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Big Data Analytics in Supply Chain Management

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Abstract - *With the world moving towards the Industry 4.0 Standard, the quantity of machines, processes, and administrations creating and gathering enormous amounts of information will increase extraordinarily later on. This will bring about Big Data, which is tremendous measures of information that can't be prepared with traditional calculation procedures. To reveal designs in the enormous measures of information and gain important experiences on it, Big Data Analytics is contrived. Inventory network is a critical supporter of Big Data wherein the variety of data is huge. The information collected by Supply Chain contains data from the key substances like assembling, logistics, and retail. The utilization of Big Data Analytics on an assortment of such abundant informational collections can develop a proactive dynamic methodology for foreseeing key freedoms and dangers in Supply Chain. This paper talks about the different applications, benefits and the difficulties of Big Data and Big Data Analytics in the Supply Chain.*

***Key Words*: Big Data, Big Data Analytics, Supply Chain, Data Driven, Supply Chain Management.**

1.INTRODUCTION

According to Gartner (2012), "High-volume, high-velocity, and/or high-variety information assets that necessitate cost-effective, creative forms of information processing that offer better insight, decision making, and process automation," according to the definition of Big Data. In addition to this, Big Data has been defined with the '3V's' concept by Laney (2001) : Volume, Velocity and Variety. With the 5V's concept, Big Data can be explained with two more 'V's' in addition to the classic Laney's definition. Veracity and Value are the two additional 'V's.

1.1 Supply Chain

Supply Chain can be considered as a mix of four unconventional yet interlinked elements like Marketing, Procurement, Warehouse Management and Transportation. Supply Chain Management is answerable for making and keeping up with the connections of various entities in a business which are liable for obtainment of raw material to ultimate end client delivery of the item (Halo, 2018). This paper centers around the wellsprings of created information in Supply Chain, openings in Supply Chain from the analysis of gathered information and the difficulties in use of that information. In this research paper we will examine about the significance, potential opportunities and difficulties of Big Data applications in Supply Chain and logistics.

1.2 Big Data Analytics

Big Data Analytics is applying advanced analytics techniques to large amounts of data in order to extract useful information and facilitate data-driven decision-making. There are three tiers of analytics in Big Data Analytics i.e., Prescriptive Analytics, Predictive Analytics and Descriptive Analytics. Each level of analytics has a distinct function and goal.

In the Industry 4.0 trend, Prescriptive Analytics gathers application data from processes like Manufacturing, Logistics, Transportation, and Warehousing, as well as newly introduced processes like Cyber Physical Systems. Procurement, risk assessment, risk management, and forecasting are all areas where predictive analytics can be useful. In terms of the amount of processes in a system, descriptive analytics has the most flexibility. Descriptive analytics is used to provide effective and summary reports on raw data that are easy to understand for humans. The majority of the data used in descriptive analytics is historical data (Nguyen, Zhou, Spiegler, Ieromonachou, & Lin, 2017).

2. Importance of Big Data in Supply Chain Management

With the technical progressions across the elements of Supply Chain, information created is expanding at a quick rate. The data stream was recorded as far as actual archives until the utilization of Information Technology in Supply Chain. Presently, greater part of the data stream connected to the material stream is being reported as advanced organized information. As the extent of Supply Chain is right now around the world, the volume of information gathered from its various cycles and the speed at which it is being produced can be qualified as Big Data. What's more, substances, for example, showcasing and deals are currently depending on examination of the unstructured information alongside the organized information to acquire better experiences on client needs and refine the expense parts of Supply Chain processes. The utilization of Big Data can offer a critical worth in regions like item improvement, market request forecasts, providing choices, appropriation enhancement and client input.

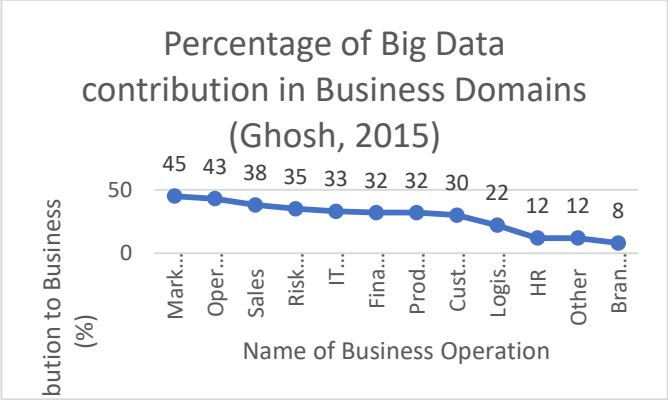

Chart -1: Percentage of Big Data Contribution in Business Domain (Ghosh, 2015)

The data is from 2015 which gives us a glimpse of how much the use of big data has grown over the years and in each and every sector and business operation. Before organizations can put big data to do something for them, they ought to consider how it streams among a large number of areas, sources, frameworks, proprietors and clients. There are five vital stages to assuming responsibility for this "big data fabric" that incorporates conventional, organized information alongside unstructured and semi-structured information:

i. Set a strategy.
ii. Identify the sources.
iii. Access, manage and store the data.
iv. Analyse the data.
v. Make data-driven decisions.

3. APPLICATIONS OF BIG DATA IN SUPPLY CHAIN MANAGEMENT

While the objective of supply chain management (SCM) incorporate saving expenses, expanding usefulness and conveying items and administrations rapidly and securely, the presence of various producers, sellers, merchants, and channels just add to the intricacy. This makes data collection and analysis challenging even for an enterprise with immense resources available at their disposal. In any case, big data analytics can give the right answers and in the end simplify processes. Big Data is intended to compound – information gathered and used in one application can without much of a stretch get over into another. Furthermore, the more information sources accessible, the more precise forecasts will be and the better the outcomes.

The use of Big data in Supply Chain Management is for following:

5.1 Inventory Prediction

Businesses must be able to take advantage of possibilities as soon as they arise. Predicting sales trends and inventory variations, on the other hand, necessitates a wealth of data and sophisticated predictive analytics. Big data combines historical sales trends with predictive technologies to provide inventory managers an estimate of what to expect. This helps to greatly reduce costs by allowing the supply chain to order just enough supplies to stock the shelves without ordering too much and mismanaging products.

5.2 Product Quality and Temperature Control

Many industries, including food, agriculture, pharmaceuticals, and chemical processing chains, require constant monitoring and control of certain supply chain constituents. Even a small temperature shift of a few degrees might have an impact on the product's quality - or even render it worthless. Unfortunately, roughly 30% of temperature-controlled products are damaged or spoilt before they reach their destination due to a lack of technological support to maintain control. The solution is cold chain monitoring technology, which uses data logging to support temperature-sensitive product logistics. During packaging, shipping, and delivery, managers can monitor temperature variations in real time and modify cooling or heating systems as needed. Big data platforms can also assist in the prevention of potential interruptions caused by fluctuating data, such as weather or traffic delays. This results in a comprehensive control system for successful supply management from beginning to end, eliminating waste and preventing product faults.

5.3 Order Fulfilment and Real-Time Tracking

For both corporate efficiency and consumer pleasure, efficient order fulfilment and traceability are critical. Many E-commerce companies provide remarkably quick delivery timeframes, as well as warnings for expected drop-off times and minute-by-minute tracking. Businesses across various industries may use big data to provide similar experiences for their customers and clients. By optimizing route deployment, delivery timetables, and item location, up-to-date shipment information can also assist minimize expenses with delivery fleet management. This will also assist businesses in considerably lowering their shipping expenses.

5.4 Machine Maintenance

Unexpected problems with machinery caused by breakdowns, poor maintenance, or ageing equipment can cause massive difficulties for businesses. According to Industry Week, the manufacturing industry loses $50

billion a year due to unplanned downtime caused by machinery faults. When big data systems and IOT devices are coupled, they can send out alerts for any abnormalities or irregularities in machinery. Sensors can be used to track production, predict problems, and alert you when routine maintenance is required to keep your machinery running smoothly.(Source: https://www.mckinsey.com/business-functions/operations/our-insights/manufacturing-analytics-unleashes-productivity-and-profitability). This helps to lower total expenses in two ways: first, it reduces repair costs and eliminates unscheduled downtimes. Predictive maintenance technology, on the other hand, aids in efficient manufacturing. Overall, according to a McKinsey study, big data and predictive maintenance technology may reduce machine downtime by 50% and even prolong machine life by 40%.

5.5 Big Data Keeps the Supply Chain Moving

Integrating big data technology into each phase of the supply chain management process can yield huge benefits. Supply chain managers can now have the tools they need for strategic decision-making by combining strong data sets with predictive analytics and IoT. Although investing in big data can be scary at first, the benefits greatly outweigh the costs for many businesses. Without a question, businesses will continue to invest in and rely on big data technology in the foreseeable future mainly because the consumers today are changing i.e., because of Covid-19 and lockdowns that were imposed, people are staying online more which is helping in generating more data.

4. CHALLENGES IN ADOPTING BIG DATA ANALYTICS FOR SUPPLY CHAIN

The issues and challenges in adopting Big Data Analytics for Supply Chain are listed as:

• Time-consuming: External variables such as lack of access to data, as well as internal issues such as the volume of Big Data, the complexity of the Supply Chain, and the interpretation goals for the datasets, all contribute to the time-consuming nature of the analytics process.

• Inadequate resources: The availability of real-time data is critical for improved results. The gathering and storage of cross functional data should be expedited because Supply Chain is a platform that creates sophisticated cross-functional data for interconnected organizations.

• Privacy and security concerns: Collecting data from diverse sources, interpreting it, and providing insights all need data sharing across a Supply Chain Network. Although, due to varying privacy and security laws governing data sharing, regional or global Supply Chain Networks may have difficulty sharing data across their many sources. In such circumstances, the accuracy of the insights generated by Big Data Analytics may be harmed due to a lack of shared data.

• Behavioral issues: Supply chain risk and inventory cost might be heightened if decision makers respond to minor changes in the physical environment, causing the "bullwhip effect" to exacerbate. Because of the variety and volume of Big Data, there is a greater risk of decision-makers detecting irrelevant correlations that are statistically significant but have no causal relevance.

• Return on Investment (ROI) concerns: The volume and variety of Big Data produced makes estimating the value of the data difficult. Building the infrastructure to perform Big Data analytics necessitates a large investment. Because the value of data is unclear, there is a greater danger of the infrastructure investment producing lower returns.

• Scarcity of skills: The complexity of Big Data derived from Supply Chain sources necessitates a combination of subject knowledge, analytical abilities, and the ability to analyze data usability. According to surveys, finding such a combination of skills and experience is tough.

• Data scalability: It is a problem. In the process of implementing Big Data Analytics in any system, data scalability is considered a major technological difficulty. Organizations' inability to transition from old constrained databases to optimize logistics activities through cost savings, greater customer happiness, and improved supply chain performance , reduce lead times, costs, and delays, as well as process interruptions, by optimizing manufacturing processes, shop-floor management, and manufacturing logistics.

• Data Quality: The quality of the data that is kept and used might have an impact on the performance of analytics tools. Based on its sources and applications, data is intangible and multifaceted. Intrinsic and contextual dimensions can be found in multidimensional datasets. The quality of data should be consistent in order to produce consistent and trustworthy outcomes for decision-making reasons. The range of data and types of data sources used in the supply chain may have an impact on the quality of the information gathered.

• Lack of techniques: A company's inability to use data has an impact on the robustness of the conclusions reached after evaluating the datasets. Depending on the complexity or volume of data, the methodologies used to analyze, compute, forecast, and visualize must be changed or enhanced (Arunachalam et al., 2017).

5. CONCLUSIONS

The idea of Big Data and Big Data Analytics in Supply Chain is examined in this study. The size of Big Data is cited as the primary rationale for its use in Supply Chain. The potential of Big Data Analytics was discovered after investigating the sources of Big Data creation in Supply Chain processes and activities. It was discovered that combining complicated data from supply chain activities with the breadth of Big Data in terms of Volume, Variety, Velocity, Veracity, and Value has practical applications that can tackle some of the most pressing supply chain difficulties that have arisen in recent years. In light of the relatively recent adoption of Big Data Analytics, it has been discovered that a lack of individuals with the necessary skillsets can stymie the potential of Big Data Analytics in Supply Chain. As the complexity of global supply chains grows, the supply chain sector, in collaboration with the data analytics industry, should seek to develop new and more effective models and approaches. Given the high infrastructure costs associated with Big Data Analytics, a focused study on how to make Big Data Analytics more cost efficient by lowering the infrastructure costs associated with storing Big Data is possible. Improving sensor accuracy in physical systems, as well as improvements in data integration technology among various business processes, is necessary to increase the volume and accuracy of data generated from various processes such as manufacturing and logistics, and could be a potential field of study for further research.

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