Logistics & Supply Chain Management

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Lecture 09 : Logistics Key Performance Indicators (KPIs)

hello dear friends welcome back to NPTEL online course on logistics and supply chain management. So, today we will start a discussion on logistic key performance indicators. So, till now we have discussed about various aspects under logistics function, we talked about transportation, we talked about warehousing, we talked about storage, we talked about logistics service provider, we talked about the national and international scenario as far as this logistics industry is concerned. Now, after getting that initial opinion about what logistics is supposed to do and what logistics is right now and what is the current scenario. we will talk about or we will try to identify some of the key performance indicators. So, that we can focus on those indicators and the overall customer experience can be enhanced in that way.

So, in this session we will try to discuss about the various types of key performance indicators and obviously, then functional wise we will go first for transportation indicators. then supply key performance indicators we'll talk about distribution performance indicators warehousing and order management indicators and in the end logistics overall performance indicators we will talk about so measuring and managing logistic performance involves evaluating various aspects of logistics operation obviously to assess efficiency effectiveness and compliance so efficiency with respect to cost effectiveness how effectively you are meeting the customer demands and compliance with the whatever your initial vision mission statements are and your goal objectives in line to those vision and mission statements right. If randomly we will talk about the performance indicators, you will talk about obviously as a customer you will talk about whether you are getting on time delivery or not, whether you are getting the variety or in the inventory or not, whether your order is processed accurately, right? and at what cost you are getting that order whether you are getting that doorstep delivery or not whether you are getting the orders as per your convenience or not and in the end whether when the final product is shipped to you and you are opening that packet whether your expectations are being met or not so these are some of the points when we talk about key performance indicators but it's not only one this is one aspect we are looking for the customer So, let me little bit try to you know elaborate on this point see these there are two extreme ends when we are talking about key performance indicators. When we are talking about performance indicators.

first is what are the implications for the services providers right services providers or the companies who are selling the products and services right so whatever if you are talking about e-commerce industry so all the e-commerce players what are the implication to those players when we are talking about kpis and second is the service level provided to customer so when we are actually we are making trade off between these two. all the time whenever we are coming up with new services new features or we are trying to delight our customer there is trade off between exactly if I will use the term is your responsiveness to customer your responsiveness to customer how responsibly you are delivering your product and services to customer And then at what cost you are giving those products and services. So you have to make trade off between these two. Obviously if you are promising as very responsive player in the industry you will obviously have to compromise with the cost. You cannot be cost efficient at that time.

because you cannot claim as cost efficient or you cannot be the very best example is when swiggy is saying even a single piece of sweet can be delivered that means they are not bothering about economies of scales right so that means they are not combining order from so many different customers so they are ready to provide you even the single piece of sweet this is something you are responsive as a player you are ready to meet the customer expectations demand at any level right so this this kind of logistics or distribution network is obviously targeted towards this kind of responsive kind of distribution network. When you are saying cost efficient, so then the best example can be the world largest giant retailer giant that is Walmart. They are saying that we are the most cost efficient player and we are selling even t shirt at 5 dollars so then they need to take care of the economies of scale how many orders are coming from that particular reason and then as per that only you will process that so always you are looking towards minimizing the cost of providing those things So, at what level of services you are going and what is the cost that trade off you have to make between these two. You at the same time you cannot be extreme responsive and at the same time you cannot be cost efficient. somewhere you are finding the proper blend of these two and where you are saying you are little bit responsive also you are responsive for your quality for delivery for variety for inventory all those things but on the other hand you are also saying that promising to your customers we are cost efficient as well and we are providing you the product with the minimum cost so these two parameters we need to keep in mind right so let's go through these types of KPIs obviously when we are dealing with the transportation these are functional areas first is transportation warehouse we can talk about inventory management in the warehouse order fulfillment we we can combine in that right and then overall customer or supply chain performance we can divide into these four five categories right quickly we'll go through what we are looking for shipping time once order is placed how much duration it is taking to ship that product it is one kind of

indicator see again when we are saying that these kpis the very basic purpose is two purposes are there first is to find out your current position where you are at on those kpis maybe you are rating the scale of 1 to up to maybe 10 where you are standing right now you are standing at 6 you are standing at 7 or somewhere at 9 you are leader in that industry maybe on that particular kpi right on the other hand when you are saying the current position then you are also looking for benchmarking right.

So, may be in that particular let us say delivery time we are talking about delivery time right. If Amazon is saying the fastest delivery player and you as industry partner or maybe being the major stakeholder in that industry, you are also looking it as Amazon is very good in maybe minimizing the delivery time. So then you will keep with respect to this KPI delivery time, you will keep Amazon as your partner. your benchmark right so for different kpis you will find out your position current position where you are on that scale from one to ten right and then you can find out the best player who is may be different players can be there some are working on may be two three point first two three points rest may be next one is working on other two three points so in that way they are defining their usps right so because of those promises only they are you know convincing the customer so this is how we are providing the services differently from the other players order accuracy how many times you are correctly you know or delivery the order right so that will happen only when you are correctly recording the customer order right picking accuracy so how many time from inventory you are picking the right product there comes the role of warehouse management where you are keeping all the inventory what are the automated technologies you are having where you can you know read the bar codes and then you can identify the exact location so that within that delivery time can be ensured if you are saying that within 2 days it will reach so then you can only ensure when you are picking the right product from the inventory and then once it is picked up you will obviously pick it and pack so how much time it is taking to pick pick and pack the product. Order cycle time once the order is placed and then it is delivered how much time you are taking for that that is order cycle time.

Equipment utilization rate, so percentage of time equipment is in use let us say you are using any trolley or you are using container or you are using automated trolley right. any equipment you are using in your warehouse right so what is the percentage how much you are using that that will ensure your this equipment utilization rate then trailer utilization rate. what percentage of that trailer you are using trailer is a kind of container so when you are storing that or transporting from one point or another point how much capacity of that trainer you are utilizing trailer you are using in the end right so we target that always it should be greater than 90 percent of what capacity we are carrying we should utilize always somewhere you are if above 95 percent that means effectively you

are using the trailer capacity right then transportation cost from one place to other place you are moving the products per unit per kilometer or whatever unit you are using how much the cost is right transportation cost this is how you can find out right so then dwell time duration goods spent at a location before moving to the next destination let us say if in the supply chain there is one warehouse right so here what you are doing you are temporarily maybe storing that product then you are sorting that product and from here you are maybe directing that product to different pin codes right so these are some of the operations maybe sometimes you are doing value adding activities or doing labeling or maybe you are doing that kitting kind of services right so then at that time the product is there in the warehouse so how much time that product is spending at this warehouse this should be minimum because only then we can minimize the overall duration inventory carrying cost so how much inventory you are holding at a time so that the cost of that inventory is inventory carrying cost this is something always you are trying to minimize that cost but yes that minimum safety stock you need to maintain so that as soon as the order comes you can simply transport that order from the available inventory. then warehousing cost. So, in the warehouse you are sorting the product, handling the product, storing the product sometimes see the cost is little high if there is cold storage right or special handling treatments are being done.

So, in that case the cost will be little higher right as we have discussed in the previous sessions as well. Pick and pack cost, so what is the cost you are picking locating the inventory and then packaging the cost of packaging material you are using and the manpower or may be if it is automated then also you will calculate the total cost. Operating ratio, efficiency measure comparing operating expenses to revenue. So, total operating expenses you will find out and what is the revenue. If operating expenses are 10 and revenue is 15, this is how you can find out the percentage .

We will go through in detail. This is just a hint. Use of packaging material. So, use of packaging material what type of material you are using first thing when you are deciding the material first thing is the safety of the product. Second thing is whether that packaging is sustainable or not because in many countries this now has been forced to the players who are doing this delivery door step delivery or who are even going for through the retail shops as well.

their packaging either they are fully responsible they are fully responsible for the packaging right once the product is consumed they have to ensure the recycling of the packaging or somehow it should be sustainable packaging or paper packaging which should not you know degrade the environment right so number of shipments you are

making within a specific period that also will show your efficiency how many times you are shipping the product inventory accuracy what your record is showing and actual physical inventory if will count so that should match so that is inventory accuracy inventory turnover how much inventory is sold and replaced with the new slot that is inventory turnover inventory to sales ratio will also tell you that this much inventory always you are maintaining and the sales is this much right so that will ensure you whether are there any chances of stock out or you are keeping all the time excess inventory right So, under these I already told you under transportation management, supply management, distribution management, warehousing management and logistics overall performance we will discuss about all these KPIs key performance indicators. quick review transportation obviously related to whatever we are doing in transportation we can measure the performance so cost is one thing and how we are carrying the products how many products we are carrying whether we are utilizing the full capacity or we are doing that vehicle routing is done properly or not so that we can optimize the route these are some of the measures we can use to ensure the transportation performance then supply performance that Obviously, in the warehouse also you should ensure the smooth supply from raw material suppliers also you need to ensure the smooth supply. So, that we can you know continue with the production lines and then you need to replace the old stock with the new stock by consuming that inventory in the market. So, that it should not be outdated or expired right. So, that also you will ensure through supply management, distribution management.

obviously is when the final distribution to the end customer is happening through all that long chain or may be through single player or courier partner who is doing the delivery right so order accuracy on time delivery these are some of the points when you are picking the order when you are delivering packaging all those things will be there when we will talk about the distribution management warehouse management first thing is how much capacity of the warehouse is being utilized fully right that is first point second is how we are maintaining the inventory how much inventory we are maintaining that is direct cost to the company right how quickly we are from the dock to stock how quickly we are moving the inventory to the shelf so that it is available for selling purposes right and if we are going for some unplanned shipment that also happens right we cannot be always accurate with the our forecasting things, right? There is some error. So if that situation occurs that we have to go for some unplanned shipment, so how quickly you will respond, your system will respond, that is your warehouse management. And logistic performance, overall performance, we'll see about, how many, orders we are delivering, how many orders are on time, how many orders are delivered with quality or damaged products. So these all we'll see. So, one by one we will go with transportation management first is average cost per order.

So, let us say the cost is these are the components for which are contributing towards the cost marketing campaign 500 dollars, then COGS, your operation cost is let's say 1200, packaging cost is there, shipping cost is there, then storage cost is there. So, you will add up all these cost and total number of orders. So, simply you will divide this. So, this is the average cost per order right. now see this absolute value will not help you right so that is why i told you this is one indicator your current scenario now you need to you know compare this with the benchmark how the other players with the similar kind of products see you need to be careful when you are comparing the these kpis because similar product some products will you can deliver within with no you know damage with no inaccuracy with on time right so some of the orders are there which are may be ah those kind of orders which are not ready right or semi finished goods and then depending upon the customer inputs then you are preparing the final one right.

So, then also these kind of goods are taking little more time. So, you can identify that right and because this cost you need to compare you can the other purpose of this is the unusual product you can find out which are you know giving you or adding more cost into your transportation cost. So, this is how you can calculate the average cost per order right. Second one is average transportation cost. So, simply transportation average how much distance you are covering per kilometer what is the cost right.

So, then you can total distance whatever you are total distance. cost per kilometer total distance whatever you are covering you can find out right total cost and then you can find out. So, monthly 10000 gross income you can divide this average transportation cost with the total income. Now, this will help you to identify that this 8 percent of this cost transportation cost is contributing towards the overall gross income right. So, 8 percent only this transportation is taking from your gross income.

So, this is how you can compare your average transportation cost. Fright cost per unit shipped right. cost of the freight how many units you are shipping you can simply divide and you say 0.70 per unit now again this will help you to compare with the other players how they are doing the very basic implication is how properly you are using the cargo mix see there is fixed capacity in the cargo. So, how you are designing that space packaging that also somewhere it is like that this is completely filled these are filled and this much is you know unutilized capacity.

in the cargo. So, that means, this capacity you are not using. So, this will add the cost right. So, if my truck can this truck can take may be 10 ton inventory. So, if you are this

is the quantity simple this is the cost right very simple diagram. If I will say if quantity is let us say 10 ton if it is taking only 1 ton cost will be per unit will be lesser if I am saying carrying 3 ton quantity cost will be lesser.

So, this cost will be like this decreasing initially up to 10 ton then if I will increase to 11 ton or 12 ton or increase further 13 ton because now I need to carry in 2 different trucks. we are now going for the second option then again it will shoot up like because we are not properly utilizing the capacity of the other vehicle. So, this will increase right. So, this is the simple concept why the initial cost decreases with increase in quantity up to the maximum level of the maximum capacity of the container. Then comes to supply management transit time to distance.

So, this is simple how much time in 1 minute you can say or 1 minute or 1 day how many miles you are covering. So, simple if 5 days you are covering these many miles per mile how many days are required 0.0025. This will show you how efficient your that particular mode of transportation is. So, if you can compare road with train with ship with air.

and then depending upon what time you have in hand you can say okay this is the 0.0025 maybe if you will go by air it will be lesser right so then you need to prioritize your products which you need to transport via which mode right and second is stock rotation stock rotation in supply management is another very important aspect because it will help you to you know avoid the your expired stock so if you want to you know avoid this outdated inventory so then you need to quickly rotate your stock you need to ensure the consumption of that so it will help you to monitor the aging stock how we can calculate it total sales average inventory you are keeping so then stock rotation is 20 right so you can simply make this statement that this company sells through its stocks 20 times in this period. So, 20 times it is rotating the stock right. So, that then depends upon which product you are dealing whether it is highly perishable in nature or you can maintain the inventory for 2, 3 days or you can maintain for little longer may be 20 days, 1 month, 6 months or 1 year. So, that depends upon the nature of the product.

out of network shipment so this is something unusual shipments but your supply management has to be you know responsive enough that you should not say that we cannot do that obviously you have to do that but the only concern is it will be expensive because you have not planned for that and then the may be then dedicated network you will be using to you know if you are daily you are supplying hundred orders may be then these five orders are out of this plan so then for five orders you are doing all the exercise right so how much percentage you are doing this out of network shipment is point four

percent this again will happen if there is problem with your forecasting if you did not forecast properly right. So, then this out of plan things will then comes to distribution management here we will talk about on time final delivery or usually we are saying on time delivery right so you will find out the ratio of the products you are delivering on time right so if you are delivering total 18 products 15 are delivered on time so 83 percent is the efficiency or you are delivering your products on time now this obviously will tell you the efficiency and performance of the supply chain but you need to take care of the quality also right if you are delivering broken product damaged packaging damaged product so then you cannot consider it as complete order right and the second case if the only let's say if in that package five items should be there but only three are there and two you are saying may be another two days it will take because that were those two items were not available in the inventory so then also it will not be completed right so this is on time delivery on time delivery will only happen when there is on time pick up your courier partner is picking the product after confirming the order within time duration see these this cycle is complete right so it is starting with customer, customer is finalizing the order then with the seller order should be ready once your order is recorded your seller should be ready with it and if i am saying that seller next stakeholder is your that courier partner who will be picking up this product right then courier partner will maybe distribute it or maybe store in the nearest distribution hub right from there it will go to the other state the location or the nearest hub to the customer location, then it will go to again the fulfillment center. and from fulfillment center it will be given to deliver to the customer right this is how this complete cycle will happen now if this courier partner is not picking on time that means next cycle will be delayed so how many times the shipments are picked on time out of 46 43 are picked on time so that means 93.5 percent is the efficiency this will help you to find out the your carrier performance right then the third point here is on time shipping so again i told you from this point distribution hub to the next distribution hub if this distribution hub is in delhi right or in gurgaon right and i am placing order from kharagpur so this distribution fulfillment center is in kharagpur right so first from this distribution delhi distribution hub it will be shipped to kolkata hub right and then from kolkata to may be the nearest ah fulfillment center it will come from where it will be out for delivery may be on the same day or may be on the next day right so this on time shipping is important only then the complete cycle will be done so if twenty three orders are there and eighteens were on fully on time means partially we will not consider so eighteen divided by twenty three so seventy eight point three percent is the efficiency So, obviously, if you are targeting 100 percent order should be delivered on time. So, shipping should be on time, your recording of order should be on time, then your packaging of order should be on time, then pickup should be on time, then your shipping should be on time from nearest hub center to fulfillment center that pickup and drop should be on time and then finally, the delivery to the customer should be on time.

So, this is complete cycle anything is creating a kind of bottleneck other activities will be delayed. Then next comes warehouse and order management right. So, unplanned shipment this we talked about if you have no plans to ship these products and the problem is why this happened because we could not figure out the demand for those products right. and now those kind of products are not available or may be somewhere in the manufacturing or may be somewhere semi finished products so those many products are there or even if you have those in your inventory but now for the day the courier partner has already picked the orders now may be in the evening again the person will visit so that 4-5 hours gap will be there or may be 6 hours or may be next day picking courier partner is coming.

So, that 12 hours gap will be there. So, these unplanned shipment 4, total shipments are 4000. So, you can see 0.1 percent of shipments are unplanned. So, this is a kind of you know the role of the managers to accurately predict it and then ship the material on time right, order accuracy. order picking accuracy and this cycle will actually start with your recording the order when you are actually recording order.

So, when you are recording the order you are recording the customer information as well. right so customer information other than your payment information and the requirements for the products or special instructions given for delivery of a product or for variety or all that so there will be one very important thing is address so if you have read the address incorrectly or maybe when you were recording that then it happened or may be problem with the pin code. So, then this order inaccuracy will be there. So, you can just see order verified correct orders packed today. So, 96 percent is the efficiency you can see that you are delivering the correct order, but see this is when you are comparing most of the e-commerce players right.

Just imagine the case when you are going to an airport what you are doing the first thing is you are dropping in your luggage right so that luggage is carrying one slip where the bar code is there. Now how many time this is happening and what can be the cost if the receiver or where we are reading that address information that this has to be routed from Calcutta to Delhi and instead of that it is routed to let us say Calcutta to Ahmedabad. how many times this is happening right so if this is very rarely this happens but if it is happening this is again big challenge because then your customer will feel dissonance and then it will be difficult right to track back and then you know deliver back the whatever package is right so you can just imagine the cost of that But in e-commerce, we need to ensure the same kind of platform where your packets are delivered on the right address. inventory accuracy already i told you whatever your big books are showing and physical inventory from counting that should match if physical inventory is this much

three four five eight and my books are showing three five zero six that means ninety eight point six percent is the this is again very important as far as warehouse management is concerned because because the point here is the example i told you if i am having fifty tyres and if one car is taking 5 tyres to complete i should produce 10 cars out of these by using these 50 tyres right so if i am somewhere lacking with the inventory where that inventory is going so those things we need to find this is not because components sometimes are very very expensive right and obviously if one component is missing doesn't matter the cost of that component may be the cost of the component is only ten rupees and the final product cost is ten lakhs unless that component is not fixed in that product your product will not be final right so that way your efficiency should be there dock to stock how much time your warehouse is taking to put the stock into the shelf right so that it is finally ready for sales right so if it is taking 12 hours 18 shipments are there so that means it is taking 0.6 hours per shipment to be to make it ready for the ah customers so that customer can pick those stocks and then they can purchase So, this will also tell your efficiency unit processed per square feet this will show how much capacity of that warehouse you are utilizing if only this much capacity is being utilized that means this is unutilized space.

So, what we can do with this unutilized space right. so that is again concern these many units are there this much square feet we are having so that means 3.7 units per square feet we are giving that area right but again that depends upon the products different products require different types of things if you are just talking about steel roads right may be then this figure will be little lesser if you are talking about water tanks you are using and you are storing water tanks or steel rods in your warehouse so obviously space required for these two items will be different right not only in the warehouse in the transportation truck as well may be steel rods you can take may be maximum capacity is twenty ton of that container you can take 20 ton right, but water tanks because of the size limitation may be then you may not be able to carry more than 2 ton because as per size the capacity is fully utilized. space use in warehouse. So, how much total area is 16500 square feet you are using only 3300 square feet that means, only 20 percent is being utilized.

So, this again you need to take care when you are talking about space utilization in warehouse. So, how you can reach up to may be 85 or 90 percent utilization of the space that is also very good point. Let us talk about now the overall logistics performance. Cost per pound again I talked about shipping the water tank or shipping the steel rods. if you will talk about weight obviously you will be carrying more weight when you are carrying the steel rods but when you are talking about water tank so weight is less but because of the big size that limitation is there because there is no space in the container so this much is the cost of shipment only this much weight lbs you are carrying so that means 0.

38 dollar per pound right so that is the cost so maybe this is for particular industry this is the cost this range is totally totally relative to the product industry cost per mile total fixed cost assets you are using vehicle carrier whatever you are using variable cost of covering that distance whatever you are covering that total cost will be there divided by how many miles you are covering that will give you the rupees in terms of per unit. or rupees per mile simply will give you the value. So, 1.34 per mile this is for particular product using may be particular mode of transportation right. So, this may be for if you are talking about road transportation for ship transportation this may vary for air transportation obviously cost will be higher.

So, that is there. number of shipments now this will help you to identify the reasons countries from where the maximum orders are coming right so maximum orders you need to find out from where it is coming so that you can combine those orders and then you can even if required you can minimize the time of the delivery as well right so may be you in the metro city this is the only reason because of those many number of orders are there so same day delivery can be promised but if you are in saying somewhere in village so if you are covering may be 10 kilometers you are delivering only 20 products but in city may be you are covering only 2 kilometers you are delivering 500 orders right so population density is there and then depends upon product type also which type of product you are delivering then this will help you to analyze the seasonal fluctuations also right if seasonal fluctuations are there you are talking about fruits you are talking about vegetables right so that demand will depend upon. So, monthly shipment by reason you can find out so that again because if it is a kind of your metro city maximum orders are coming. So, you can promise the same day delivery as well because in that you can enjoy the economies of scale because you can consolidate large number of orders. then by product also you can find out the information what type of products they want and what is the frequency of buying those types of products right so this is related to your logistic performance some of the key performance indicators we have identified right so in the very next session now we will spend a couple of sessions on targeting how we can improve these performance indicators right so these are some of the references from where these slides have been prepared and other than that i have highlighted all the books referred those six seven books right so those are always there right so that's all from this session thank you very much