supply chain seems to be efficient and what are the resources like water ground water is basically becoming scarce the power is basically if you want to use the power to either transport water or bring water.

Then water up this one to run your motors then that is also becoming very expensive and this one so the resources which have been see cheap in the olden days like water power and so on they are become scarce so it becomes very important that for people to look at look at the agriculture which is a very important thing because you know it supplies 2 for 3 to look at how to make this efficient so that is why we are first looking at the Indian which Indian applied trained foot supply chain which is an emerging market.

Which are large players which is important for the country and what are the rules regulations and the supply chain efficiencies that we hear we have looked at and what are the resources so if you look at the Indian resources they are mind-boggling you have basically everything that you need the only thing is you have all the resources your resource management skills are very bad and second thing is it is the mindset of the government and the people that are involved who are the planners that they are basically concentrate and pre-harvest they do not concentrate a on food processing industry .

Because if you want to supply a nutritious food as we see in the next few like next lecture that then it is a processed food you have to add vitamins minerals and so on to the food one thing is to produce crops with vitamin very enriched products like sweet potatoes and all that or you have you can produce grains which are vitamin not mineral enriched but that kind of research will take a long time to materialize but what can be done today is you take the grains you have added vitamins and I add minerals.

So that they become food secure so let us look at the delivery service infrastructure or what is called also they last might in other words from the farmer to the consumer what are the kinds of infrastructure that we have and what are the problem.

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Cold Chain

- Cold chain provides facilities for storage for perishables from origin to point of consumption in order to preserve quality and ensure longer life.
- Cold Chain Infrastructure includes
 - Pre-cooling facilities, Cold Storages ,Refrigerated Carriers,
 - Multi-Modal Transportation
 - Information Management System, WMS, RFID,
- These are in short supply in India

So look at what is since gravesite provides facilities for storage of perishables from origin to point of consumption in order to present progress of quality and ensure long life see the point is all these products that we have they are perishable in other words they get they got spoiled once they are not stored properly and so on so already the foodstuffs are scarce and if they are spoiled then it will be 30 or 40 % is going to be wasted as now as in India so - also it will be low quality so to preserve both quality and also longer life will require cold chain whole train infrastructure includes three cooling facilities as I said before.

If you want if you pre cool then you are going to increase the life and also cold storage and the refrigerated carriers for example some of the some of the foodstuffs fruits and so on they had to be use the refrigerated multimodal transportation either train or truck and so on and then information management systems like warehouse management systems use sensor networks like radio frequency identification tags and so on so basically if you like if you want to look at the cold chain and cold chain provides facilities for this one it is an important element.

In agriculture but these are in short supply in India that is one of the problems that we have but one of the issues that India has if you look at any state in state there are transportation systems available in other words there are buses from our headquarters it will state capital to move the village so can these transportation systems bad buses can they be possible have it air conditioned or temperature sensitive right care compartments so that they can carry her to the

villages one of the problems that one may have is you may not be able to have full load trucks from each from the each capital.

To the village and actually the food trucks are they come from the village to the to the capital's because the food is supplied there so it in terms of all this there is some thinking that is needed to make the existing infrastructure more friendly to frights.

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The slide features a blue background with a white vertical bar on the left. The white bar contains the text 'Ecosystem Aware Global Supply Chain Management' and the NPTEL logo. The main title 'Distribution Logistics In India' is in yellow. Below the title are four white bullet points.

Distribution Logistics In India

- Fragmented, Individual company based, technology sophistication minimal, not integrated into the supply chain.
- Current attempts are to build hard infrastructure and no attention to soft infrastructure such as trade facilitation, ERP, WMS, Sensor Networks
- Losses due to theft, spoilage, goods damage due to manual handling, long lead-time and resultant supply chain inefficiencies.
- India ranks 46 on the 2012 logistics performance index.

So what is the distribution logistics in India fragmented in other words there are four to three truck corners there are millions of them individual company based the distributions or individual company based if you have Food Corporation of India it has 5000 warehouses if you take ITC which is a big company it has 2000 warehouses and so on technology sophistication minimum thus these warehouses and others do they have the warehouse management system and then temperature sensitive air conditioning and so on.

Are they integrated into the global supply chain or the supply chain itself it on sir is no so basically these warehouses or not are used properly for temporary storage of their products rather than as a part of the value chain so current attempts to build hard infrastructure in other words what are the attempts that people are making today the attempts are to build hard infrastructure what is hard infrastructure our infrastructure is roads warehouses container fry stations and these kind of things are the hard infrastructure.

So which is accepted tension which is highly expensive unnecessary but as we saw earlier that the both the efficiency and the time that is taken or of an in supply chain are dependent on the soft infrastructure as well what are the kinds of soft infrastructure that you require that is using not only software trade facilitation ERP enterprise and source managed planning systems warehouse management systems sensor networks all these things are they soft infrastructure in when you are transporting goods.

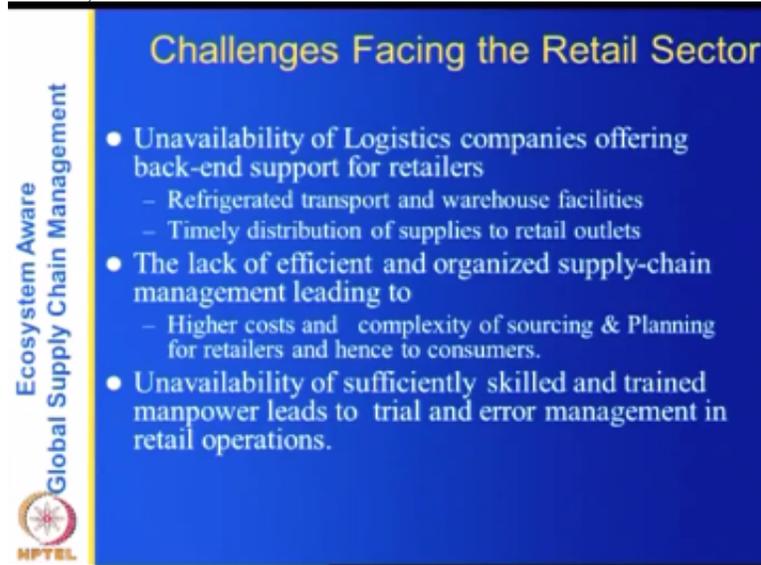
If you want to take permissions for the transport how many forms you have to fill up and how many permissions you need to take for interest interstate transfer so and if you are doing the transfer from one place to the intern in this M state how many times this is the truck goes from the form to directly to the e to the Mandi yard the answer is no it may have to be it is not even crosstalk cross talking is not familiar it is they material the material then is Matt hi and sandaled three or four times and it has changed changes three or four track they are four trucks.

So in the result there is lot of manual handling and which spoils the vegetables and this one and so on so losses due to theft spoilage Goods damage due to manual handling long lead times and resultant supply chain efficiency so the supply chain becomes highly inefficient because of the this manual handling along with grants and so on and India ranks 46 on the 212 logistics performance index I mean you have all these performance indices that that where countries are ranked and India of course ranks pretty low it terms of in terms of 46 in terms of the logistics performance index.

Now the performance index depends on several factors and it basically depends on the infrastructure mainly I also a number of players who are involved how many type third party logistics players how many people with trucks and trucks also what is the condition of the trucks in other words are they volt trucks or something so basically you have to look at what is the state of the equipment as well as the other assets Logistics assets and their technological technology enablement.

It is used if you have a warehouse is it air-conditioned is a temporary temperature sensitive does it use forklifts it is automatic material handling and does it have RFID tags and so on so that you can basically find out whether a particular item is there or you have to go somebody has to go on searching for it so what are the losses in the warehouse so there are several issues which are involved so what is the challenges facing the retail sector.

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Challenges Facing the Retail Sector

- Unavailability of Logistics companies offering back-end support for retailers
 - Refrigerated transport and warehouse facilities
 - Timely distribution of supplies to retail outlets
- The lack of efficient and organized supply-chain management leading to
 - Higher costs and complexity of sourcing & Planning for retailers and hence to consumers.
- Unavailability of sufficiently skilled and trained manpower leads to trial and error management in retail operations.

HPTSL

Another on ability of Logistics Company is offering back and support for retailers. So if you are a retailer writer exec it with cold iron or things you require two things one is shop shopping mall space and second thing is in there has space to store goods the place and also there you do not want to do it yourself you are a retailer so the back and support you need some logistics company to do it I mean you could do the logistic herself but it will equate to be very expensive so refrigerator transport and warehouse facilities timely distribution of supplies.

To retail outlets and the lack of efficient and organized supply chain management leading to higher costs traced to higher cost and complexity of sourcing and planning for retailers so if you are a retailer becomes your sourcing becomes very complex so what are you what are you sourcing from where are you sourcing from not a source if it is fruits and vegetables from amending and who is going to transport from Mandi to your retail shop there is no largest explainers which are who have reputation.

So you have to hire a truck or something and then these negotiations we can say whether they build a big this one and planning for retailers has snow hence to the consumers I mean after all they tell us our intermediaries they are going to pass it on to the consumer so why is this like a high-cost coming up the high cost is coming up why this because of inefficiencies in this unavailability of sufficiently skilled and trained manpower leads to trial under management in retail operations so everybody thinks he can sell.

We can procure and so on but the unavailability of the skilled manpower it goes into it basically takes it basically pleads to trial and error management.

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The slide features a blue background with yellow and white text. On the left side, there is a vertical logo for 'Ecosystem Aware Global Supply Chain Management' with the acronym 'HPTTEL' and a circular icon. The main title is 'Use existing Facilities more Fruitfully'. Below the title, the text reads: 'Take advantage of the vast network and logistical capabilities of the existing institutions such as Post office, Road transport corporations, Banks, etc to bring a host of services to rural populations.' At the bottom, it says 'Do not wait for the infrastructure to be available'. A small mouse cursor is visible at the bottom center of the slide.

So one thing needs to comply that they their oaths are not there or the warehouse management and other things are used and so on but are you using the existing facilities fruitfully are you using existing facilities as they are donors so the answer is no take advantage of the vast network and logistics capabilities are the existing institutions there are seven institutions here post office they are hunted 65,000 post offices almost every village has a as a post office.

So what is a post office it is a basically a letter delivery as well as it is also a bank so is it possible to use the post office as a delivery mechanism there develop ourselves is it possible to ship something if they somebody wants to ship something to a village retailer is it possible to send it by the road transport bus to the post office and the post office will deliver it to the retailer or retailer we will collect from the post office and there several banks bank branches etc so is it hosts of services that can be given by using the existing infrastructure.

So we are not try to use the innovations I am not trying to innovate using the existing how to use the existing infrastructure to provide a new sound valuable services to the populations because if you are retailer in a village his requirements are low he does not require big trucks to supply certainly a passenger bus with a air-conditioned compartment can supply the goods that

are needed to the village and the bus passes through several villages so it has an advantage if it has a right compartment so the issue is are we thinking about this do not create.

For the infrastructure to they were available and you said start use the existing facilities more fruitfully in other words it will be highly inefficient to wait for the exits to the infrastructure to be to be available because the infrastructure is asset intensive and a capital intensive it takes a long time for the infrastructure to be available in the fashion that you require.

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The slide is titled "Food Safety and Hygiene" 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 at the bottom. The main content consists of four bullet points:

- Need to assure consumers about safety and quality of food.
- The Sanitary and Phytosanitary (SPS) Agreement under WTO has led to increasing recognition and adoption of food safety measures.
- Compliance with international food standards is a prerequisite to gain a higher share of world trade.
- **Food standards are important**
 - Concerns on food safety on the back of breakout of diseases such as BSE, Avian Influenza, Bird Flu etc
 - Growing consumer demand for products which are healthy .

What about food safety in housing due to insurance consumers about safety and quality of food safety is important and the sanitary and phytosanitary SPS agreement under WTO as like to increasing recognition and our option of food safety measures in other words at the point of entry into the cost into the country not at the point of departure in your country at the point of entry into the country the foodstuffs should satisfy SBS agreement so if they do not the food will be returned so their food that is rejected by a country why should it return you have to basically dump it somewhere so it becomes very important that you follow.

These regulations otherwise countries can assure compliance with international food standards is a plaque with directly to gain higher share of the world trade food standards are important concerns on footsteps on the back and food safety on the back of breakout this is just such as BSE avian influenza Avian Influenza Bird Flu etc particularly for meat eaters this becomes very important to in terms of the food safety because it types of Avain influence our bird flu or

something by the time it is recognized that there is bird flu in your birds you could have so a lot of meat.

Which you could have infected two people so one has to be extremely careful going to consumer demand for the products which are healthy so there is this one so the Food Standards becomes and hygiene becomes important.

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So if you look at the food supply chain in India very if you want to be this one it is highly inefficient we have gone through the ecosystem we are gone through supply chain we are gone through the resources we ran through the institutions and we have gone through the delivery mechanisms and the conclusion it is very inefficient needs good governance needs food processing industry if cold chain logistics it needs immediate attention because it affects the entire country so with this we will stop here and then continue next.

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