AI in Marketing

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Lecture 54- AI in Logistics Management-I

Welcome to this NPTEL online certification course on artificial intelligence and marketing. Now we will talk about module 54. So as you can see from this slide, these two modules 54 and 55, they are dedicated to understanding the role of AI in logistics management. So let us start with the part 1, the end module 54. And these are the things that we will cover in this module. So the first thing is to discuss the concept of market logistics and logistics management.

The second is to discuss AI adoption in logistics and its impact. And the third is to study AI applications and use cases in logistics. So let us first try to understand what is logistics management. So the first thing that is included in logistic management is the physical distribution.

It starts at the factory. Managers chooses a set of warehouses, stocking points. So these warehouses are also called as stocking points and transportation carriers that will deliver the goods to final destination in the desired time or at the lowest total cost. Physical distribution has now been expanded into the broader concept of supply chain management. The second is supply chain management.

It starts before physical distribution and means strategically procuring the right inputs that is the raw material, components and capital equipments. Then converting them efficiently into finished products and then dispatching them to the final destinations. And even broader perspective looks at how the company suppliers themselves obtain their inputs. So we are talking of suppliers, their suppliers and then company and then dispatching them for the final destination. The supply chain perspective can help a company identify superior suppliers and distributors and then help it improve productivity and reduce cost.

Firms with top supply chains include Apple, McDonalds, Amazon.com, Unilever, Intel, Procter and Gamble, Cisco Systems and Samsung Electronics. Market logistics including planning the infrastructure to meet demand, then implementing and controlling the physical flow of material and final goods from point of origin to point of use to meet

customers requirement and at a profit. So market logistics planning has four steps. The first step is deciding on the company's value proposition to its customers.

What on-time delivery standard should we offer? What level should we attain in ordering and billing accuracy? The second is selecting the best general design and network strategy for reaching the customers. For example, should the company serve the customer directly or through intermediaries? What products should we source from which manufacturing facility? How many warehouses should we maintain and where should we locate them? The third is developing operational excellence in sales forecasting, warehouse management, transportation management and materials management. And the fourth is implementing the solution with the best information systems, equipment, policies and procedures. Studying market logistics leads managers to find the most efficient way to deliver value. For example, a software company traditionally produced and packaged software disks and manuals, shipped them to wholesalers which shipped them to retailers which sold them to customers who brought them home to download onto their personal computers.

Market logistics offered two superior delivery systems. The first let the customer download the software directly onto his or her computer. The second allowed the computer manufacturer to download the software onto its products. Both solutions eliminated the need for pricing, packaging, shipping and stocking millions of disks and manuals and had quickly become the norm of the industries. The next thing that we will understand is integrated logistics systems.

The market logistics task calls for integrated logistics systems which include material management, material flow system, physical distribution and that all is aided by the information technology. Information systems plays a critical role in managing market logistics especially via computers, point of sale terminals, uniform product barcodes, satellite tracking, electronic data interchanges and electronic font transfers. Market logistics encompass several activities. Many experts call market logistics the last frontier for cost economies and firms are determined to wiring every unnecessary cost out of the system. Now these are the some decisions that are related to market logistics.

The firm must make four major decisions about its market logistics. The first is how should we handle our orders which is also called as order processing. Where should we locate our stocks that is warehousing? How much stock we should hold inventory and how should we ship the goods which is transportation? Now let us look at each one of them in some more detail. Order processing most companies today are trying to shorten the order to payment cycle that is the time between an order received, delivery of that order and the payment received for that order. The longer the cycle takes the lower the customer satisfaction and the lower the company's profit.

The second is warehousing. Every company must store finished goods until they are sold because production and consumption cycles they rarely match they do not match. More stocking locations means goods can be delivered to customers more quickly but warehousing and inventory costs will go up. The third is inventory sales people would like their companies to carry enough stock to fill all customer orders immediately. However this is not most cost effective management needs to know how much sales and profits would increase as a result of carrying larger inventories and promising faster order fulfillment time and then make a decision.

The next is transportation. Transportation choices affect product pricing on time delivery performance and the condition of the goods. When they arrive all of which affect customer satisfaction. Companies consider such criteria as speed, frequency, dependability, capability, availability, traceability and the cost of transportation in shipping goods and materials. Now we will look at the role of AI in Logistics Management.

AI technologies in logistics are not a luxury but a necessity for organizations to achieve and maintain their competitive edge. According to Forbes insight research 65% of the industry leaders believe that logistics transportation and supply chain have ushered in the era of profound transformation. A report by Accenture reveals that 36% of large, mid and small size organizations have successfully adopted AI for logistics and supply chain processes and 28% of the survey respondents are at the threshold of bringing AI to logistics. AI revenue growth in logistics is axiomatic since the technologies are already revamping the industry in different aspects. Early adopters of AI in transportation and logistics already enjoy profit margins greater than 5%.

The following two graphs denote the impact of AI and related technologies in logistics. So this is one graph. Disruptive technologies in logistics. So, blockchain 52.8, AI 51.3, robotics 44.6, self-driving cars 42, drones 24.9 and all of the above 6.7. So this shows the potential economic valuation from AI in the next 20 years. So here we have management, marketing and operations. Risk is 0.5%, finance and IT 0.5 and others are 0.5. In marketing and sales 1.4, supply chain 1.3, product development 0.1, human resource 0.1, strategy and corporate finance 0.1, service operations 0.2. Leading companies are already harnessing artificial intelligence and machine learning to inform and fine-tune core strategies such as warehouse locations. As well as to enhance real-time decision making related to issues like availability, cost, inventories, carriers, vehicles and personnel. While these new technologies bring about truckloads of data, thus transportation industry has been capturing data for years. Decades ago trucking, rail and sea cargo being tracked by a satellite via telematics and versions of electronic driver logs have been around for nearly 20 years. The industry has also for many years now applied high level decision theory to optimize the cost and transit time associated with high value vehicles and often even higher value cargos.

The difference today however is not only more data but also vastly more powerful computing power and algorithms to sort, evaluate and accelerate understanding the action. According to John Lengle, a clinical professor of supply chain management at Penn State University, though the transportation industry has always been data focused, today we see all of this added computing power, IoT telematics data collection, data mining, artificial intelligence and machine learning that can be focused on making better decisions not only from an overall strategic and resource planning basis but in real-time decisions also. Now let us look at some practical applications. AI, ML and assorted technologies promise to enable leaders to focus IoT and myriad other data feeds on achieving greater optimization and responsiveness across the whole of their logistics, supply chain and transportation footprint. So the first practical application of AI in logistics is Augmented Real-Time Decision Making.

 Electric teams often handle a wide range of complex but repeatable tasks that require large amounts of input data in order to make the best choices. Optimal carrier selection for example means combing through thousands of possible candidates, routes and schedules. In practice workers often require 10 minutes or more to gather the needed information. But with AI and associated tools, supply chain professionals can automate the analysis and narrow their selection to just two or three within a matter of seconds. Human intuition then closes the deal.

The second is Predictive Analysis when all customers be ready to order. Of course the sales team wants to know but this is also vital information for logistics, supply chain and transportation planning. An example where an AI platform could collaborate closely with sales and marketing. Regarding specifically a transportation needs, telematic IoT can help determine when a vehicle might need preventive maintenance thus avoiding breakdown and reducing the risk of failing to meet customer needs and expectations. The third is Strategic Optimization.

Where, when and how? Leaders in these disciplines are learning how to gather and comb information to make the best decisions regarding the deployment of not only inventories but also transportation assets needed to connect all the dots from origin to customer locations. Where are the drivers and where are the vehicles? What commitments have been made? Where are the customers? These and related variables can be fed to AI and machine learning engines that can crunch the data and then present a range of scenarios for optimization. With sophisticated tools that continuously learn and improve, industry professionals are able to make better up to the minute decisions as well as more informed, longer term strategic choices such as warehouse locations, fleet size and specifications etc. AI can accumulate knowledge based on human decisions, make judgments and interact with humans. Such systems can help automate accessing shipping data, fill in some invoices and webforms and distribute data to the right database.

The next comes Logistic Planning. Logistics requires significant planning that requires coordinating suppliers, customers and different units within the company. Machine learning solutions can facilitate planning activities as they are good at dealing with scenario analysis and numerical analytics, both of which are crucial for planning. Now let us look at the artificial intelligence use cases and benefits in logistics. The first is demand forecasting. AI capabilities enable organizations to use real-time data in their forecasting efforts.

Therefore AI-powered demand forecasting methods reduce error rates significantly compared to traditional forecasting methods such as ARIMA Autoregressive Integrated Moving Average and Exponentially Smoothing Methods with improved accuracy in demand predictions. Manufacturers can better optimize the number of dispatched vehicles to local warehouses and reduce operational costs since they improve their manpower planning. Local warehouses and retailers can reduce the holding cost that is the opportunity cost of holding the items instead of investing the money elsewhere. Customers are less likely to experience stock-outs that reduce customer satisfaction.

The second is the supply planning. Artificial intelligence help businesses analyze demand in real-time so that organizations update their supply planning parameters dynamically so as to optimize supply chain flow. With dynamic supply planning, businesses use lesser resources since dynamic planning minimizes waste. Automated warehousing, inventory optimization, avoiding over and under stocking. Machine learning is used in warehouses to automate manual work, identify potential difficulties and reduce paperwork for warehouse employees. ML also helps to program robots used in warehouses.

Additionally computer vision helps in detecting arriving packages, scanning barcodes etc. The third is warehouse robots. Warehouse robots are another AI technology that is invested heavily to enhance businesses' supply chain management. The warehouse robotic market was valued at US$4.7 billion in 2021 and expected to grow at a combined average growth rate of 14% between 2021 and 2026.

Machine learning makes AI capable of accumulating knowledge based on human decisions, make judgments and interact with humans. Other less complicated tasks can be completed with the help of robotic process automation. Robotic process automation powered systems are rule based and can help automate mundane tasks with the help of AI in the transportation industry. Among these tasks are assessing shipping data, filing in some invoices and web forms, distribute data to the right database and finally data becomes accessible to the AI. The use of robotic units for data related repetitive tasks offer businesses significant perks.

Amazon employs more than 100,000 warehouses robot that can already take over from human employees in many aspects. And as the statistics by EY, one of the largest accounting firm claims this can enable cost saving up to 65%. The online retail and shipping sector have progressively automated their warehouses more over the last decade. Another example is Alibaba. They have the world's largest automated warehouse where robots can collect and pack products for delivery to clients.

The fourth is damage detection, oblique visual inspection. Damaged products can lead to unsatisfied customers and churn. Computer vision technology enable businesses to identify damages and ensure quality control in warehouse operations. Logistic managers can determine the size and type of damage and take action to reduce further damage.

The fifth is predictive maintenance. Predictive maintenance is predicting potential machine failures in the factory by analyzing real-time data collected from Internet of Things sensors in machines. Machine learning powered analytics tool enhance predictive analysis and identify patterns in sensor data so that technicians can take action before the failure occurs. McKinsey Global Institute reports predictive maintenance will help organization save up to $630 billion by the year 2025. The deployment of AI for maintenance purposes is a powerful asset management solution for large scale organizations. The better is the maintenance of an asset, the higher is the performance and longer is an asset's life.

AI driven systems automatically gather and analyze data about assets and warn about possible breakdowns. Such systems can accumulate information about failures, draw up statistics and based on that statistical data schedule repairs. If a provider can guarantee the employment of available and reliable assets, it will help gain a competitive edge and trust of service consumers. The next is predictive intelligence. Global supply chains employ different means of transporting including a freight carrier, railway transport, waterway shipping.

Developing AI for better logistics, suppliers mitigate risks and generate predictions to prevent possible breakdowns. ML solutions combined with natural language processing can be used to gather meaningful data from multiple social media sources, process unstructured tests, conduct sentiment analysis and indicate possible risk. Likewise, AI based systems can use digital and satellite maps and information about traffic to help optimize routes. The system can take into account and process in the real time mode, time, place, traffic state changing customer demands.

The next is autonomous things. Autonomous things are devices that work without human interaction with the help of AI. Most things include self-driving vehicles, drones and robotics. We should expect to see more autonomous devices in the logistics industry due to the industry's suitability for AI. The next is self-driving vehicles. Self-driving cars

have the potential to transform logistics by decreasing heavy dependence on human drivers.

Vehicles such as flat-ooling support, driver's health and safety while reducing carbon emission and fuel usage of vehicles. Tesla, Google and Mercedes Benz are investing heavily in the concept of autonomous vehicles. It is only a matter of time before autonomous trucks are seen on roads around the world. However, according to BCG estimations, only around 10% of the light trucks will drive autonomously by 2030.

The seventh is delivery drones. For the logistics of products, delivery drones are useful machines. When businesses deliver products to places where a ground transfer is not possible, safe, reliable or sustainable. Especially in the healthcare industry where pharmaceutical products have a short shelf lifespan, delivery drones can help businesses reduce waste cost and prevent investments in costly storage facilities. Dynamic pricing is real-time pricing where the price of a product responds to changes in demand, supply, computation price and subsidiary product prices.

Delivery based pricing is an emerging phenomenon. The ninth is route optimization and freight management. AI models help businesses to analyze existing routing and track route optimization. Route optimization uses short-list path algorithm in graph analytics discipline to identify the most efficient route for logistics trucks. Therefore, the business will be able to reduce shipping cost and speed up the shipping process. For example, Valley RAN's Smart Road System is an AI web-based traffic management platform that deliver information about road conditions to autonomous vehicles and users.

Route optimizers are also effective tools for reducing corporate carbon footprint. Back office, every business unit has back office tasks and logistics are no different. For example, there are numerous logistics related forms like a bill of lading from which structured data needs to be manually extracted. Most businesses do this manually.

The next benefit is automating document processing. Invoice, bill of lading, rate sheet documents help communication between the buyers, suppliers and logistics service providers. Document automation technologies can be used to increase the efficiency of processing these documents by automating data input, error reconciliation and document processing. The eleventh is automating other manual office tasks. Hyper automation, also referred to as intelligent business process automation, means using a combination of AI, robotic processes automation, process mining and other technologies to automate processes in an end-to-end manner. With these technologies, businesses can automate several back office tasks.

Such as scheduling and tracking, AI systems can schedule transportation, organize pipelines for cargos, assign and manage various employees to particular stations and track packages in the warehouse. Report generation, logistics companies can use RPA

tools to auto-generate regular reports that are required to inform managers and ensure everyone in the company is aligned. RPA solutions can easily auto-generate reports, analyze their contents and based on the contents, email them to relevant stakeholders. The next is email processing. Based on contents and auto-generated reports, RPA bots can analyze the content and send emails to relevant stakeholders.

The twelfth is customer service chatbots. Customer service chatbots are capable of handling low to medium call center tasks such as, email requests, request for delivery, amending an order, tracking shipment and responding to a FAQ. Chatbots are also valuable tech to analyze customer experience. Chatbot analytic metrics enable businesses to understand their customer better so that they can enhance the customer journey they deliver. AI and rail transportation, vehicle fleets and facility networks. Large scale supply chains have to manage numerous vehicle assets and premises worldwide.

AI in supply chain and logistics makes it easy to tackle these challenges. It helps processes and classify related contracts, review long legal documents, keep customers' information up to date, verify delivery date, eliminate duplicate information and on and on. Additionally, such tasks require the involvement of whole department, which is expensive and unproductive. However, AI systems still require human supervision. A human in the loop approach is the best one when it is needed to review the output provided by AI.

Another example in the AI breakthrough in rail transportation. AI technologies can be used to build fully autonomous rail systems with smart infrastructure and self-driving trains for carrying cargo and people. The trains will also interconnect with other trains, exchange data, receive notifications from human managers and take notification-based actions. What is more, AI and rail transportation are inseparable when it comes to predictive maintenance. Intelligent systems enable real-time equipment analysis and mechanical issue detection both locally and remotely. So, to conclude, we have discussed the concept of market logistics and logistics management.

We then explored the disruptive technologies in logistics and potential economic impact of AI applications in logistics. We also studied the major AI applications and use cases in logistics and we finally discussed AI in rail transportation, vehicle fleets and facility networks. And these are the 9 sources from which the material for this module was taken. Thank you.