Impact of Big Data in Supply Chain Management

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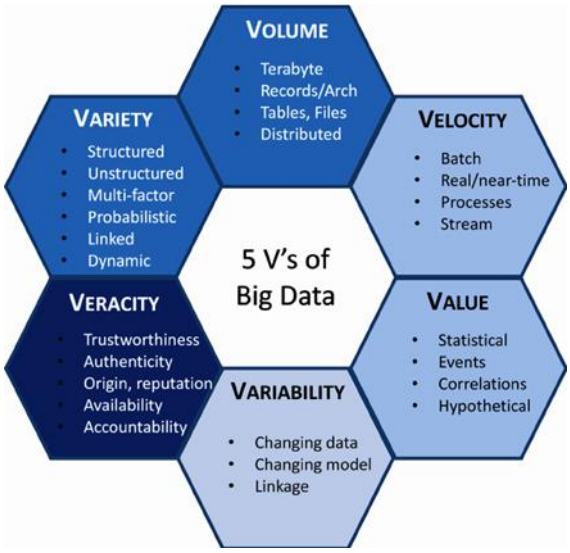
1. Introduction

In the work of Gartner (2012), Big data is explained to be a valuable information which are extremely large in terms of volume, velocity and variety that requires advantageous and modern ways of processing data that facilitate a well understood, specialized and better decisive process. Adding to laney's (2003) 3'V concept of big data, a 5 V concept of big data is seen in the work of Marr B (2014) with the inclusion of veracity and value.



(Source: Adopted from Marr 2014)

Prior to the year 2010, approximately 13,000 worth of data were produced, considering the fact that one exabyte is equivalent to one billion gigabyte (Rozados and Tjahjono, 2014), An important characteristics of big data is the volume which has been observe to be beyond the scope of the existing and conventional method of managing database (Sanders, 2016).

The velocity is describing the speed in which the data are gathered. As a result of the growing access to the internet all over the world, the mechanical integration and operations with the internet, and the unified ways of collecting data. The pace in which data are gathered has been continuously increasing (Normandeau, 2013).

In consideration with the velocity and volume in which the data are generated, The variety which talks about the various types of data is an essential characteristic of big data and these are structured and unstructured (De Mauro et al., 2016). A data that is structured could be logically gathered from items sold, the transactions done in terms of money and stored business operations. While data that is generated from things like social media, telecommunication and emails are seen as unstructured (Woerner and Wixom, 2015).

According to (Lomotey and Deters, 2014) veracity can be explain as reliability or quality in respect to the data collected. Putting into consideration the authenticity of the data gathered, it is necessary to analyze them. Therefore, when examine big data, Veracity is way more important than the volume. In other to concentrate on quality, setting up a metrics on both the kind of data collected and its source is very important.

Good investment is needed in other to gather datasets of a big data. The value gotten from the dataset is usually determined through evaluating the understanding which could be gotten after analyzing the dataset (Slavakis, 2014).

In Consideration of the supply chain that can be viewed and classified into four self-controlled but connected entities like, Managing and transport, marketing department, warehouse, and procurement department. The supply chain management is in control of the making and supporting the connection of these various business entities that are with the responsibility of purchasing unprocessed item which therefore is converted into finished product and delivered to the consumers (Tan et al, 2015).

Therefore, this article will be focusing on what big data Analytics is, where these big data are generated from within the supply chain, Benefits and challenges of using big data in the supply chain, also Amazon as a case study example will be looked at. Thereafter a suitable conclusion will be drawn

2. What is Big Data Analytics

According to (Gandomi and Haider, 2015) big data analytics requires using improved method of analytics for the extraction of valuable insight out of the extremely large volume of data that promote better decision made. Big data analytics can be categorized into 3 various levels which has distinct responsibility. Big data analytics can be classified into descriptive, prescriptive and predictive Analytics.

Prescriptive analytics is mostly use in operations that involves, transportation, production, Logistics and warehousing together with modern operations like the industry 4.0 trend considering the cyber physical system. The major users of the predictive analytics are seen in purchasing, forecast, risk evaluation and management. The descriptive analytics possess vast range with regards to amount in which a system operate, it is strongly apply in developing and explaining raw data briefly for the understanding of human (Malik, 2013).

3. Big Data Relevance in Supply Chain

Due to development in technology within supply chain operation, the creation of data is rapidly growing. The movement of details used to be reported as a physical document before introducing Information Technology within the supply chain. Lately, great amount of the information flowing is connected with how materials are moved, and it is getting stored digitally (Sandhu, 2015). Since the supply chain is known globally, the huge amount of data gathered out of various operations and the speed in which it is created is what is known as big data. To add to this, marketing and sales are beginning to depend on how both structure and unstructured data can be analysed for greater understanding to what customers want as well as develop on how to achieve cost reduction from the process of the supply chain. According to Ghosh (2015) using big data would provide sufficient benefit in various business operation, and this is shown in Percentage in the table below.

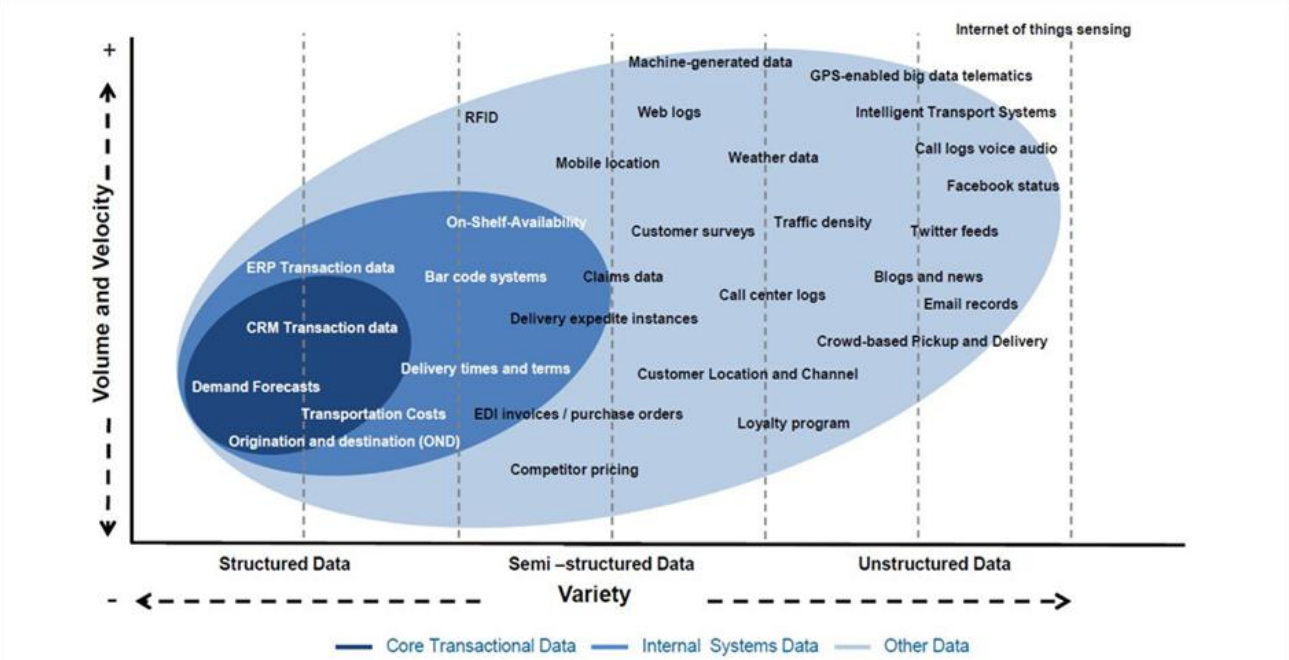
Business Operation	Value in percentage
Marketing	45%
Operations	43%
Sales	38%
Risk Management	35%

Information Technology Analytics	33%
Finance	32%
Product development	32%
Customer Service	30%
Logistics	22%
Human Resources	12%
Others	12%
Brand Management	8%

(Source: Adopted from Ghosh, 2015)

4. How Data Are Generated in the Supply Chain

In the work of Columbus (2015) 52 common means of big data within the supply chain were looked at to classify this sources to different categories such as unstructured, semi structured and structured data relating to it volume and velocity on how these data are generated from these sources .



(Source: Adopted from Awwad and Pazour, 2018)

According to Awwad and pazour (2018), After being observed through statistical method for the development of data to find out the various sources, Sources like the Point of Sales or Radio frequency identification scan, and sensor, social media, transitions were documented to contribute 41%,42%,43%,43% and 88% respectively, Which makes them the 8 highest sources were data are generated from in terms of analytics. Lots of organisations are keeping pace with how to maximize the use of these data really fast. Utilizing this data in the right way is key for transforming firms globally, and that has been shown as the pattern of developing firms. Although, using it some areas like maritime transport and logistics which is sea based, it is complicated to gather data by Radio Frequency Identification scan and sensors due to its location.

5. Various Big Data Analytics Opportunities Within Supply Chain Management

One of the main reasons for the introduction of big data analytic within the supply chain is the capability of it to find solution to the existing issue which could not be resolved using the conventional method. The technicality of processing unstructured data in the supply chain is a difficulty facing big data and big data analytics (Chen and Zhang, 2014).

The interconnection of the supply chain operation starting from extraction stage, manufacturing stage, the final goods and return items, flow of information and money transaction. How to manage this growing problem within the supply chain makes it is important for organisation in other to compete very well in the global market (Bucher, 2012).

The flow of material and information across the supply chain operation show how complex it is, unlike the way it was done traditionally which was a linear flow from the supplier to the customer, it is now a simultaneous transection today in which it is done electronically among the business associates in the supply chain (Zhong et al.,2016).

The different characteristics and how they relate are very important to show how complex the system is, and the characteristics should be put into consideration for understanding its effect. According to (Awwad and Pazour, 2018) the main features of the supply chain are.

Amount of operation in the supply chain: The various operations should be put into consideration. The computation of data from the large number of sources is difficult because it becomes larger with the amount of operation done.

Diversification: The classification of the supply chain could either be its homogeneousness or its heterogeneousness.

Dependency of one another: There is interdependent relationship between the material use, the product and the parties working jointly in the supply chain operation. How complex this is enhances directly with how they depend on one another.

Variation: Representing the dynamic department within the system.

Unpredictability: Different dilemma exist in the supply chain as a result of lack of understanding around the whole operation. How complex the supply chain increases with the level of its unpredictability.

6. Applying Big Data Analytics to the supply chain

In an done by ComputerWorld (2018), the prioritization of developing strategies for big data analytics would assist firms control the challenges in the supply chain. Through the utilization of big data and its analytics, the aim to improve areas such as the ability to predict the demand of the customers, evaluate and react to risk on time would be the main function of the supply chain.

Improve the predictability of customer's demand: The incapability to satisfy a firm's customer need will lead to reduction of its customers, also the reputation of the organisation could be damage for not being able to fulfil the customers need. The ability to offer the needed goods to the right individual when and where it is needed is very necessary to continue to have and satisfy its customers (Cegielski and Farmer, 2016). A good firm should strengthen the use

of big data in other to get the overall understanding of the need of its customers and their unique preference and create a different operational exposure to them (Bean and Kiron, 2013).

Improve efficient supply chain: Using big data analytics appropriately will lead to reduction in cost and the organisational spending, analytics will hence be the topmost priority of the organisation within the supply chain management (Beyer and Laney, 2012).

Improve the evaluation of risk in supply chain: One of the main functions of big data analytics is predictive analytics which assist in assessing possibility of problematic event and its impact. Supply chain risk can be identified through evaluating huge volume of past data and using a method which map out the risk with the assistant of predictive analytics. Appropriately predicting these risks would enhance the development of method to reduce the impact of the possible risk (Kitchin, 2015).

Improve the capability to trace goods within the supply chain: The ability to trace provide advantage to follow up with the product till they get to the customer. Enhancement of the ability to trace these goods would assist with the integration of the various operations in the supply chain and improve how these product flow. The ability to track ensure a well-controlled supply chain process (Akter et al., 2016).

Improve agility: According to (Awwad and Pazour, 2018) approximately 90% of organisation confirm that being agile is essential for a firm. The capability of an organisation to move quick and flexible in other fulfil its customer needs is seen as one of the most essential things for achieving competitive advantage within an industry. The use of big data analytics to operate would cause how fast a firm can react to its supply chain problem about 41% and also aid the development of order to cycle time delivery to 4.25%

The Work of Benabdellah et al (2016) discusses different outcome that will be achieve if big data analytic is applied to processes like planning, Manufacturing, Supply, Distribution and its returns with the use of the table below.

Processes	When big data analytic is applied
Planification	i) It assesses risk and give plan on how to recover quickly ii) Reduction of risk associated with infrastructure assets and contract outer potential iii) It enables and monitors accomplishment, and improve the operation of the management and plans
Supplying	i) Minimize storing space and distribution ii) It provides a supply networks which are centred more awareness. iii) Attain granular stages of the total acquisition patterns.

Production	i) ii) iii)	It enables intelligent market for SMEs. The most voluminous bunch of data are linked to an automatic discerning power, Integrated and smart to product handling and packaging network approach progress. Attaining on time capacity accessibility and ensuring faster reaction and supplier-controlled inventory.
Distribution	i) ii) iii) iv) v) vi) vii)	Optimum routing On time route effectiveness; Location confirmation; Crowd based renewal and distribution; Environmental intelligence Enhance traceable supply chain Getting a measure oflead time derive as a result of delays cause by traffic, atmospheric condition. Maximize logistics operation thanks to cost minimization, enhanced fulfilment of the customer's need and development of the supply chain. Optimum production operation, shop floor management, and production logistics Minimize lead time and reduce cost set back and also operation interference
Returns	i) ii) iii) iv) 	Minimizes the drive turnover, the work of the driver, employing sentiment data evaluation Managing dedication of the customers, Constant service development and innovative products. Beneficial to the government (for example for urban arrangement) and organisations (Localized advertisement and effective routing) Creation a good perspective of customers reaction, working performance and guaranteeing the fulfilment of the supplier and the customers

	v) Technical know-how has ensured a better practicable to acquire data from customer, with the help of big data to observe social behaviour vi) Knowing the customers view of a given goods or service and seeing customers unnoticeable behaviour

7. Case Study Explain -Amazon

According to (Spiegel et al., 2013) Amazons US patent for anticipatory transportation of product through sea in the year 2013, December. The purpose for the registered trademark is mainly for shipping product earlier to customer's request to minimize the time it will take to be delivered. The ability to predict what will be requested for is the prime reason for the patent. The licence permits various practise. To start with, some deliveries by ship are done close to the location without necessarily having the full details of the actual address of the customer. This leads to optimization of deliveries, lead time improvement, increased sales and fulfilment of customer's need.

In addition, Amazon endeavour to pair up product according to their geographical area these requests are made by the customers during the shipment. The reason for it is to utilize and limit the transportation cost for buffering the uncertain chosen product. This reduction in cost of transportation is beneficial to both amazon and the customer.

The method of purchasing these products itself possess the vital impact on how the data used for predicting are formed in other to know when to ship and deliver. Some of the information that influences this prediction are the extent a particular web page was looked at, the amount of hovering of links, the cart used to shop, list of wishes and related product that was bought before

8. Difficulties in the adoption of big data analytics within the supply chain

In the work of kitchin (2013), the problem facing the adoption of big data analytics in the supply chain could be generally classified into Organisational and Technological challenges.

Organisational Challenges:

Time absorbing: Elements like the largeness of big data, how complex the supply chain is, as well as external variables like insufficient means to data causes the analytic process to take much time (Nambiar et al,. 2013).

Limited resources: To ensure a good outcome, provision of data that shows the actual time is necessary. Due to the complexity of the supply chain which create cross functional data for connected operations, Gathering and keeping this cross functional data needs to be modernized (Mikavica et al,. 2015).

Confidential Issue: How data are shared around the supply chain network is a crucial component for gathering data out of different sources, evaluating and providing better understanding. However, Localized or a worldwide supply chain network could encounter problems with giving out details around its various sources as a result of differences in privacy, Safety regulations concerning data sharing. Shortage of sharing this information regarding that could impact the validity of the awareness big data analytics could have generated (Szongott et al., 2012)

Behavioural Problem: The uncertainty of the supply chain and inventory cost could be a lifted risk as a result of the firm's executive reaction towards trivial changes in the society that could intensify the bullwhip effect (Hofmann, 2017). In consideration of both the volume and variety of bid data, there has been a growing risk to the executive of an organisation to identify inconsequential relationship, yet a statistical important relationship exists with irrelevant causal linkage (Beyer and Laney, 2012).

Problem related to Return on Investment: The largeness and variation of big data gathered create the difficulty of estimating the benefit from the accumulated data. Trying to systematically analyse performance with big data needs great volume of investment in constructing the infrastructure. As a result of the unpredictability of the data value, there is a wider increase risk regarding returns investing on infrastructure could create (Hasan and Shamsuddin, 2014)

Insufficient Capabilities: The complex nature of the collection of big data within the supply chain sources needs a mixture of adequate practitioner analytics expertise and the capability to clarify how a data can be usable, and an individual with this capability and experience is really hard to come across (Gandomi and Haider 2015) .

Technological Challenges

Data Scalability: One of the main technological problem when trying to utilize big data analytics with whatsoever operation is the data scalability. The lack of ability of a firm to move from the conventional restricted database into a more distributive database or cloud storage limits the understanding that could have been gotten from big data analytics due to certain level of data being unused (Weill and Ross, 2009).

The quality of the data: The worth of the kept and used information could influence the outcome of the method use for analysing it. The elusive nature of data and several dimensions is established from its sources and how it is used. Elements of several dimension dataset could be divided into intrinsic and contextual. In other to get predictable and dependable outcome to make decisions, it should be ensured that the data quality is congruous (Kaisler et al., 2013)

Lack of process: inability of an organisation to make use of data influences how robust the understanding established following the dataset analysed would have been. The approaches that are made use of for analysing, computing, forecasting and visualizing requires an upgrade in other to fit the complex and voluminous nature of big data (Chen and Zhang, 2014) .

9. Conclusion

Overall, big data and big data analytics in the supply chain was discussed. The major reason for the adoption of bid data within the supply chain is it scale. Following the study, how big data is generated in the supply chain operation, beneficial understanding relating to the

capability of big data analytics was detected. Some observation was made which suggest that combining the data from supply chain operation complexity with big data scope regarding the 5 Vs has feasible uses for solving majority of the existing problems facing supply chain recently. In consideration of adopting big data, recently, it was discovered that the speed in which infrastructures should be created to support the ever-growing data should be developed. Another observation was that absence of enough expertise capable could affect the capability big data analytics has to offer within the supply chain. With the intensifying convolution of supply chain operation globally, the need for the development of modern methods and effectual models are required from the supply chain field and data analytics profession (Malik, 2013).

Regarding the exorbitant cost of infrastructure to obtain big data analytics, a study focusing on ensuring big data analytics is better cost advantageous is feasible through the reduction of infrastructure cost big data will be stored with. In other develop the capacity and how accurate the collected data out of the several operations like production and logistics, enhancing the perfection of sensors within the physical system as well as improving data incorporation technologies between different business operation is important and could possible be a studied field

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