

Supply Chain Management and Big Data Analytics (SCMBDA): Perception to SCM Business

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Abstract— The standards of big data and analytics are being very much buildup with the aid of commercial enterprise executives, media, software program providers and consultant executive. But it is not simply buildup, as some groups are genuinely utilizing big data and analytics in real life experience. Big data and analytics in Supply Chain Management (SCM) has found discovered becoming alluring because of its unpredictability and the extraordinary part. This research proposal highlighting how “Big Data analytics can be used most productively in managing the supply chain.” They can be utilized to evaluate “what happened, why it happened, and to develop a plan for change. Based on pre-defined business rules, they can identify where an action is needed, they can help to prepare more accurate forecasts,” and, primarily, they are able to help to determine the best course of motion with WHAT-IF analysis. Materials and Methods used in research proposal describe the promising field of big data analytics in SCM, discusses the benefits, outlines an architectural framework and methodology, describes examples reported in the literature, briefly discusses the research problem. Possible outcome covered in research proposal how the SCM area can be affected by these new propensities and advancements.

Keywords— *Big Data, Supply Chain, Big Data Analytics, Analytics*

I. INTRODUCTION

Change is inevitable and as supply chain managers prepare for the future they face many challenges. Two major trends over the last few years are the growing importance of ‘big data’ and analysing these data through ‘analytics’. The data contain much value and companies need to capitalize on the variety of data sources by in-depth and proper analysis using ‘big data’ analytics. In SCM, Big data and analytics enabling business executives to make better decision in timely manner particularly in their operation part. SCM data science uses quantitative and qualitative methods from various disciplines in combination with SCM theory to predict outcomes and solve relevant SCM problems. SCM predictive analytics uses both quantitative and qualitative methods to improve supply chain design by predicting past and future levels of the integration of business processes among companies, as well as the associated costs and service levels. Its quite obvious thing to first we need to understand terms” Big Data” and “Analytics” in context to SCM.

A. Defining: Big Data

To store, handle and evaluate a large dataset always be a prime problem throughout all industries. And now in this contemporary era, data provide better advantages and opportunities for industries. In terms of data, organizations having a lot of complexity to address it due to the fact, a source of data in no way generated from single factor it

comes from diverse resources with distinctive methods (structured, unstructured, semi-structured and many others.)

Analysis Using Big Data

Big data is specific because of the quantity, range, and speed of the statistics, which these days are broadly available and much less expensive to access and store. BD has been characterized by way of 5Vs: volume, variety, velocity, veracity and value. BDA involves the use of superior analytics techniques to extract valuable information from great amounts of data, facilitating data-driven decision-making.

II. LITERATURE REVIEW

As indicated by Accenture [3], Global Operations Megatrends inquire about an investigation, most organizations having the desire from BDA in their SCM. 1000 best official given pointers by receiving BDA it will enable them to deal with their operational exercises easily. 97% overviewed administrators have a comprehension of BDA and knowing BDA can help them in accomplishing their coveted objective however just 17% executed in their one increasingly or more SCM capacities. These numbers are probably going to increment as organizations turn out to be more OK with cutting-edge innovations, for example, huge information investigation that enables them to settle on better business choices and make stronger supply chains.

Organizations anticipating promoted BDA in Supply bind task get a kick out of the chance to enhance the permeability,

adaptability, and mix of worldwide supply chains and coordination’s forms, viably oversee request unpredictability and handle cost variances [2][4]. Waller and Fawcett [7], rehashed the requirement for incorporating area information in the utilization of examination. Pearson [5] express that the motivation behind the examination ought to be forward-looking, and alongside estimating the impact on planned choices. Sanders [8] presented a non-exclusive meaning of BDA deprived of particularly fitting it for SCM. Later, specialist, O’Dwyer, and Renner [6] have changed Pearson’s interpretation by depicting another composed in which models should be a proactive phase of information rather than responsive information. So basis on various reputed research paper, Journal, white paper, case studies following observation has made up:

TABLE I. OBSERVATION ON BIG DATA ANALYSIS FOR SCM

Paper Title	Observations
Data Science, Predictive Analytics, and Big Data a Revolution That Will Transform Supply Chain Design and Management [11]	<ul style="list-style-type: none"> • Paper focusing on three 3 areas Data Science, Predictive analysis and Big Data(DPB). • Technical knowledge and domain knowledge have an impact on the effectiveness of an SCM data scientist. • SCM predictive analytics utilizes both quantitative and qualitative methods to upgrade inventory network plan and aggressiveness by approximating the past and future phases of joining of business forms among functions or companies, as well as the related costs and administration levels.
Big Data Analytics in SCM: Trends and Related Research [13]	<ul style="list-style-type: none"> •Between the stages of the SCM data flow BDA precisely, focus on the investigation. • Usage of Advanced analytics (Descriptive, Predictive, and Prescriptive) will help in the scientific process of transforming data into insight for better decisions.
Data quality for data science, predictive analytics, and big data in SCM: An introduction to the problem and	<ul style="list-style-type: none"> •”SCM data science is the application of quantitative and qualitative approaches from an assortment of castigations in integration with SCM theory to resolve appropriate SCM complications and forecast results, considering data value and

suggestions for research and applications [9]	convenience problems”. • “Paper focusing on Dimensions of Data quality problem, broadly described in two categories Intrinsic and Contextual”.
Data-intensive applications, challenges, techniques and technologies A survey on Big Data [14]	•”This paper gives a transitory summary of Big Data problems, comprising Big Data prospects and challenges, current methods, and knowledges”. •”Absolute confidence that Big data analytics continues to be inside the initial level of development, considering that existing Big data strategies and equipment are very confined to resolve the real big data problems completely”. •”Big Data similarly means big systems, big challenges, and big profits, so more research works in these sub-fields are essential to solve it”.
Research Problems Associated with Big Data Utilization in Logistics and Supply Chains Design and Management [15]	•”The paper emphasized the numerous features of big data and data management in logistics and supply chains and pointed out how to proficiently use big data crosswise the supply chains development and management”. •”Illustrated Open research issues in logistics and SCM identified on four business functions: forecasting, inventory management, transportation management, and human resources”.
Supply Chain Game Changers- Mega, Nano, and Virtual Trends and Forces That Impede Supply Chain Design [16]	•”This paper explores five evolving “game changers” that signify potential supply chain strategy modulation points: Big Data and extrapolative analytics, additive manufacturing, independent vehicles, materials science, and borderless supply chains. •How well managers address socio-structural and sociotechnical issues will determine firm survivability and success”.
Big data analytics for supply chain management A literature review and research agenda [17]	•”In this paper, it was presented and discussed the findings of big-data-related Supply Chain articles identified in SCOPUS”. •”Authors have highlighted the current research of big data analytics

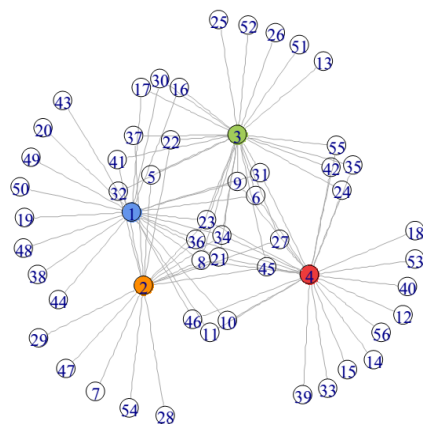
	for SCM in categorized form such as publications by year, subject area, and country”.
Big Data Driven SCM and Business Administration [18]	<ul style="list-style-type: none"> •“This paper introduced some major issues, Universal challenges of Big Data and Big Data challenges in SCM of Big Data in SCM and commercial management”. •”Demanding situations include data seize, data integration, data visualization, data integration, data sharing, data privacy and data security, surprisingly fragmented data ecosystem and unstructured, unprocessed and apparently uncontrollable information, and so forth”.
The impact of big data and business analytics on supply chain management [19]	<ul style="list-style-type: none"> •”Paper emphasize the growing nature of the SCM environment, to categorize how the two major tendencies (‘big data’ and analytics) will influence SCM in future”. •”Supply chain managers need to embrace BDA progresses to persist competent, consequence and modest”. •”Supply chain managers want to pay attention to the value of data-driven decisions”.
Big data analytics in logistics and SCM: Certain investigations for research and applications [10]	<ul style="list-style-type: none"> •In this paper, Supply Chain Analytics has focused on two major application of logistics and supply chain parts: Strategy and Operations. •Proposed maturity framework, will align with both strategy and operations with certain organizational goals which includes five different levels, namely, functional, process-based, collaborative, agile, and sustainable.
Big data applications in operations SCM: A literature review [20]	<ul style="list-style-type: none"> •In this paper, literature review highlighted Various analytical tools for big data implementation processes in operations/supply chain management. •Paper focused on 5Vs data acquisition sources(Variety), data storage(Volume), data analysis (Veracity), data application(Velocity) and data value-adding(Value) in

	SCM.
Big Data for SCM in the service and manufacturing [21]	<ul style="list-style-type: none"> •“Current challenges & opportunities such as data collection approaches, data transmission, data storage, processing technologies for Big Data, Big Data-enabled decision-making models, in addition to Big Data explanation and application are emphasized”.
Critical analysis of Big Data challenges and analytical methods [22]	<ul style="list-style-type: none"> •“This paper has carried out through perceiving and understanding the past developments and extant patterns/themes within BDA research area, estimating contributions, summarizing knowledge, thereby figuring out boundaries, consequences and potential supplementary research”.

The idea of Supply Chain Analytics (SCA) does not comfortable prior with BD Technologies until as of late it indicates how it will help in business development. Bases on different definition, here might want to express that – SCM Big information examination is the system of applying progressed investigation strategies in blend with SCM hypothesis to datasets whose volume, speed or assortment necessitate data innovation apparatuses from the Big Data innovation stack; taking advantages of inventory network experts with the capacity to consistently detect and react excessively important issues by giving precise and convenient business bits of knowledge. According to current pattern of Big Data in SCM for the most part four exercises are occurring: acquiring, offering, development and putting away. [24] Every one of these exercises are related with 4 noteworthy elements of a store network: obtainment arranging, promoting technique, transportation / coordination’s and stockroom tasks. As all these 4 levers cooperating, information change starting with one utilitarian territory then onto the next yet at same time reconciliation of information necessities with exactness, convenience, and rightness. Just for reference, displaying gets and tracks request by means of Point of Sale (PoS) information, transportation make information from GPS transponders, RFID information separates set away items and electronic data exchange pass customized buying orders.

SCM Big Data sources are ordinarily made in unstructured setups that are difficult to analyze with

customary IT devices. While data organization has thorough on developing velocity and volume capacities with respect to esteem based data, the amount of focus esteem based data sources is by and close to nothing. There is an asymmetry in SCM data sources between the typically humbler sorts of volume and speed versus the greater ones in information accumulation, and a positive alliance betweenness the unstructured arrangements and high volume/speed [23]. Fig. 1 speaks to different information sources are utilized as a part of 4 noteworthy capacities in SCM [25]. According to organize distinguished, we can combine couple of information source like area data (24,35,42,55) between lever 4 (Marketing) and lever 3 (transportation) or shipment orders (16,17,30) between lever 1(procurement) and lever 3 (transportation). In SCM, most sources are taken care of by single element or space.



(A)

- | | |
|------------------------------------|--|
| 1 Procurement | 29 Inventory Costs |
| 2 Warehouse operations | 30 Invoice data |
| 3 Transportation | 31 Local and global events |
| 4 Demand chain | 32 Logistics Network Topology |
| 5 Bar code systems | 33 Loyalty program |
| 6 Blogs and news | 34 Machine-generated data |
| 7 BOMs | 35 Mobile location |
| 8 Call center logs | 36 On-Shelf-Availability |
| 9 Call logs voice audio | 37 Origination and destination (OND) |
| 10 Claims data | 38 P2P (Procure-to-Pay) |
| 11 Competitor pricing | 39 Pricing and margin data |
| 12 CRM Transaction data | 40 Product reviews |
| 13 Crowd-based Pickup and Delivery | 41 Product traceability and monitoring system |
| 14 Customer Location and Channel | 42 Publicly available infrastructure information |
| 15 Customer surveys | 43 Ratings and reputation from 3rd parties |
| 16 Delivery expedite instances | 44 Raw material pricing volatility |
| 17 Delivery times and terms | 45 RFID |
| 18 Demand Forecasts | 46 Sales history |
| 19 EDI invoices | 47 SKU level |
| 20 EDI purchase orders | 48 SRM Transaction data |
| 21 Email records | 49 Supplier current capacity and customers |
| 22 Equipment or asset data | 50 Supplier financial performance information |
| 23 ERP Transaction data | 51 Traffic density |
| 24 Facebook status | 52 Transportation Costs |
| 25 GPS-enabled big data telematics | 53 Twitter feeds |
| 26 Intelligent Transport Systems | 54 Warehouse Costs |
| 27 Internet of things sensing | 55 Weather data |
| 28 In-transit Inventory | 56 Web logs |

(B)

Fig. 1.(A) & (B) Data Sources across SCM identified by Kamad-Kawai

III. RESEARCH PROBLEM :

In view of an audit of the writing, following are the issue to be considered as difficulties in enormous information investigation in zone production network administration.

- Due to enormous information qualities, there are few acquired difficulties related with it like catching, stockpiling, seeking, examination and virtualization.
- Collecting huge information from different wellsprings of data itself is enormous difficulties. Interoperability and joining of arranged information are turning into a basic issue in the territory of SCM.
- Quite hard to examine multi-channel information and client opinion in a fluctuated enhanced manner.
- SCM association does not have normal or once in a while have finish incorporated framework and information principles because of which store network effectiveness, appraisal of inventory network task, traceability
- SCM association faltering to share its own information and thinking result in lost upper hand.
- No such focal archive at present exists, where information are in accumulation frame which may give some helpful task technique to run association in the better way.
- With current customary framework not ready to be examining immense measure of data about client need and wish
- Due to information speed and information volume, not ready to take better and speedier choice which general debasing execution of inventory network task.

IV. PROPOSED METHODOLOGY

The supply chain manager had a quick relationship between the providers, creators, wholesalers, and the customers however now with the nearness of electronic business and rising customer asks for the generation organize has wound up being eccentric and along these lines, the executives are feeling that it's difficult to enhance the exercises. So, the standard target of the examination is to comprehend how to diminish the multifaceted thought of the creation organize by utilizing Big Data and to perceive the information sources that might be considered for central organization purposes in each of the SCM levers: acquiring, publicizing, transportation, and assignment center exercises.

In this work, we acquaint the advantages of huge information hybridized with Delphi strategy to see the issues of SCM and to discover answers for them. The examination structure follows the techniques and frameworks organized to lead the examination as for any issue. It joins fundamentally

three stages: information gathering, hypnotizing examination, and last evaluation. The proposed mixture approach enables people to motivate from beginning to end information regarding any matter by asking the bosses. The stars can control the all-inclusive community on the issues furnishing them with encounters and fitting course. Online regions like OpenIDEO, Techcast, and Horizon fill in as a medium to these methods. It enables individuals to interface with people after a short time on the web. There is regularly a main assemblage of 3-4 people, each expert in their own particular locale. We have used the Delphi system to figure out how to get acclimatized to the issues of association and by working up a review which was appeared to the experts to get bits of data on the issues and their answers. The request was replied by specialists that have helped us in finding the reactions for these issues that can be reasonably settled utilizing Big Data.

V. EFFECT OF BIG INFORMATION EXAMINATION HYBRIDIZED WITH DELPHI TECHNIQUE IN SCM

Supply chains that are grasping enormous information capacity improvement, first need to wind up mindful of the advantages that huge information arrangements can convey to their tasks. Choices should be made about the cost-viability of organizing certain parts of their activities. Comprehensive enormous information arrangements connected to the entire production network can include high costs, settling on store network chiefs more particular in altering answers for activities.

A. Advantage of using Big Data in SCM

- Increased permeability of stock levels, request, and assembling limit; thus more precise generation and circulation plan.
- Real-time directing of enormous information investigation with Delphi system utilized for recognizing stock levels, conveyance miss-matches, and approaching conveyances.
- Monitoring of conveyance courses, activity information, climate continuously and rerouting if important for limit and resource sharing.
- Full straightforwardness and completely mechanized renewal frameworks joined with request estimate information that disposes of under/overloading and enhances stock running.
- More precise estimation of interest by getting to information of offers advertise patterns, contenders' information, and pertinent neighborhood and worldwide financial elements.
- Real-time streamlining of complex networks of appropriation centers, plants, and stockrooms in view of the material stream information.

VI. CONCLUSION

By applying ideas of BDA in SCM activity, the accompanying is the rundown of conceivable result may enable SCM to work better in future.

- Will take care of issues, enhance efficiencies, increment benefit, and diminish inventories.
- Will help in report execution, SCM chief may figure out what happened, why it happened, and in like manner official may build up an arrangement for change.
- Will help in better choices and distinguish the requirement for activity.
- Predictive Analytics to enhance such procedures as determining, client association administration, and stock control.

VII. REFERENCES

- [1] Zhu, Qinghua, Joseph Sarkis, James J. Cordeiro, and Kee-Hung Lai. "Firm-level correlates of emergent green SCM practices in the Chinese context." *Omega*, vol.36, no.4, pp. 577-591, 2008.
- [2] Kim, Minkyun, and Sangmi Chai. "The impact of supplier innovativeness, information sharing and strategic sourcing on improving supply chain agility: Global supply chain perspective." *International Journal of Production Economics*, vol.187, pp.42-52, 2017.
- [3] Accenture Global Operations Megatrends Study, 2014. Big Data Analytics in Supply Chain: Hype or Here to Stay? (<http://www.accenture.com/us-en/Pages/insightglobal-operations-megatrends-big-data-analytics.aspx>)
- [4] Thomas, Douglas J., and Paul M. Griffin. "Coordinated SCM." *European journal of operational research*, vol.94, no.1, pp.1-15, 1996.
- [5] Lambert, Douglas M., and Martha C. Cooper. "Issues in supply chain management." *Industrial marketing management*, vol.29, no.1, pp.65-83, 2000.
- [6] Beamon, Benita M. "Supply chain design and analysis: Models and methods." *International journal of production economics*, vol.55, no.3, pp.281-294, 1998.
- [7] Kaisler, S., Armour, F., Espinosa, J. A., & Money, W. (2013). Big data: Issues and challenges moving forward. In 2013 46th Hawaii international conference on system sciences (HICSS), 7–10 January (pp. 995–1004). Wailea, Maui, HI: IEEE.
- [8] GilPress (2012). A very short history of big data. June 6, 2012
- [9] Hazen, Benjamin T., Christopher A. Boone, Jeremy D. Ezell, and L. Allison Jones-Farmer. "Data quality for data science, predictive analytics, and big data in SCM: An introduction to the problem and suggestions for research and applications." *International Journal of Production Economics*, vol.154, pp.72-80, 2014.
- [10] Wang, Gang, Angappa Gunasekaran, Eric WT Ngai, and Thanos Papadopoulos. "Big data analytics in logistics and SCM: Certain investigations for research and applications."

- International Journal of Production Economics, vol.176, pp.98-110, 2016.
- [11] Waller, M. A., & Fawcett, S. E. (2013). Data science, predictive analytics, and big data: a revolution that will transform supply chain design and management. *Journal of Business Logistics*, 34(2), 77-84.
- [12] Zhong, Ray Y., Stephen T. Newman, George Q. Huang, and Shulin Lan. "Big Data for supply chain management in the service and manufacturing sectors: Challenges, opportunities, and future perspectives." *Computers & Industrial Engineering* 101 (2016): 572-591.
- [13] Varela Rozados, Ivan & Tjahjono, Benny. (2014). Big Data Analytics in Supply Chain Management: Trends and Related Research. 10.13140/RG.2.1.4935.2563.
- [14] C.L. Philip Chen, C.-Y. Zhang, Data-intensive applications, challenges, techniques and technologies: A survey on Big Data, *Inform. Sci.* (2014), <http://dx.doi.org/10.1016/j.ins.2014.01.015>
- [15] Lamba, Kuldeep & Singh, Surya Prakash. (2016). Big data analytics in supply chain management: some conceptual frameworks, *International Journal of Automation and Logistics*. *International Journal of Automation and Logistics*.
- [16] Fawcett, Stanley & Waller, Matthew. (2014). Supply Chain Game Changers—Mega, Nano, and Virtual Trends—And Forces That Impede Supply Chain Design (i.e., Building a Winning Team). *Journal of Business Logistics*. 35. 10.1111/jbl.12058.
- [17] Fosso Wamba, Samuel & Akter, Shahriar. (2015). Big Data Analytics for Supply Chain Management: A Literature Review and Research Agenda. 61-72. 10.1007/978-3-319-24626-0_5.
- [18] Wang, Lidong & Ann Alexander, Cheryl. (2015). Big Data Driven Supply Chain Management and Business Administration. *American Journal of Economics and Business Administration*. 7. 60-67. 10.3844/ajebsp.2015.60.67
- [19] Ittmann H.W., "The impact of big data and business analytics on supply chain management", Available from: <http://www.jtscm.co.za/index.php/jtscm/article/viewFile/165/318>
- [20] Addo-Tenkorang, Richard & Helo, Petri. (2016). Big Data Applications in Operations/Supply-Chain Management: A Literature Review. *Computers & Industrial Engineering*. 101. 10.1016/j.cie.2016.09.023.
- [21] Zhong, Ray & Newman, Stephen & Huang, George & Lan, Shulin. (2016). Big Data for Supply Chain Management in the Service and Manufacturing Sectors: Challenges, Opportunities, and Future Perspectives. *Computers & Industrial Engineering*. 10.1016/j.cie.2016.07.013.
- [22] Sivarajah, Uthayasankar & Kamal, Muhammad & Irani, Zahir & Weerakkody, Vishanth. (2016). Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*. 70. 10.1016/j.jbusres.2016.08.001.
- [23] 13. Tan, K.H., Y.Z. Zhan, G. Ji, F. Ye and C.T. Chang, 2015. Harvesting Big Data to Enhance Supply Chain Innovation Capabilities: An Analytic Infrastructure Based on Deduction Graph. *Int. J. Production Economics*, 166: 223-233. DOI: 10.1016/j.ijpe.2014.12.034
- [24] Schlegel, G.L., 2015. Utilizing big data and predictive analytics to manage supply chain risk. *J. Bus. Forecasting*.
- [25] Varela Rozados, Ivan & Tjahjono, Benny. (2014). Big Data Analytics in Supply Chain Management: Trends and Related Research. 10.13140/RG.2.1.4935.2563.