Machine Impact in Supply Chain Management

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Abstract: This paper is an analysis on the impact machine learning, Artificial Intelligence, and robotics has on the supply chain management. The analysis covers the basis of AI in the SCM mechanisms while defining it from the ground up. Later on, to shed a true light on supply first the paper zooms in on the effects of machines in marketing. From what particular methodologies are deployed in today's environment extending all the way to its anticipated outcomes. As the reader progresses he/she will find valuable studies on the main segments of machine learning within the supply chain itself. Certain novelties and innovations are scrutinized regarding SCM alongside these studies. These innovations are exemplified by certain cases presented in Part 3. The penultimate section briefly examines the possible drawbacks of the surge in machine application in SCM. The final section compiles the ideas presented in the paper as a whole and gives a glimpse of an estimate for the near future.

Keywords: Artificial Intelligence, Machine Learning, Supply Chain Management

I.   Introduction

Ever since the first Terminator movie debuted in theaters, we have started seeing any improvement in machines and machine thinking as an omen of a dystopian society. Historically speaking, starting in World War 2 and extending to today, machines have left an undebatable impact in our lives and continue to do so. Machines have transformed our ways of thinking while also making our lives so much easier by undertaking tasks extremely complex to the human mind. Although machines are a very broad term, in our context we will generally refer to machines as artificial intelligence while also emphasizing robots and other machinery (tangible and intangible machines). This paper will emphasize how machines transform our supply chain management with various segments including marketing, supply chain management innovations with AI, and even these innovations' overall impact.

What is Artificial Intelligence (AI)?

Artificial intelligence's dictionary definition is "The theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages". On another note Alan Turing, inventor of the first computer in World War 2, runs a specific test to identify AI. According to his test two subjects would be kept in different rooms with a human asking typewritten questions. If the person asking the questions cannot distinguish between the two, we have a case of artificial intelligence. His maxim aligns with the specific question- "Can machines think?" (Vaillancourt, 2018).

Machines in our daily lives

Do we ever pay attention when we go on Netflix to watch a movie and see a wide spectrum of other movies suggested to us based on our streaming history? With various numbers suggesting a 92% match or 61% match to our taste as we scroll down a list. Going to a different platform, when we are on Amazon and see all these product suggestions based on purchase history or certain products appearing before others, do we wonder why or how? These are perhaps a couple of the dominant presence of machines in our lives. As consumers maybe we do not pay attention nor may not even bat an eye. However, for the companies supplying these services and products our reactions to these suggestions create the backbone for their continuity. Even though we might be completely oblivious to these features and call them marketing ploys, they constitute the knowledge base on which their supply chain is constructed.

II.   Part 1: Machines and Marketing

Nobody needs to have a major in economics to pinpoint how supply and demand are like Ying and Yang, songs and dancing, or in simpler terms intrinsically necessary complements. Russell H. Conwell, the founder of Temple University in Pennsylvania, once said   "If you know what people need you have gotten more knowledge of a fortune than any amount of capital can give you." (goodreads.com). This alone gives us an idea of how important demand is to supply and essentially the supply chain management. Although there are

many novelties in the supply chain management alone, machine marketing is and should be the first milestone to be recognized.

Machine learning in improving customer experiences

Customer experience is the leading determinant of demand as it gives companies the lens to see through what customers want. This in turn reflects in sales and revenue. In fact, according to Capgemini 3 in 4 organizations implementing AI in their marketing strategies increase the sales of new services and products by 10%. This also aligns with their additional 10% customer satisfaction rate. A similar study conducted shows faith in machine learning for customer care, as 57% of executives believe that AI will change the customer care segment remarkably (Colombus, 2018).

Personalized advertising

When many online users are just going about with their lives, they constantly encounter chatbots or ads specifically targeting their interests on the websites they frequently visit. At first this was a method implemented by eBay and Amazon to test product demand based on clicks per product or purchases per product. Today this method has extended beyond e-commerce platforms into personalized ads everywhere we go. As personalized advertising stands as a pivotal channel between businesses and customers the improvements expected by 2020 are staggering. The top two sections in which astonishing results are expected in real time personalized advertising alongside optimized message targeting, respectively increasing 3% and 8% (Colombus, 2018).

Predicting churn rates

Perhaps one of the greatest portents of an unpropitious future for businesses is customer churn rates. Churn rates are a real factor in the business supply chain alongside a sensitive area in measuring decrease of demand. In order for this to be truly accounted for machine learning and AI has been used. Especially telecommunications sector, which has a high elasticity to price fluctuations, has adopted these techniques within the past couple years efficaciously. This sector uses one AI tool extensively in pursuit of evaluating customer churn accurately. This AI tool is called Microsoft Azure and it uses a 3-step intervention method with 2x2 charts. First chart analyzes probability and risk tolerance. The second chart, also the most important step, uses probability to churn (high, low) and customer lifetime value (high, low). After adding the two it uses an algorithm to measure whether or not to call and email, email, or not promote at all based on what decile the customer falls in (Colombus, 2018). Needless to say, all of these factors contribute to a plan of action in the supply chain. Especially if these companies are goods oriented rather than service oriented the accuracy of measuring customer churn becomes a much more sensitive subject.

Price elasticity: The future of manufacturing

Do we ever wonder why airline tickets are updated on Mondays and Tuesdays? Perhaps do we ever get baffled to see completely different price tags on certain flights even if the more expensive one was 8 months later than the cheaper ticket? AI has become so advanced today that it analyzes demand with absolute precision. Although hotels, cars, and airline tickets are the main drivers of this type of forecast manufacturing and services are on the rise of dethroning them. According to new methods adopted in manufacturing segments price elasticity is measured under four subdivisions. These subdivisions are channel segment, customer segment, sales period, and the product's overall position. These channels are being used extensively on e-commerce platforms like Amazon, eBay, and Shopify (Colombus, 2018).

III. Part 2: Machines and Supply Chain Management

Machine learning on the supply chain level is decisive to long term and short-term success of many companies. As this paper puts heavy emphasis on machines and their impacts on supply chain management it is essential to analyze the innovations related and within this segment. Marketing sets the first step in terms of reaching out to customers and assessing their needs. Supply chain management engulfs everything from how the manufacturing is conducted to the point on how goods and services are delivered to consumers. The general purpose in fact for using AI in supply chain management is boosting profits and productivity. In fact, a study by Tungsten Network suggested that an astounding 6500 hours are spent by businesses on average a week with manual operations. These operations can be generally named under paper-based processes, chasing invoice exceptions and discrepancies, and last but not least with addressing supplier inquiries (Kodiak, 2017). How do machines address the issues present in supply chain mechanisms today?

Accurate demand forecasting

This is a hybrid area for businesses in which marketing and supply chain management work together. As data sets get bigger and bigger a shift towards innovative demand forecasting should be taken into effect.

Normally speaking, businesses have been adept in calculating their demands with warehouse data on a monthly basis. With the power of AI this process is expanded on a product and store level encompassing daily, weekly, monthly and even annual periods. What companies could not fathom to predict before AI is virtually doing effortlessly. For instance, Procter & Gamble, a well-renowned consumer goods company, relies on an AI technology named E2open that completely automates the forecasting process. The creators of this technology claimed that any outside intervention to the algorithm gives worse outcomes than the algorithm working on its own (Banker, 2019).

Procter & Gamble is not the only company taking full advantage of AI in demand forecasting and adjustment. For instance, Lennox, a residential heating and cooling provider, uses a cluster-based model. In this model there are various clusters and its contributions to the overall forecasting. These clusters are web, media, promotions, market models, new products, and historical demand. All of them comprise the demand model (Colombus, 2018). These models do not only improve assortment efficiency, but they are estimated to bring in a 2% increase in EBIT (Earnings before interest and taxes), 20% stock reduction, and last but not least 2 million fewer product returns annually. These numbers are followed by a McKinsey report suggesting a 50% assortment efficiency for retailers while expecting to deliver a 30% surge in online sales (Colombus, 2018).

Virtual assistance

As aforementioned businesses and companies cannot always keep up with the extreme workload caused by manual labor in the office. Since the number of hours spent carrying out these tasks reach 6500 hours a year companies can use help from virtual assistants such as chatbots,including the following:

- Chatbots can serve simple tasks such as talking to suppliers for basic needs and leave the difficult conversations for a human.
- Instead of bringing in a human to run a supplier through compliance requirements, chatbots can automate the process.
- Bots can handle cold calls with simple instructions. Cold calling is an area within most businesses that most employees do not like carrying out and this situation gives even more incentive to companies to adopt bots.
- Bots can be used as prospectors meaning they can find suppliers and analyze market prices. If there is a certain supplier found with lower than market prices chatbots can engage in negotiations. These include purchasing, bidding, and carrying out low cost transactions.
- Bots will also handle perhaps the most enervating process to human employees-paperwork. By paperwork we mean invoices, payments, order follow ups, shipments, and many other trivial yet time consuming tasks. (Smith, 2016)

Warehouse Management

What is supply chain management without warehouse management? Warehouse management is undoubtedly one of the most complex systems within the supply chain system. Warehouses are essential to layout planning, order matching, alongside time efficiency and management. There are various aspects of building these complex warehouse systems and these aspects include vision-based sorting, vision-based inventory management, machine-video perception, voice activated order systems, in-facility robots, autonomous fleets (will be covered in the following section), and many others (Colombus, 2018). Especially DHL partnering with IBM created very complex solutions to logistics and warehouses.

Warehouse management does not only pertain to layouts, but it also measures factors of production, and yes these include service companies as well. For instance, Manhattan Associates uses an optimization algorithm to estimate time required to complete certain operations. According to the data derived from the assessments the algorithm prioritizes the operations and distributes roles to both machines and humans. Nonetheless same approach is also used by Cloud service companies one of which is Oracle. Oracle adapts to the dynamic forces used within their cloud services for business owners around the world. The procedure mandates the algorithm to compute an average load each business needs. Later on, it first arranges the cloud space and then redistributes it to the customers instantaneously. These and many other companies adroitly use AI within their day-to-day physical and virtual warehouse managements (Reiser, 2018).

There is not always a fine line between warehouses and production facilities. In reality many of them use their facilities as their warehouses. When we take this truth into consideration AI should also help with production plans. Certain companies use build-to-order or make-to-stock models. With the additional help of AI companies are also scoring impressive leaps forward regarding order timing. This in turn reduces inventory costs effectively.

Logistics and deliveries

It would indeed be a tedious and lengthy process to analyze or name every minute detail within the supply chain management. That process would be amplified in length when we combine machines into the equation. Yet there is one aspect of supply chain management that may truly redefine the future and that segment is logistics. Perhaps one of the greatest limitations to deliveries and logistics are government regulations. By law a driver is not allowed to drive more than 11 hours a day and without taking an 8-hour break. Especially after the breakthroughs of Tesla with self-driving cars alongside Google's pilotless car trials, businesses have extreme optimism looking into the future. Autonomous vehicles would mean faster shipping, significantly reduced costs, better lead times, and a consequent competitive advantage. Although it is a bit more futuristic than today's prevalent trends, we may encounter these novelties heavily in the very near future (Kodiak, 2017).

In terms of more present innovations we see drone deliveries as the new age of delivery. Of course, this method has demographic limitations and cannot be applied to wide geographies. Nevertheless, Amazon and Alibaba pioneered these two unique delivery methods. Amazon launched Prime Air in 2016 to deliver certain areas in 30 minutes in the United Kingdom. Alibaba on the other hand used the same method in Shanghai for food delivery (Richter, 2018).

Deliveries keep gaining new dimensions with various predictive techniques. Another method for delivery improvement lies within various new inputs. These new inputs include customer feedback, historical delivery information, and weather reports to pinpoint delivery times. Since delivery times are one of the biggest determinants of customer retention rates, getting accurate data serves many purposes. A telecom manufacturing company, Infinera had a really disappointing year right before they integrated artificial intelligence into their supply chain. This update improved their customer satisfaction rating drastically also creating a more cohesive company (Morgan, 2018).

IV.   Part 3: Leading Examples of Machine Impact in the SCM

Amazon

When there is a benchmarking test done in the e-commerce industry the top competitor every other company looks up to is Amazon. From their immense level of success, they have even pioneered a term after themselves call "Amazon Effect". Wherever Amazon put its foot in it has revolutionized the company. They have acquired Whole Foods and brought outstanding supply chain innovations to it particularly using AI. Partnering different business is never easy, yet Amazon already started implementing new methods called Amazon Go. This method allows Amazon to give customers an outstanding experience. With this beta, Amazon introduces 3 milestones simultaneously. The first is checkout-free shopping, which allows customers to "Just Walk Out". The last step involves an automated payment when the customer leaves. In order for Amazon to establish this breakthrough mechanism they need immense supplier integration. Not only do they have to track inventory in-store, but they should establish a system to update inventory using warehouse supplies nearby. This process is extremely expedited but could only be achieved by an AI expert like Amazon. Nonetheless, this is only one example from Amazon's magic hat of innovations (Howells, 2017).

Amazon is so dominant in machine learning that they have built warehouse robotics (paywalls), blockchain, and IoT's to nearly switch to a full automation technique. They are also known for using smart robots in their warehouses and facilities for smart arrangements. Since Amazon is almost synonymous with AI, they are expected to shape the future of supply chain management or if not lead it (Taylor, 2019).

Other examples
- Rolls Royce: The luxury vehicle company uses AI and machine learning to safely transport its vehicles overseas. The smart sensors and machines attached to the ships are expected to warn the ship as it traverses through wavy or stormy locations. Considering most of Rolls Royce cars are nearly half a million dollars this is a smart strategy (Morgan, 2018)
- Kroger and Microsoft partnership: Amazon and Whole Foods partnership has irked competitors of both segments. Kroger, a grocery store behemoth, wanted to embrace a similar outlook partnering with Microsoft. With this partnership Kroger aims to meet consumer demand using digital pricing signage, instant promotions, and IoT sensors. Consequently, improving its supply chain with generating more interest to physical stores (Shoot, 2019).
- UPS: UPS uses ORION (On-road Integrated Optimization and Navigation) to help its fleet make timely deliveries using efficient routes. This system compiles customer, driver, and vehicle information to create efficient routes for drivers. This innovation can help UPS lower wear and tear, time loss, and financial loss. UPS predicts that this optimization can help them reduce delivery miles by a 100 million while saving the company $50 million annually (Morgan, 2018)

V. Part 4: Is There a Catch?

Can machines figure it all out?

In order for machines to have a high success rate the rules are simply laid out. If you feed machines bad data, you will get bad results. Machines indeed are very efficient, yet they cannot create variables on their own without preprogramming the input. If they did, we would probably be actually living in that dystopian society in "I Robot". AI does not have a predilection unless the right input is coded to acquire the right output. Since supply chain is a very complex structure there needs to be human involvement until a web of responsive systems are established. Afterwards, human interaction becomes seldom necessary, unless matters become too complicated (Vaillancourt, 2018).

Are machines replacing people?

If there is anything scarier to our society than an army of robots spraying bullets to humans, is the same army of robots replacing their jobs. There has been an extremely hot debate for decades now regarding robots and their qualifications to replace the workforce in the future. In reality however, robots create a much more creative environment for humans by eliminating trivial and draining tasks from their lives (Vaillancourt, 2018). This way instead of occupying their minds with simple tasks, employees in the supply chain can improve their strategic decision-making. In the long run this does not only create better leaders but also better critical thinkers. For instance, after Amazon started installing robots manufactured by their $775 million acquisition Kiva, later on named Amazon Robotics nobody got laid off. Actually, the employees that once carried out what robots did,were now operating the robots (Wingfield, 2017).

VI. Conclusion

Machines and AI in our generation has took the supply chain industry by storm. Today there are countless companies integrating machines into their supply chain management in countless ways. AI will keep growing to unprecedented proportions while robots and drones will also be a part of this realm. According to a study conducted by Aberdeen Group, we might have AI technologies doing the following by 2030 in the respective efficacy rates:

- Collaboration with customers strategically: 93%
- Demand forecast accuracy: 86%
- Segmenting the demand forecasts with the right customer-product channel: 73% (Barry, 2017)

Just looking at these values alone can be suggestive of an almost human AI involvement in supplier-consumer environment. Overall, this industry is constantly evolving every day and every year. There is one thing certain for the future of supply chain management: Machines will be a colossal part of this segment and will do more in the future than it does today for SCM.

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