Logistics & Supply Chain Management

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Lecture 17 : Lean Logistics (Contd..)

So, hello dear friends. Welcome back to NPTEL online course on Logistics and Supply Chain Management. So, in the last couple of sessions, we started discussion on Lean Logistics and we discussed various aspects of Lean Logistics. We started discussion on implementing Lean Logistics through various methodologies and framework.

And in that, we will discuss about the challenges also and one case study. So, here we will discuss the second approach which we can use for implementing lean logistics is DMAIC approach and like I told you that this the methodology is used to implement 6 sigma in your process. So, that we can reduce the defects only up to 3.4 per million opportunity that is 6 sigma ok.

how we can achieve that accuracy level is you need to define what you are doing as a process you need to measure that right then again you need to analyze how you are doing is there any deviation from the actual plan right where the bottlenecks are or where the problems you are facing related to delivery related to wrong product shipment related to wrong order recording related to packaging damaged during shipment right related to anything so that you need to analyze how we can improve that whether we need to improve the technology so that we can share exact information coming from the customer if customer is giving you some requirements that when you will prepare the food may be the spicy related to it should be less spicy right so then those instructions should be exactly supplied to your kitchen right so how you can ensure with better you know visibility and traceability throughout the distribution network So, then you need to control it after improving again you will see how it is moving and then whether it is going as per the expectations you improved something. So, may be new technology you need to analyze whether it is going as per that or not. So, first is define phase you will define scope goal and financial performance targets where you want to improve we want to improve the recording the orders. process so when we are recording the order some customer information is missing so that is why we are not able to provide the exact services required by the customer then measure the phase what is the current state of performance how many times we are recording wrong orders right and what are the reasons right we need to identify the root cause why that is happening so we need to understand the complete cycle from customer their order is coming to let us say zomato

right zomato is again sharing this information with the restaurant again sharing information with the courier partner that now the product is ready to be shipped and then it is finally reaching to the customer now this information should be shared with the zomato and with restaurant as well and with the courier partner as well right so if I'm saying that it should be less spicy that information is very very important for the restaurant if I'm sharing that I'm placing the order right now but I don't want within 30 minutes if your policy says it will be delivered within 30 minutes because maybe I will be free late by my office from office right so after 1 hour 30 minutes you deliver me this product right so then that information is required for courier partner how i can at that time i can utilize that and maybe i can deliver some other orders right so that information you need to share improve phase how you can design the process in a better way information sharing that means the platform you are designing how all the stakeholders can be included in that platform of you are coming with the new processes may be you need to change the recipe how you are preparing the food then you also include those KPIs in your process improvement part and then control phase will happen when you will actually track the performance indicators and which with your actual output how you are doing that and you will see is there any deviation. Means your this actual output whatever you are doing whatever your standards were then you will see is there any deviation is there any deviation yes no that means you are doing perfectly fine yes then you need to change the again the process from where your actual output is coming out right.

So, that way you need to plan the control phase and you need to review the performance again and again. So, another lean logistics tool is just in time approach, this is because we want to get rid of managing the inventory, storing the inventory and then while storing the inventory we saw that we are damaging sometimes and sometimes inventory is expiring in the stock only right. so to avoid all those issues can be go for a kind of system where directly raw material is coming to the production lines and it is streamlined with the production process and that production is happening and packaging is done and then move to the final dispatch center from where the from to different market locations the final product can be shipped so how this will happen if we are able to implement this so this will not eliminate the waste in the inventory this will also improve the quality why quality will be improved because when you are keeping the inventory in your warehouse obviously at that time because when handling is involved you are transporting from here to there keeping again to other point location and then maybe on 100 day you are processing it to the production line right in that way quality will be degraded right and if you are talking about some electronic appliances electronic components you are using and if those electronic components are left just like that for 100 days or maybe for 3 months 4 months so then you can imagine so if fresh raw material coming and you are processing it on the there is no match if you are talking about quality right. So, this will only happen when you have close coordination with your suppliers and how that will

happen? These are eight steps you need to design the process in that way where you can say the raw material is directly fed to your production lines and you need to manage the overall quality of the system. It is not only quality of the product, your quality of work life, quality of equipment, quality of production floor, quality of all the stakeholders involved in that process and then So, Kanban production cards you can use right to just pull you can break the order into small parts and then you can be you know assigning different responsibilities to different vendors as per the requirement.

so then you need to establish strong vendor relationship only then just in time will happen and then fine tune the inventory that means if you are not maintaining that minimum stock you have to be very very fine with forecasting with predictive analytics with you are observing the customer buying behavior their buying patterns right. And if any fluctuations are there in the market because of any disruptions those also you should consider while planning this otherwise just in time will not work because if you plant some just in time way on the way something goes wrong there is strike right there is some may be flood is there may be some natural disaster is there so then how you will feed your production line so that is why we always try to be safe and try to keep some inventory right but another very important thing when we are talking about the vendor relationship can we develop one or two big vendors near to our manufacturing house so that they can we can feed them large orders and they are also happy to set up their production units near to our production line so that directly order can be those raw material can be fed to the production line. and you need to develop those kind of skills and capabilities with within house and with your stakeholders as well only then that stream line just in time will happen your starting with your recording the order from the customer that channel should also be very very strong then you cannot say that your regional sales team is collecting the data it is processed by district level, then it is processed by state level, then it is processed by regional level, then national level this will not happen. Then how the quickly that information feedback is entered by the customer, how it quickly you can share throughout your network. So, only then just in time is possible.

And then you need to refine the product and processes as well. Product means the components you need to design those components which can be ensured through just in time environment right so and processes also it should not be that one process is taking too long and that other process is waiting right that should also not happen if that is happening you need to define the process bottlenecks. right and you need to remove those process bottlenecks and in the end the key performance indicators you will analyze using your JIT how efficiently the orders are delivered how quickly the orders are delivered how efficiently you are recording the orders how efficiently you are reducing the inventory cost handling cost damaging cost obsolete going obsolete means expired

inventory in terms of that you are managing that so that also you need you can track that and you can surely you will observe that improvement in the performance so these all are the steps already I discussed about these steps The next methodology is 5S approach. We discussed this approach in quality tools as well. So, this simple concept here is Japanese concept how we can keep our workstation sorted and So, that it is not only sorted it is clean, standardized, efficient and safely we can operate there.

We can reduce the accidents rates as well when we are saying that we are implementing 5S housekeeping approach right. So, again this approach was initiated in Japan and mostly these approaches have come from Japan only because their production facilities are like no match. So, quickly if you will go through these steps you can see first is sort you need seiri you need to sort the things like this. So, that you need not to search where the key will be, where the allen key will be, where the plucker will be, where the hammer will be and then hammer also different size of hammers are there, key also different size of keys are there. so if all the time you are looking for your equipment so that is wastage of time so you might have seen when you go for your any service station for repairing your car or routine services they usually try to arrange in that way so that easily you can identify but this is one work station you just imagine the manufacturing facility we are thousand of people are working and one repetitive action you are doing if for the day you are producing 50,000 products so one person going to repeat his function activity whatever he is doing approximately 50,000 times so you just imagine 50,000 times you are just looking where is your hammer where is your key where is your screwdriver right so that cannot happen not only those equipments even the supply material how you are keeping the material within the store if you are looking for So, that in that way automated warehouses will help you to identify where the product is you can just scan the code will identify to locate the you know location and you can easily pick that even if manually not your robot will pick and will driver on your production line and we need to shine this we need to maintain the cleanliness and obviously, in manufacturing production supply chain standardization is something.

we want to achieve this stage as soon as possible because once the process is standardized we are relaxed that now we will be moving towards the productivity we will be more efficient we can reduce the cost we can improve our margins because now the rejection is also reduced like we talked about the process rejection and then in the end we need to sustain that environment of continuous improvement the next approach is kaizen kaizen is actually again kaizen is made up of two words kaizen so change for improvement right so small steps improvement will be there so the very basic function if you see how we can do that we need to plan first then accordingly we will do that we will study the effects and we will continue that process if the effects are in the positive

direction see the approach here is the not continuous improvement, continual improvement. right kaizen focuses on continual improvement what is the meaning if i am targeting improvement let us say this is two percent improvement then first achieving this two percent improvement i will try to stabilize it for some time then again i will go for again one percent improvement i will try to stabilize it again then again i will go for two percent improvement will stabilize here so the best part if you will talk about continuous improvement continuously you are improving so if you fail at this point suddenly you will come down to 0 right again you need to abort the whole mission and whatever you invested will be waste but in this case if you are failing here you will be at least you have stabilized so at least you have stabilized this stage so that means still you are there is loss you implemented you tried something new, but that could not happen. So, this is the Kaizen approach make it better, make it faster, make it cheaper and the other very important characteristics when we talk about Kaizen projects is small steps improvements. So, investment required to improve those small things is not used in that way right. and very small efforts are required from the employees as well so in that way it is safe approach right you can see earlier how they were lubricating their gear box with the oil it was so difficult now after just small improvement how much cost is there earlier it was very difficult to inspect the condition of the belt because it was completely covered so just change in the design how quickly you can do you just imagine how long a person is taking when you are going for repairing our tyre and then if you are talking about F1 race so only 5 seconds 5 seconds are even more than for replacing all the 4 tyres and if in this case this is 5 to 10 minutes no one is taking minimum 30 minutes person is taking to replace the tyre so these small steps improvement how we can you know big picture if you will see the improvement will be very very big and this is obvious from this that improvement is big single minute exchange of dye is very again prominent concept we use in manufacturing where we say that if you are doing any change over that should be done within less than 10 minutes single digit minutes right.

So, if you are changing die so that is little technical die we are changing in the molding machines right or simple if you say again if you will take about the example of a restaurant. if right now some person order for non veg the next person order for veg and he is completely veg right so you need to clean and you need to change the things the recipe and some ingredients right so when you are changing that how quickly you are changing that or can we go for separate workstation for veg for non veg and if you are going for that is it cost efficient are we getting enough orders for veg or enough orders for non-veg that also we need to take care if not enough orders so on single workstation only oven only we need to cook all the item so how quickly we will change over you just see toyota bolt maker earlier they were taking 8 hours now 58 second you just imagine these small small steps improvement how much they are contributing mitoshubi so 24 hours 22.7 minutes hitachi diecast earlier they were taking 75 minutes now only 3

minutes and hp ic insert they were taking 30 minutes now only 3 minutes so this is the thing improvement you can see what are the challenges obviously culture resistance that is always there because whatever the current situation is going on we are always happy with that if i will ask you to change your mentality even over something the resistance is obvious right what we have been doing since last ten years that legacy we are saying that we usually proudly say that last thirty years i am doing this right so even something better is coming we try to resist initially that is the basic nature of the any this human right but then we are talking about human will be replaced by the machines right by the robots so even if you are changing morning evening technology they are not going to resist in that way lack of leadership commitments because of initial resources investment is required so in that way your committed leadership is required we have this kind of mentality where we we have communication barriers we we are preventing collaboration we have fear what if we will fail what if we will not be able to recover the initial investment cost right and then limited employee engagement you believe me most of the suggestion ninety percent of the suggestion which we are talking about kaizen small small step improvement come from those people who are actually working on the production line may be illiterate people or may be ah IT holders they have some proficiency in technological courses they have done that the major major improvements suggestions are coming from them only but if we are not engaging them we are not making them comfortable that they are part of that organization so that input will not get and you visit any organization So, major improvement skills are coming these suggestions are coming from the worker who is repetitively doing that activity for more than 50,000 times in one day. You just imagine the proficiency or the expertise he is having because one single piece he is processing if he is producing 50,000 units, so 50,000 times. so how we can keep those skills motivate them if we are providing them training we are making them capable of thinking we are making them fearless you give us your suggestions whatever if we will fail we will fail together if we are rising we will rise together right so then we will go for measurement and accountability so suggestions may be sometimes we are implementing but then we need to track right it can go other way around also but yes then we cannot stop the thinking and we cannot stop the continuous improvement process and when we are talking about lean manufacturing so it is reducing the waste obviously we are reducing the burden on the people as well working with us planet as well extracting the resources from the environment and obviously profit will improve because we are reducing the cost of producing those goods external factors are there as challenges because how then external environment will change technological position will change will disturb your equation political scenario even will change will disturb your equation global scenario will change there is war between Ukraine and Russia how the crude price oils will that oil price will go up right how you will and if this is only the crude oil price and affecting almost every industry not only transportation industry because every industry is using transportation industry right so in that way how resilient you are your

supply chain is even something is going wrong in the external environment how you can tap that right or seek the opportunities.

So, if I will compare lean and agile logistics. So, lean is we are focusing on reducing based in that way we want to be efficient, but in agile we want to be flexible. If my customer is asking in 10 minutes delivery I will send the private jet I will send the best possible way the service is right so that it should be delivered on time if that much valued product is right but in lean logistics we will try to remove the waste but here customer satisfaction we are not here the constraint is we are not discussing about the cost if we are selling BMWs Mercedes we are not talking about the mileage we are talking about the safety features we are talking about Volvo we are talking about safety we are talking about the comfort right and here we are talking about the customer services because you are not using Volvo right you are not using Mercedes so then customer services will be compromised somewhere right but we are cost efficient right so long term stability obviously but here you there is nothing long term because we are working in the dynamic environment so you cannot say that this is long term productivity is main target but here target is we are productive we are taking the minimum time giving you the best services and if you are saying that i want bmw i don't care about the cost but interior how you will design i want you to implement all my inputs i want wooden work i want AC facility here there I want this much boot space I want that all those things how you want to design the interior carpet and all those things that flexibility your manufacturer is giving to you when you are at you know we are talking about the agile logistics right and then here we talk about uniform standardized work but here we cannot say that because customer is part of your production process and he wants to contribute in that way that's only agile how agile we are and we are providing you say us if you want one ice cream will you give you one ice cream if you will ask thousand ice creams we our distribution network is flexible enough to give you thousand ice creams as well right so in that way we can just compare the lean logistics versus agile logistics so now this beautiful case on Toyota production system so based on only lean logistics concepts although many concepts are implemented earlier they were into spinning and weaving industry and then so many concepts came from there very beautiful concept is judoka will discuss about that and then they are now they are known for their automobile contribution whatever they are doing and if we will talk about the founders of TOYOTA production system Taichi Ohno and Shigeo Shingo who contributed largely in their production system in terms of improving the quality reducing the rejection right and they always post their organization as very poor organization who cannot afford to produce something like waste How? Seven principles of Toyota production system, setup time should be minimum, small lot production, if something goes wrong with the lot so that that only lot is spoiled not the if the lot size is big so whole lot will be spoiled that is the concept. employee involvement empowerment so they are putting the suggestion box and motivating employees giving

reward who are coming with the you know good suggestions right so quality at source they are not saying that within manufacturing you can maintain the quality with your raw material suppliers you need to equip your suppliers with the technology and whatever design specification you want you are always training your suppliers so that is our extended hands that those are very much part of if we can cut the cost at the initial stage we can cut the cost throughout the network equipment maintenance how we can ensure the predictive maintenance it should not be like something goes wrong then your maintenance team is working on the how we can be you know very very useful with the predictive maintenance before something goes wrong we should predict it pull production system let the order come then we will provide the order to the customer and supplier involvement already we talked about This is the complete Toyota production system or the quality house you can say where the highest quality, lowest cost, shortest lead time while eliminating all the waste. So, these quality, cost, lead time.

these three focuses and how you can do that by eliminating all the waste. So, what is the foundation of this house? The foundation are these concept hijunka, standard work, total productive maintenance and value chain right. So, and just in time these are the pillar just in time and jidoka are the pillar and then continuous improvement environment they are providing within the organization. We will go with this steps these processes one by one see continuous flow of material right how you can ensure that how you hijunka is how you are ensuring the evenness we talked about unevenness when we talked about mura muri muda right so unevenness is creating muda or sometimes overburden you did not do anything for first two days third day you are overburdened that is obvious so that will ensure how smooth supply how many products are required those many are shipped from the raw material and it is coming to your warehouse these many may be these are 20 only 20 items are required 20 components we are fixing right. So, we know how much time is required and then in the end we produce 20 products and finally, we shipped 20 products in the market.

So, this is continuous stream line flow we are not maintaining extra inventory that we can be short of this inventory let us maintain this 50 and these are only 20. So, wooden sticks are only 20. So, and let us say take iron hammer 30 or 50. So, that means that inventory is mismatching anyhow without that you cannot do that. how this is happening you are not ensuring make one move one so then the extra time you are consuming let us take the batch production system where we are producing in batches so first batch is processed then it will be passed it's not that one product is produced and will be passed to the next stage so you see just one this one example this batch process this process requires three steps step one two and three so first step is taking 10 minutes so whole batch will be passed to the second stage then 10 minutes that means 20 minutes then

whole batch will be passed it's not single item is passed right whole batch will be passed to the third stage now after first minute of third stage my first product will be out that means it will take 21 minutes minimum to produce the first product right because 10 minutes here 10 minutes here then the complete lot is coming here i will start processing in the very first minute i will produce the first one so 21 minutes but if i will see here first minute one minute is we are taking on the first stage it is move to the next stage one minute is taken there move to the next stage and on the third stage again 1 minute is required.

So, after 3 minutes your first product is ready. So, how we can ensure the continuous flow processing? They implemented this scenario in their Toyota production system. Just in time, they implemented just in time and this was done by Kichiro Toyota in 1937 and they said that we are poor company we cannot afford waste right so how we can do that we need to you know collaborate with our stakeholders raw material suppliers in that way so whenever it is required it can be shipped to our production lines so after world wars second mr taichi ohno so who was working in spinning and weaving industry right So, there they implemented this concept of just in time and Jidoka. I will tell you in spinning industry then he was transferred to automobile industry to improve the quality of the product. so in spinning industry what was happening let's say when in the spinning machine so many different threads used to come the quality of the cloth you can check how many threads are there in each thread right so usually 24 threads 40 to 64 like this 98 threads so many threads are there means quality will improve right so many threads are coming and in the weaving machine spinning machine we are coming up with the one piece of cloth continuously flowing Let us say in between one thread is broken so that means in the complete cloth there will be one line because that thread is not now captured by the weaving machine by the spinning machine.

this Taichi Ohno he discovered this concept of Jidoka if something goes wrong at this point and thread is broken at the same point of time your machine will stop working so this is Jidoka so this piece of cloth may be 100 meters you produced and that piece of thread was broken may be after 20 meters so even then you kept on producing rest of the 80 meters cloth which is now waste So, can we do something whenever the defect was detected there only your machine should stop working that is jidoka. So, they implemented this jidoka and later on they try to implement this from their weaving industry to manufacturing. automobile industry poka ok is another concept where you they implemented this that even if you want to do some mistakes intentionally even then you cannot do that a very good example of this can be let say if you are very new with the computer i will give you keyboard mouse CPU UPS screen all the accessories pen drive and all are just ask you put in you plug in all the wires required power cables data cables and all this so even if you are doing very first time even then you cannot do the mistake

because the jack designed there are designed in that way the only that will power cable will go into power plug only data cable will go into data point only right. So, the jack is designed in that way where intentionally you cannot even if you want to commit the mistake you cannot do that. So, these two concept Jidoka and Poka Yoke, the now in the industries manufacturing industries used like anything and your services industry also are implementing.

Then Enden system So, this is a kind of indication board where you can just indicate if there is any problem at any stage let us say 100 stages are there on the production line something goes wrong on production stage third. So, there will be red light if the problem appeared. So, then the yellow light will be there everything is going perfectly fine green light will be there. So, immediately our intention will come to the random board that. if something goes wrong whole production system will stop this is poka yoke I was talking about see even if you want to fix this here you cannot fix because the system design product design is of that nature so you can just see I talked about this CPU system how you can plug the wires so that is a kind of poka yoke system this is another approach used by Toyota production system Gemba first is genchi genbutsu go and see if there is any defect you need to visit that stage and then you need to observe that why that happened and then you need to ask five why's you need to find out the root cause that means five why's we asked in fishbone diagram why that happened we will go to the root cause of that problem and then we will try to discover form of waste by identifying muda muri mura unevenness overburden is there or waste you are producing respectful whatever you are doing do it as a team and that togetherness spread should be there and analysis once you are doing collecting the data you are collecting data related to defect why that happened you should include the stakeholders who are working on that stage right so that also they included in this program this is hijunka we talked about how you can smooth the production process here you can see person one is working on assembly line and the second person is waiting and third is also waiting they are doing something here on may be in one stage how you can ensure your production streamline you can streamline the whole production so that everyone is having something to do that will only happen when if the first stage is requires 5 seconds your next stage you are designing in the production assembly process that should also take somewhere around 5 seconds right if it is taking 7 seconds 8 seconds so there will be semi finished product inventory so he will not be able to process that because there will be huge pile of that unprocessed product on that stage right.

So, you need to streamline the process in that way. This concept of streamlining the process smoothing the production is known as Heijunka which is the base of Toyota production system. Kaizen already I talked about in small steps Toyota production system started working everybody every day everywhere it's not only with the process

with the equipment as well with the person as well you need to improve every day and then standardization if you will do standardization takt time we calculate takt time by your production time you are having and then the demand from the market right. So, how quickly you are producing and meeting the demand that is the idea you can get by calculating the takt time. Working sequence how sequentially I told you in work flow one piece one time.

Standard in process stock that much inventory which is required to ensure the minimum takt time and work sequence can be maintained. So, it should not be like that that for your first stage you are waiting for the raw material so that should not happen so standardization is a critical ingredient for jidoka and just in time system which is quite obvious because if you are maintaining that only then you can ensure the smooth flow of the raw material if you see performance so when they started somewhere here they started implementing toyota production system that house of quality heijunka jidoka poka yoke where they identified the fault you can see with other players the performance how they improved right so and this is you can see 80% increase in per head production earlier they were producing 39.7 vehicles per person now after implementing this system in late 80s near about 71 vehicles per person and if you talk about operation income this is how they have improved you see and this is the era when they implemented Toyota production system house of quality right and now you see some figures are given here earlier this u s market ford and gm general motors they were you know capturing the whole market and the this is quite obvious that forty percent chunk of us car and light trucks market gm was carrying right but toyota was carrying only two percent but then you see after implementing in eighties this tps they improved three percent then eight percent in nineties then nine percent in two thousand and then more than 10 percent in 2006 and the share rose to 13 percent where GM share fell down to 26 percent. So, slowly, gradually, steadily this is the baseline if you will try to you know define the Toyota production system. So, this is how you can see small step improvement led to big improvement in the overall production system.

So, this is all about your lean logistics, how we can reduce the defects, how we can enhance the efficiency of value adding activities by reducing the non-value adding activities. So, these are the references and some text books you can refer for your detailed study. So, thank you very much.