

Challenges and Its ways to Cope Up with New Digital Techniques in this Digital Supply Chain Management Era

¹Ankita Maiti, ²Rupesh Khare

¹ *Data Scientist, ABB, India*

² *Global Head of Advance Artificial Intelligence, ABB, India*

Abstract

This paper is an extension to the previous paper based on the digital supply chain framework and its importance, its need to digitalize various parts of the supply value chain. In this paper, we discuss about how to overcome the challenges of traditional supply chain such as Inventory management accuracy, warehouse efficiency, smarter planning, and risk management, on time delivery and high transparency between the tiers, also suggested various analytical strategies and application of Machine Learning technology with its pros and cons on overall framework.

Keywords— Artificial Intelligence, Machine Learning, Analytics, Digitalization, Supplier Chain Management

I. INTRODUCTION

The traditional way of supply chain has many existing challenges, including the lack of transparency and traceability, difficulty in managing risks and disruptions, and the need to build trust and faster production process. In the previous paper, we have discussed about the traditional supply chain flow and the areas in supplier chain which need to be enlightened for digital integration. Fig 1.1 (Appendix) shows the traditional supply chain process in an electrical equipment manufacturing company and its parts which could be digitalized. The paper also discussed about the digital supplier-manufacturer framework for integration with the detailed frameworks of Supplier chain processes from Supplier Selection to Negotiation and Evaluation digitally. Fig 1.2 depicts the final view of the supplier-manufacturer digital supply chain framework.

The four phases of the paper discussed about the digitalization in the supply chain, give a framework to digitalize those supplier's areas and associated benefits. As an extension to the same paper, we now talk about the other major areas of that needs to upgrade and its benefits to the supply chain framework. In this paper, we

would further highlight the various parts of the supply chain that need to be digitalized and answer various questions such as why digitalization is needed in the traditional supply chain, how can this be achieved, what are the various challenges in traditional SCM and how advanced analytics can be introduced in the supply chain to make the processes more efficient.

Application of Artificial Intelligence (AI) and other Machine Learning (ML) algorithms provides us various gain over the challenges that the SCM now faces with in the current digital world and technologies. Artificial Intelligence (AI) and other Machine Learning (ML) are already beginning to change the face of the supply chain industry. By culling out deep-rooted inefficiencies and uncertainties, Analytics drive enterprise-wide visibility into all aspects of the supply chain and with granularity and methodologies that humans simply can't mimic at scale. Analytics in supply chains is helping to deliver the powerful optimization capabilities required for more accurate capacity planning, improved productivity, high quality, lower costs, and

greater output, all while fostering safer working conditions.

II. SCENE SETTING

This research study aims to look at various KPIs of interest in the entire value chain with focus on Customer-Manufacturer-Supplier ecosystem from a Digitalization perspective scenario creating a huge impact on Materials, Planning and process in the supply chain and suggesting preventive methods using AI and ML technologies.

2.1 To study the existing framework of supply chain

The traditional supply chain has many existing challenges, including the lack of transparency and traceability, difficulty in managing risks and disruptions. We also figured out various KPI's that caused adding on the various non-value-added services in the supply chain.

2.2 To study the need and difficulties confronted with and without digitalization in the supply chain

Digitalization enables industry to reach yet another level of accomplishment. Digitalization – i.e. the networking of people and things and the convergence of the real and virtual worlds that is enabled by information and communication technology (Kagermann, 2018), that digitalization triggers a radical transformation of the manufacturing environment. That is, with the emergence of the Internet of Things, we are now entering the era of the “fourth industrial revolution – Industry 4.0” (ibid, 2017).

2.3 To study the various analytical strategies that can be applied to facilitate the interaction of SCM digitally

The current technology-based market is demanding and fast processing, with less human intervention and low error rates. So, with the help of Data Science and analytical techniques we are getting more data from more sources; it is the right data; and it is accurate.

2.4 To collect data and analysis based on the survey on supply chain digitalization integration

This part has been explained and surveyed in the next section of this paper. This gives out a very data specific outcome, of how is transformation from traditional to smart applications and technologies helped industries and companies form various threats and opened a way for new opportunities. Also, rectifying many existing limitations in their systems to ease the process flow and help industries evolve with the changing environment and technologies.

2.5 To understand how Integration of Analytics help in overcoming challenges based on empirical studies

Artificial Intelligence and Machine Learning (ML) are already beginning to change the face of the supply chain industry. By culling out deep-rooted inefficiencies and uncertainties, Artificial Intelligence and Machine Learning drive enterprise-wide visibility into all aspects of the supply chain and with granularity and methodologies that humans simply can't mimic at scale.

III.OBJECTIVE CONCEPTS AND INSIGHT

3.1: The whole focus of the previous paper was on analyzing the existing prior art and identifying digitalization opportunities and identification of value proposition in data exchange between manufacturer and suppliers which was purely case based approach from the company's perspective and studies.

Various non-value-added services or factors that influenced the data flow in the supply chain were-

1. No seamless data and information flow
2. No common platform for internal communication
3. Lack of transparency
4. Inappropriate hierarchy
5. Data duplicity or multiple copy of data
6. Reduce markdowns and stockouts
7. Human effort wastage

3.2: Traditionally, manufacturing organizations focus on producing and selling tangible products (Herterich, Uebernickel, and Brenner, 2019). In recent years, the manufacturing industry has been facing challenges such as constant need to expand into new markets and geographies, to capitalize on technology to affordably adapt new processes, to implement faster and more efficient ways of sharing fulfilment information, and furthermore to demonstrate compliance capabilities to win new businesses. Meanwhile, industry distribution faces challenges of increasing demand for just-in-time inventory, the need for up-to-date supply chain visibility, and service automation requirements from customers. **Digitalization** alludes to "the expanding infiltration of computerized advances in the public eye with the related changes in the association of people and their conduct" (Gimpel and Roglinger et al. 2019).

The digitalized "smart factories" are simultaneously vertically connected to the operational processes of individual factories while being horizontally linked to value networks that stretch across the entire globe, incorporating everything from ordering to delivery.

Forward-thinking companies are turning to integration to digital supply chain strategies harnessing the power innovations such as big data, the internet of things, artificial intelligence, machine learning and augmented reality. There can be various challenges both advantageous and disadvantageous faced in the process of transformation from traditional to digital supply chain management,

Challenges:

1. One of the major challenges in the digitalization of logistics is involvement of different stakeholders and communication among these stakeholders needs to be inclusive
2. Necessity of a platform where stakeholders can access common relevant information, dashboards that process and present this information empower decision-makers to pinpoint production bottlenecks, transform maintenance activities from reactive to

preventative and predictive, identify parts redundancies and consolidate sources of supply.

3. Silo-based procurement, inventory, and maintenance processes create conflicts among departments whose performance is measured based on isolated factors such as work order completion, units produced, on-time delivery, or cost per piece. As a result, cooperation among various factions can be challenging.

3.3: Technology such as artificial intelligence, machine learning and cloud computing enable us to analyze and use that data in powerful new ways. Rather than using information to sound alarms when there are "exceptions" – problems or anomalies in the supply chain – we can use it to prevent them. Data becomes about managing the future, not the present.

3.4: Deep learning algorithms are appropriately named since their primary focus is on building systems that can learn from daily activity, mistakes, and solutions alike. In Inventory management, forecasts of future demands are generated to select an efficient inventory level, balancing inventory holding costs for excessive stocks with costs of lost sales-revenue through insufficient stock. Consequently, the precision of the forecasts directly determines the safety stocks kept, the inventory level and the inventory holding costs. Hence, forecasting methods with superior accuracy such as ANN may significantly reduce inventory holding costs. The ability to ingest mountains, and we mean terabyte after terabyte of data and come up with real-time actionable insights is pattern recognition on a whole new scale. There are several practices to implement and rely on simulation modeling for strategic and operational decision making, including hiring simulation engineers, building internal simulation team, or contract consultants. These practices are different in terms of budget, time to implement, and returns.

There are various other technologies and techniques in the digital world that can be adapted in SCM. Few are namely: AI and ML, DNN & ANN, Stochastic simulations, Physarum model, Bayesian networks, Swarm

intelligence, SVM, Internet of Things (IoT) and many more.

3.5: AI in supply chains is helping to deliver the powerful optimization capabilities required for more accurate capacity planning, improved productivity, high quality, lower costs, and greater output, all while fostering safer working conditions.

Studies suggest that AI and ML can deliver unprecedented value to supply chain and logistics operations. from cost savings through reduced operational redundancies and risk mitigation, to enhanced supply chain forecasting and speedy deliveries through more optimized routes to improved customer service. Some of the high impact areas in supply chain management include planning and scheduling, forecasting, spend analytics, logistics network optimization and more.

Integration of supply chain with smart analytics brings in various advantages in the supply chain from reduced labor, decrease utilities, increased productivity per hour, low percentage errors to increased profits for the organizations.

IV. DATA COLLECTION AND DATA ANALYSIS

As a part of research analysis, we analyzed our data and case studies over various companies in the supply chain market globally. The following results were analyzed and the main reasons behind these were followed up and depicted after the analysis process. The analysis was done in 3 stages:

1. Data collection: from the various sources on internet, research thesis, old research papers and offline interviews
2. Data Analysis: done after the data collection using the analysis tools
3. Data Interpretation: based on the findings of the analysis, we concluded how much Digitalization is needful for the current market from small SC businesses to globally

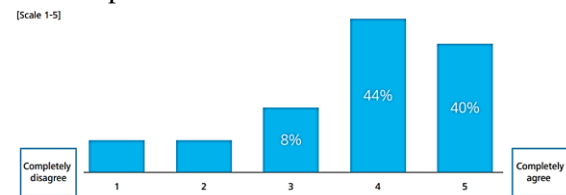
4.1: Data Collection

Based on survey done online (LinkedIn Voting, 2021), the digital transformation from traditional way to smart way has made good

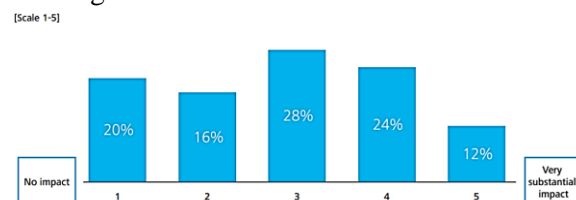
progress all over globally. The transformation not only influenced competitiveness in companies but also opened upon many new opportunities and risks, identifying future scopes and potentials for business and facilitate new manufacturing technologies.

We considered various factors in the transformation-

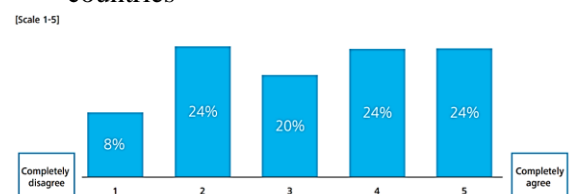
1. Digital transformation boosts the global competitiveness



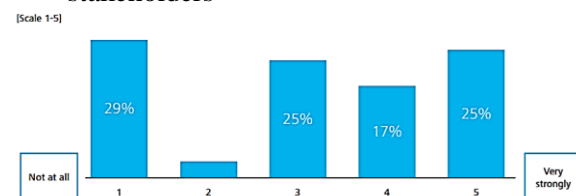
2. The company's feeling about the impact of digital transformation



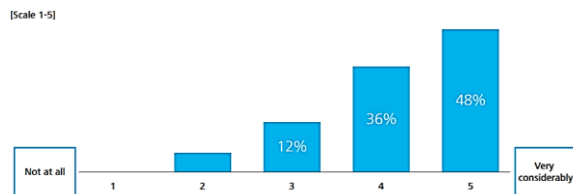
3. Digital transformation slowing down trend towards relocating production to low-wage countries



4. The company is already processing data through digital processes among all their stakeholders



5. Digitalization increasing cyber risk for manufacturing companies globally



4.2: Data Analysis and interpretation

After studying the collected data and understanding the graphs, we can conclude that Digitalization might have increased the chances of cybercrimes and invited with many new cyber thieving, but as they say, a coin has two faces, so with disadvantages comes the advantages on the other face, where data processing and accessibility to them is now very easy and globally from anywhere in the world. The stakeholders have much appreciated with the transparency in the whole chain and there involvement throughout with hierarchical securities and authentications.

As the study depicts, digital transformation slowing down trend towards relocating production to low-wage countries, giving those countries in economic needs to grow and have decent knowledge of the global demands too. With reduced wage and high fruitful outputs and productions, the companies have now started to have a huge competitiveness globally. Increasing new paths to betterment.

V. ADVANTAGES & CONCLUSION

5.1: Benefits of AI in Supply Chain

5.1.1: Accurate Inventory Management:

Accurate inventory management can ensure the right flow of items in and out of a warehouse. By and large, there are many stock related factors like request handling, picking and pressing, and this can turn out to be extremely tedious with a high propensity for blunder. Additionally, precise stock administration can help in forestalling overloading, lacking stock and startling stock-outs.

With their capacity to deal with mass information, analytical tools can end up being exceptionally successful in inventory administration. These keen frameworks can break down and decipher gigantic datasets rapidly, giving opportune direction on

anticipating organic market. These AI systems with smart calculations can likewise foresee and find new customer propensities and conjecture occasional interest. This use of AI expects future client request patterns while limiting the expenses of overloading undesirable stock.

5.1.2: Warehouse Efficiency: An efficient warehouse is an integral part of the supply chain and automation can assist in the timely retrieval of an item from a warehouse and ensure a smooth journey to the customer. AI systems can also solve several warehouse issues, more quickly and accurately than a human can and simplify complex procedures and speed up work. Also, along with saving valuable time, AI-driven automation efforts can significantly reduce the need for, and cost of, warehouse staff.

5.1.3: Enhanced Safety: AI-based automated tools can ensure smarter planning and efficient warehouse management, which can enhance worker and material safety. Analytics can also analyze workplace safety data and inform manufacturers about any possible risks. It can record stocking parameters and update operations along with necessary feedback loops and proactive maintenance. This helps manufacturers react swiftly and decisively to keep warehouses secure and compliant with safety standards.

5.1.4: Reduced Operations Costs: This is a big benefit of AI systems for the supply chain. From customer service to the warehouse, automated intelligent operations can work error-free for a longer duration, reducing the number of errors and workplace incidents. Warehouse robots provide greater speed and accuracy achieving higher levels of productivity.

5.1.5: On-time Delivery: AI systems can help reduce dependency on manual efforts thus making the entire process faster, safer and smarter. This helps facilitate timely delivery to the customer as per the commitment. Automated systems accelerate traditional

warehouse procedures, thus removing operational bottlenecks along the value chain with minimal effort to achieve delivery targets.

5.1.6: High transparency: By implementing Analytics in supply chain and logistics, supply chain managers can enhance their decision making by predicting building-up bottlenecks, unforeseen abnormalities, and solutions in order to streamline production scheduling that otherwise tends to be highly variable due to dependencies on manufacturing operations management. Furthermore, analytical techniques in supply chain also led to accurate predictions and quantification of expected outcomes across different stages of the schedule enable the scheduling of more optimal alternatives as and when such interruptions occur during execution. Having a cognitive AI-driven automated platform offers a single virtualized data layer to reveal the cause and effect, to eliminate bottleneck operations, and pick opportunities for improvement. All this using real-time data instead of redundant historical data.

5.1.7 Faster Decision Making: Faster decisions based on accurate representations of usage, costs, and historical performance. Elimination of effort duplication in which several departments input similar data for different purposes. By digitalizing and collecting data from across the enterprise, supply chain integration creates a single version of a company's performance – sales, efficiency, cost allocations, profit centers and more. Less downtime as machine learning and analytical forecasting helps coordinate maintenance and predict part failure.

VI. CONCLUSION

We can conclude that digitalization might have increased the chances of cybercrimes and invited with many new cyber thieving, but as they say, a coin has two faces, so with disadvantages comes the advantages on the other face, where data processing and accessibility to them is now very easy and

globally from anywhere in the world. The stakeholders have much appreciated with the transparency in the whole chain and there involvement throughout with hierarchical securities and authentications. Furthermore, AI in supply chain also led to accurate predictions and quantification of expected outcomes across different stages of the schedule enable the scheduling of more optimal alternatives as and when such interruptions occur during execution. Having a cognitive AI-driven automated platform offers a single virtualized data layer to reveal the cause and effect, to eliminate bottleneck operations, and pick opportunities for improvement. All this use real-time data instead of redundant historical data.

VII. LIMITATIONS AND FUTURE SCOPE

7.1: Challenges of AI in Supply Chain

7.1.1: System complexities: AI systems are usually cloud-based and require expansive bandwidth which is needed for powering the system. Sometimes, operators also need a specialized hardware to access these AI capabilities and the cost of this AI-specific hardware can involve a huge initial investment for many supply chains partners.

7.1.2: The scalability factor: Since Most AI and cloud-based systems are quite scalable, the challenge faced here is the level of initial start-up users/systems needed to be more impactful and effective. Since all AI systems are unique and different, this is something that supply chain partners will have to discuss in depth with their AI service providers.

7.1.3: The cost of training: Like any other new technology solution, training is another aspect which needs significant investment in terms of time and money. This can impact business efficiency as supply chain partners will need to work with the AI providers to create a training solution that is impactful yet affordable during the integration phase.

7.1.4: The operational costs involved: An AI-operated machine has an exceptional network of individual processors and each of these parts need maintenance and replacement from time-to-time. The challenge here is that due to the possible cost and energy involved, the operational investment could be quite high. Manufacturers would also need to replace these which can shoot up the cost of utility bills and could directly impact the overhead expenses of keeping them running.

7.2: Future Scope

For this system, we have focused only on AI and simple analytics technique to help overcome the limitations of traditional SCM based problems. This study could be furthermore divided and studied into sub parts on IoT applications, machine learning technologies, Advance Machine learning techniques, various stochastic algorithms, technology specific models and many more.

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[Appendix]

FIGURES AND DIAGRAMS

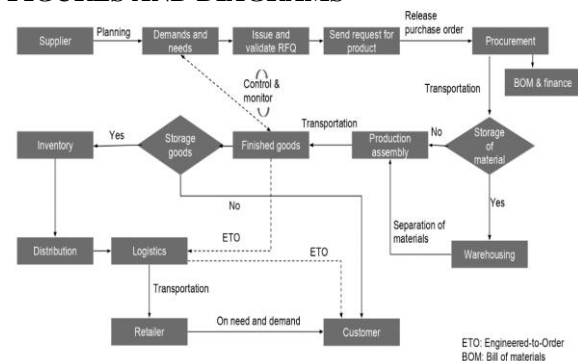


Fig 1.1: Traditional supply chain process

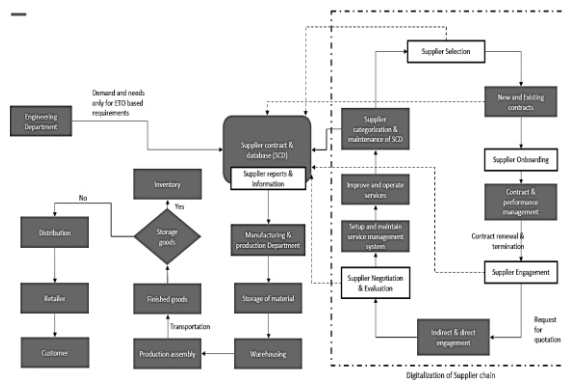


Fig 1.2: Final Digitalization integrated supplier-manufacturer Framework

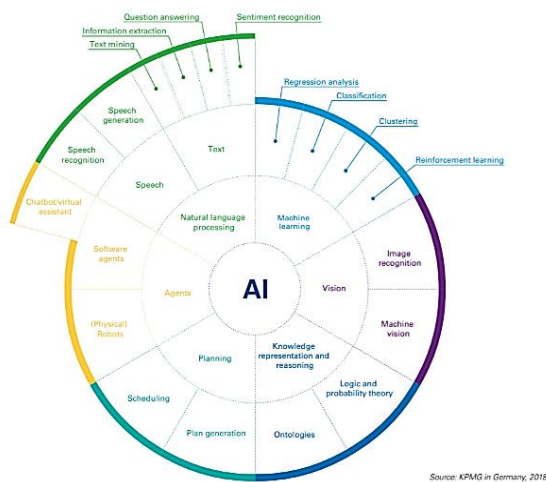


Fig 3.1: AI and ML integration with Supply Chain