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Impact and Significance of Big Data in Supply Chain Management and Healthcare

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Abstract-This paper aims to illustrate the potential and significance of big data in healthcare industry. The primary focus of this paper is to deliver and present the magnitude of big data in the complex and developing areas. A description of nascent area of analysis of big data in supply chain management and healthcare is provided in this study. Big data helps in the evaluation, processing and generation of effective conclusions. This paper demonstrates the effectiveness of big data analytics in decision-making procedures. The competitive edge provided by big data analytics is considered a great benefit in logistics field. Critical activities such as risk assessment and prevention are supported by scrutinization of big data. This paper delivers the significance of big data in genomics and biology field. This paper consolidates the unique and defined characteristics of big data.

Keywords- *Big Data, Supply Chain, Healthcare, Logistics*

I. INTRODUCTION

The data is growing faster as it is pooled up by many resources. The technological advancements are lagging back as compared to the growth of data. Hence, coping up with the big data is becoming very demanding. The other properties of big data need more attention than the volume. Big data must be divided into facts and dimensions to be utilized optimally [4]. The healthcare industry has generated enormous amount of data through the medical claims, clinical, pharmaceutical experiments and consumption, patient care and hospitals. The trend points towards the digitalization and cloud storage of data which garners the improvements of healthcare delivery and promises the elevation of problem solvency rates. Big data supports the decision-making systems, disease supervision and health management [1]. Big data implementation is dominated by predictive analysis and data types. It constitutes high volume, high velocity and high variety of structured and unstructured data. The heterogeneity of data can be solved by technological upgradations [2]. Big data challenges include early warning of detrimental activities, real time feedback, responses and representation of actual environment. Big data mining is considered an effective way of performing the scrutinization and digging deep into the numbers that lead to surprising conclusions [3]. The analysis of big data is very challenging as compared to the identification, scrutinization and citation. Moreover, big data throws complications by displaying the properties such as variety, timeliness, large volume, vagueness, security and procedural toughness. Data acquisition, extraction, analysis and decision-delivery are the steps involved in the usage of big data in various fields [5]. Big data grants access to deliver solutions to the clinical challenges. It helps in the dissemination of the knowledge to support the decision-makers and major industries [6].

II. THREE V'S OF BIG DATA

Big data has several properties which define it as a composite element. The three V's describe the meaning and importance of big data. These V's are as follow [3] [40]:

1) Volume: Volume is considered as the primary element of big data. The volume is the size or quantity of the data pooled by various sources. This can be in terabytes or petabytes. Big data quantification can be performed by counting the claims, transactions, records or even time. Sometimes the data quantity of actual records and analytical records differs.

2) Variety: The big data emerges from variety of resources. Hence, it is found in various forms. It is structured, unstructured or semi-structured. It can be in the form of video, audio, images, XML, RSS, graphs, sensor data etc. For example, RFID tags used in the supply chain activities provides readable or writeable data.

3) Velocity: The velocity of big data is defined by the speed or frequency by which the data is generated. Web sources generate data persistently. The velocity is the frequency of data delivery from any source. It can be done by clicking, surfing etc. The velocity of big data is very high as the data being received is tremendous.

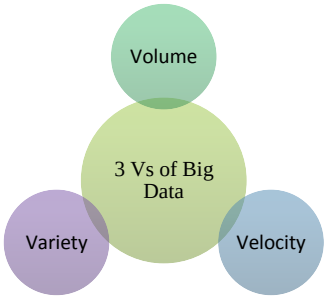

Figure 1. Big data properties

III. Supply Chain Management

Author says that supply chain is the attempt of integrating the suppliers, producers, storages systems to ensure the accurate production, distribution and delivery to reduce the costs related to system while considering the consumer satisfaction a goal [7]. Author explains that big data in supply chain management reaps benefits of short response times, performance improvement, inventory level reduction and new product marketing in lesser time-period. The challenge is to determine the appropriate infrastructure for data analysis. The software like Analytica, Decision explorer, TAPS and LINGO help in generating valuable information form semi-structured or unstructured data [8]. Author mentions that supply chain and big data together have the capability to deliver better decisions by using the existing resources and explore present potential [9]. Author mentions that the field of supply chain needs technological development in the areas of data analytics to provide solutions to the supply chain problems. It consumes variety of data and the data types consumed in supply chain [10] are as follow:

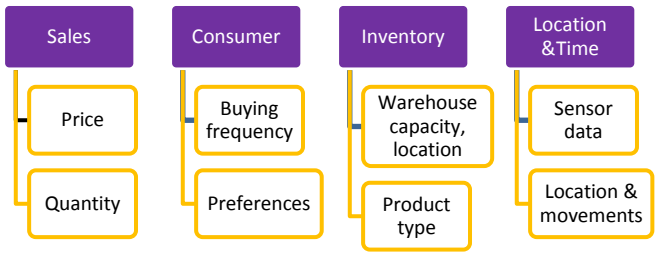

Figure 2. Data types in Supply Chain

A. *Inventory Planning and Management*

Maximum inventory storage can be ensured by reserving enough space for each item in the warehouse [11]. Inventory demands, the product tracking and availability require a beneficial technique to anticipate the necessity and maintain the inventory accordingly [12]. Enhanced fuzzy neutral network (EFNN) supports the decision-making process that is dedicated to reducing or maintaining the inventory levels of the central warehouse. This network helps to anticipate the accurate demand of the spare parts of the inventory [13]. Barcodes, RFID tags and Hadoop distributed file system (HDFS) are the big data tools used in inventory control and management [14].

B. *Logistics*

Big data enables effective decision-making techniques in logistics through revealing dimensions of delivery time, products, supplier information and knowledge of logistics [15]. The RFID technology serves many benefits; hence it is given great importance in logistics activities in supply chain management(SCM) [16]. Logistics highly depends on the data fetched by RFID tags. This big data tool helps in preparing the layout for distribution networks and outlining the plans to execute the logistics operations [17]. GPS, RFID, barcodes provide significant insights about trajectory of products and movement patterns. These patterns and behaviors of product movement pillar the information excavation of the logistics stages [18].

C. *Sourcing and Procurement*

The big data in procurement benefits in reduction of unnecessary time of the procurement employees by combining the unstructured data with other data to anticipate the period related to payments. It also pillars the decision-making system [19]. Big data in procurement proves to be favorable in spend analytics, predictive analysis, supplier management and forecasting. Procurement teams that utilize big data tools are profound in capturing the trends. It helps in tackling the complaints of consumers as well as in risk reduction of untimely supply of products [20]. Performance and costs are influenced by the procurement. Big data enables the procurement to be connected to the issues of operations and remedial activities with suppliers that provide whole view of supplier performance [21].

D. *Predictive Analysis*

Predictive analysis in supply chain management requires big data tools to significantly determine consumer potential that contributes to the amelioration of products. It also helps in the exploitation of the past and present data to derive the challenges and opportunities. Big data gives high dimensional value delivery and creation [22]. The combination of big data and predictive analysis result in attaining the performance and value of the company. In predictive analysis, big data provides the solutions to the issues like data storage, capturing and visualization [23].

IV. Healthcare

Author explains that healthcare is evolving through the open information era. The rapidly growing healthcare data has driven the industry to point that demands changes and decisive moment. The complex, enormous, dynamic and varied technological characteristic big data is identified and scrutinized by the industries to throw light on the solutions to the inconsistency of the quality and spending in healthcare field. It can provide insights of the effective treatments; drug consumption impacts and cost reduction techniques for patient treatments. Author further mentions that big data helps patients to choose right ways of lifestyle, follow selfcare approaches that are coordinated, right service provider for particular diseases, serving right value by eliminating frauds in the systems and improve the therapies and treatments of patient care [24]. Author explains that the Electronic health records (EHR) help in deriving the various disease patterns observed in patients. Hence, medicals and hospitals adopt these records to develop the knowledge foundation required to understand the connections between events. Big data can contribute in improving the knowledge of diseases, genome, therapies and decision-making of medical field [25]. This big data promises to reduce costs, effective health management, disease inspections and improve the quality of medical services. Author mentions that the digitalization, combination and

effective utilization of big data in healthcare results in early detection of severe diseases, fraud detections and management of individual health of patients. It is expected that US healthcare sector will save $300 billion through the usage of big data tools to analyze health patterns [26]. Big data helps in reduction of the mortality, detecting kidney failures, predicting the patients who have body that is resistant to certain drugs, infection developments and determine the decompensation of risk [27].

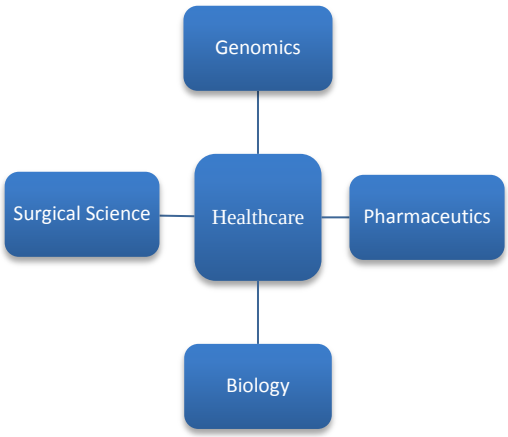

Figure 3. Big Data in Healthcare

A. *Genomics*

The data generated in genomics doubles every seven months and appears in diverse formats with high distributions. It is expected that by the year 2025, the genomics sector will consume around 2.5 million sequences of plant and animal genomes. Cloud computing significantly reduces the bandwidth of genomic data distribution, which allows the execution of applications from remote locations. Acquisition, storage, distribution and analysis are the critical technological needs of genomics [28]. Big data tool Hadoop has the potential to solve the complexities of the genomic sequences. Algorithms such as CloudAligner, CloudBurst, FX help in estimating the expression levels of genes, performing the evaluation of genome re-sequencing and mapping the genome sequences [29]. The documentation of genomics efficacy and big data gives rise to clinical trials and patterns of experiments. The epidemiologic approach of big data has helped genomics [30].

B. *Pharmaceutics*

The big data information in pharmaceutics derives favorable health outcomes from the medicinal datasets. The pharmacy field requires to leverage the drug related data to ensure patient safety, cost reduction and enhance the results. In year 2013, a critical pathway was developed using data mining techniques that helped in the comparison of pharmacy streamlined intervention with asthma patients who had sub-optimal control [31]. Data enlightens ways of performing various disease mechanisms, safety progressions, development of aimed therapies that lead to minimal adverse impacts in pharmaceutics. Big data in pharmaceutics ensures that right patient is served with right therapy at the right time. Big data promotes formulary management, adverse event monitoring, application enhancement, information derivation, quality measurement of treatment results [32].

C. *Biology*

The biology field has been directed towards data-intensive approach as the experiments are compiling tremendous data. The goal to serve humanity has given rise to unique techniques and problem-solving operations that handle and perform mining activities on the data produced by biology and the connectivity related to it. This enhances the knowledge of cells and builds a foundation for biology networks [33]. System biology utilizes metabolomics to understand the modelling and living conditions of the organisms that demands analysis that is based on computations. Big data tools are used to handle the data compiled by the biological fields [34]. Topology pools tremendous data and it uses big data techniques to valorize and derive conclusions from complexities like low signals, ratios of various noises and shifts in the variables [35].

D. *Surgical Science*

Big data is a resource to determine the quality care in surgical science. In ophthalmology, big data allows to evaluate the unusual or rare incidents that involve difficulties in cataract surgeries. Big data is also utilized to assess the connections between the bone fractures and the cataract surgeries [36]. Surgery risk assessment tools are evaluated by physicians to retrieve the information regarding the risks involved in various surgeries. These tools involve data from lab tests, medications and the patient profiles. The electronic health records (EHR) have a huge contribution in decision-making systems and improving the treatment results [37]. In Korea, the obesity was analyzed using the medical health records, which revealed that common obese patients were prone to initial cancer stages, whereas higher levels of obesity was a cause of rectal-colon cancer [38]. The research of brain network analysis to detect mild traumatic brain injury utilizes electroencephalography data that identifies the biomarker in adolescents [39].

V. CONCLUSION

Big data holds the power of influencing the decisions made by crucial fields such as supply chain management and logistics activities. It can deliver critical transformations to the methods of utilizing the sophisticated technologies. These transformations help in gaining major insights in the tremendous amount of data generated by clinical, pharmaceutical, medical claims. It is becoming larger, varied and faster. A rapid growth of big data usage in logistics and healthcare is been noted. The big data implementation elevates the effectiveness of the decision-making outcomes. There are several challenges that must not be disregarded as overcoming those challenges will result in the increment of the solutions for various issues and complexities involved in major fields. The challenges such as privacy guarantee, security, standard and governance establishment are becoming more crucial to be identified and overcome. There is a need to develop analytical methodologies to eliminate the complications that hinder the

problem-solving rates. Big data is a source of innovation as it is encouraging the development of applications and softwares to solidify foundation of technological advancement. Every coin has two sides and so does big data. It complies with technological developments but at the same time it entails major setbacks that are difficult to deal with. From this research paper we can conclude that the hype and hope of big data transforming major areas needs to be handled with proper attention or its wrong interpretation holds the potential of destroying the whole industry. However, the possibilities and opportunities risen from big data are non-negligible.

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