

Big Data Analytics: A Tool for Entrepreneurial Innovation through Transparent and Flexible Network Management in Healthcare Sector

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Abstract

Purpose: The purpose of research is to find out through caselets of various organisations how implementation of big data has helped these organisations to enable transparent and flexible network management in the healthcare sector.

Methodology: The study has been undertaken through case study method adopted by Eisenhardt (1999).

Findings: The research findings suggest that the implementation of big data is a critical success factor for organisations. Especially if the organisation intends to enable transparency and flexibility within the systems for better designing the work flow processes, big data acts as an enabler.

Originality: This research has interdisciplinary characteristics involving the implementation issues of big data and the benefit thereof. The findings also are unique in nature since it has brought the impact of big data in enhancing flexible systems and transparency. The implications for industry and academia are also discussed.

Keywords—Big Data Analytics; Dell; Healthcare; IBM; Microsoft; Oracle

I. INTRODUCTION

Healthcare sector is where Big Data Analytics can be used in a vast way. This sector has an accumulation of huge volumes of data. Day by day, patient records, prescriptions, bills etc. increase in number and require being stored in such a way that can be extracted easily for insights, subsequently to improve patient care and research. Such data is crucial to analysis in a correct manner to provide timely medical care and save lives. Various IT Companies provide Big Data Analytic Solutions to hospitals/ organizations in the healthcare sector. There are many success stories but there are also a few clients who are not completely satisfied with the results. This paper analyses the technology and mechanism used by various solution providers, how they can be beneficial, the impact of these Big Data Solutions on the healthcare organizations using them, their success and points out causes for dissatisfaction of few clients, along with a few solutions.

Oracle believes, "Big data is the derivation of value from traditional relational database-driven business decision making, augmented with new sources of unstructured data." According to Microsoft, "Big data is the term increasingly used to describe the process of applying serious computing power—the latest in machine learning and artificial intelligence—to seriously massive and often highly

complex sets of information.” (www.technologyreview.com).

Historically, the healthcare industry has generated huge volumes of data originally kept in hardcopy form that is using files and folders containing paper documents. Nowadays, rapid digitization is under process, in which all the data from patient records, staff records, prescriptions, insurance claims etc are being stored in databases or data warehouses. The data stored has enormous potential to serve a great deal of insights into the current trend of diseases. It is nearly impossible for traditional database management systems to handle the sheer volume of data in the system, that too data that is growing at a very fast velocity. The data, whether it is patient records, prescriptions, imaging results, doctor notes or staff data is not in a uniform format. Some data may be using Excel sheets while the other might be fed in as queries. Hence the data stored is not in a normalized form and cannot be integrated to gain insights of the trends. This is where Enterprise Resource Planning (ERP) comes in and subsequently and most importantly the new and growing concept of Big Data Analytics.

The Healthcare Sector is one of the most fast growing and critical areas where data analysis is of utmost importance. Wrong trend understanding can lead to misleading facts, wrong drug therapy. Healthcare expenses in the US were 14.9 percent of gross domestic product in 2007, with the number expected to rise to 20 percent by 2019 (www.informationweek.com). This shows that a huge amount of money is spent in Healthcare because of the sheer number of patients consequentially creating huge volumes of unmanageable data. For the healthcare sector, Big Data is the patient records, prescriptions, insurance claims data etc. Data is available for retrieval and analysis but it is so scattered, unformatted and vague sometimes incomprehensible in a particular context that it cannot be used to extract meaningful detail. Just storing the data and not putting it to good use, for improved patient care and research, is a waste of money and effort. It needs to be normalized and meaningful data analysis applied. This area is a very big opportunity for big data experts to advance in their field and create solutions. According to a PwC study, 95% of healthcare CEOs felt that it was important to explore better ways to exploit Big Data to advance in business/enterprises and the same applies for healthcare (www.informationweek.com).

Digitizing patient records and subsequently using analytics can greatly be advantageous. Big Data Analytics along with Data Warehousing can get doctors fast query responses crucial to saving lives in emergency situations. Such data if available online like a hospital facilities etc can even help patients make a right choice. Analysis of medicine effects can be exploited for drug safety regulations and even detecting diseases in patients before they occur, thus preventing it (Ragupathi, 2014). Such a case of drug safety analysis is explained in further sections, on Harvard Medical School using IBM PureData System for Analytics.

The following is a table from statistics as quoted in paper (Oracle, 2012), regarding the % events regarding healthcare causing serious after-effects, in increasing order.

TABLE 1: PERCENTAGE OF VARIOUS CRITICAL EFFECTS IN HEALTH

TYPE OF EFFECT	PERCENTAGE OF TOTAL EFFECTS
Irreparable harm	5%
Death	10%
Life Sustaining intervention needed	23%
Long Hospital stay required	62%

Hence getting a detailed insight consisting of each and every angle of analysis, unravelling hidden embedded data and using it for patient care is essential. This cannot be accomplished with the traditional databases as they are unable to analyse hidden data and do not give fast query responses. Big Data Analytics provides a solution.

Various leading IT Companies like Microsoft, Oracle, Dell and IBM provide big data analysis solutions in various sectors including Healthcare and identify it as a sector which can use Analytics for immense growth, research and advancement to improve patient care and save lives.

II. LITERATURE REVIEW

The Healthcare Sector has around 500 PetaBytes of Big Data and by 2020 it is estimated a total of approximately 0.0281 ZetaBytes of data will be available (Volume) (www.prezi.com). The data is not normalised, it is in various formats which makes it difficult to consolidate and use for analysis (Variety). The rate at which different data is fed and the current status make it difficult again to analyse

data sets (Velocity). Uncertainty is also an issue creating difficulties (Veracity). Hence Big Data Analytics comes to the rescue.

As stated in the previous section, companies like Microsoft, Dell etc. provide Big Data Analytic solutions in the Healthcare Sector providing insight into records, trend analysis for drug safety and research and also fast query response times.

III. FLEXIBILITY AND BIG DATA

Modern enterprises are challenged with the need to store and analyze massive amounts of structured and unstructured data. This is essential to derive crucial insights that may give the company the necessary advantage over its competition. The amount of this data grows at a faster pace than ever before. Timely and accurate analysis of this data is of utmost importance. High-Performance Computing Cluster (HPCC) Systems is an open source big data processing platform from LexisNexis. LexisNexis has collaborated with Cisco to offer a high-performance analytics platform that is scalable, flexible, and cost effective. The solution is based on the Cisco Unified Computing System™ (Cisco UCS®) Common Platform Architecture (CPA) for Big Data. The software includes a Thor cluster that acts as the extract, transform, and load (ETL) engine; a Roxie cluster for that acts as a high-performing concurrent data delivery platform; and an Enterprise Control Language (ECL) Machine Learning (ECL-ML) module. HPCC Systems has validated and certified this solution on Cisco UCS CPA for Big Data. "Big data" refers to the data in various structured and unstructured forms that originates from a multitude of devices and applications connected to the Internet. This data typically doesn't fit into traditional relational models because of its size, velocity, and composition: the amount of big data increases rapidly, and big data is a mix of structured and unstructured data. As a result of the continuing dramatic increase in data, many organizations are overwhelmed by the data in their systems, with the result that they are unable to process the information and use it effectively. The answer to these challenges is a scalable, integrated computer hardware and software architecture designed for parallel processing of data-intensive computing applications.

IV. METHODOLOGY

A. Caselet: IBM

IBM provides various types of Big Data analysis solution (PureData System for Analytics powered by Netezza Technology) for data warehousing, analysis and now even working with Hadoop. IBM's PureData System for Analytics combines integration by design, built-in expertise and a simplified experience. It has highly reliable and scalable database services, adaptive deployment, fast responses to queries, fast data loading suited for client needs along with compatibility to multiple programming languages like Java, Python making IBM PureData System for Analytics a good tool. It can even be used in an extension to a currently adopted scheme hence flexible (www-01.ibm.com) (IBM, 2012). It is powered by Netezza Technology, tool for sequencing and integrating different types of data much like an ERP tool (Enterprise Resource Planning). It allows accurate and faster predictions along with rapid response to changes. It uses parallelized algorithms running on the database helping in faster processing of data (www-01.ibm.com/software). Netezza offer a powerful base for analytics to run on. It drives critical business processes timely and accurately to generate desired results. It is fast, reliable and scalable. It provides the client with business intelligence (BI), analytics, integration, and an upper hand on managing data. Users gain a clear understanding of data in all domains of their concern. Netezza offers TwinFin, a modular and scalable appliance, which allows organizations to modify the capacity in accordance with their needs. It amalgamates processing, storage, database, and analytics into a single system. Netezza transform raw data into meaningfully stacked quality data such that execution, review and analysis can be facilitated. Netezza hence organises the data warehouse into a repository of easily accessible meaningful data supporting analytics and various business applications.

Business Intelligence benefits of Netezza:

- Simplicity
- Performance
- Cost-Effectiveness (Information Builders)

Hence using IBM PureData System for Analytics and Netezza Technology, the expected results can be obtained since Netezza provides a base for IBM Analytics to run on. Two client stories have been explained in further sections.

B. Caselet: Microsoft

Microsoft is another big data solution provider. It provides *flexibility* to deploy a Hadoop Cluster with HDInsight or on premises HDP on Windows Operating System. Polybase enables combination of various types of data, normalization that eases query of data in a scalable manner. It uses its own products such as Microsoft Office Excel and Power BI to create understandable and comprehensive visualizations of data for analysis (www.microsoft.com). Two clients of Microsoft's Big Data Solutions have been explained in detail in further sections.

C. Caselet: Oracle

Oracle, another IT giant, provides an intensive solution that acquires and organizes a wide variety of data including existing data. Building a Big Data Platform typically consists of three major steps:

- Acquire the data: This means gathering all data irrespective of type, this data is not in normalized state. It is a huge veracity of data which can be gathered using NoSQL (Not Only SQL) databases. Oracle NoSQL Database is a distributed, scalable and key-value database. It is easy to install, manage and supports a broad veracity of data thus making analysis easier.
- Organize the data: This means normalizing the data or bringing it in a uniform format such that analysis can be performed effectively (much like Enterprise Resource Planning- ERP).
- Analyze the data: This involves detailed examination providing insights to even the data that is deeply embedded. This can provide a great deal of beneficial information that can be a very effective tool in the Healthcare Sector.

Oracle is the first vendor to offer a complete integrated solution to Big Data Analysis. It is scalable to the existing technology in use, such that the existing data can be included. It is designed such that new big data technologies like Hadoop etc. can run in simultaneity with the Oracle data warehouse to deliver the desired results.

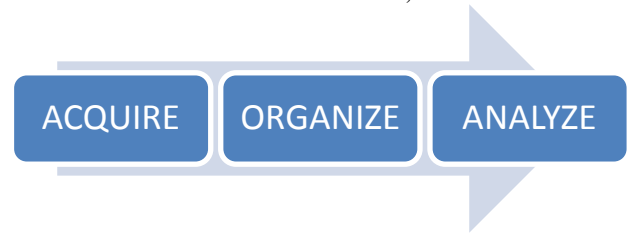


Fig. 1. Oracle Strategy for Big Data Solutions

Oracle Big Data Appliance is a system that combines hardware with software that is hardware with a big data software stack. It is a configuration with 18 Sun servers with storage capacity storage capacity of 648TB. Each server has 2 CPUs with 8 cores and 64GB memory. It includes:

- Cloudera's Distribution
- Oracle Big Data Appliance
- Cloudera Manager
- Statistical package R
- Oracle NoSQL Database Community Edition2
- Oracle Enterprise Linux OS, Oracle Java VM (Oracle, 2013)

Once all the big data is collected and organized, Oracle Big Data Connectors can be used to integrate the data required for various purposes using Oracle Exadata and Oracle Database. It has four components:

- Oracle Loader for Hadoop: OHL is added at the last step of the Map Reduce of Hadoop mechanism. It loads Hadoop, performs Map Reduce and then at the final step, it transforms the data into the Oracle database format such that they can be easily accessible and retrieved faster.
- Oracle SQL Connector for Hadoop Distributed File System: It is high speed connector for accessing data on Hadoop Distributed File System (HDFS) directly from Oracle Database. Hence the user can retrieve any data at any time as per requirement.
- Oracle Data Integrator Application Adapter for Hadoop: It is basically for a simple data integration procedure from Hadoop and an Oracle Database.
- Oracle R Connector for Hadoop: This is for providing access and analysis in a scalable manner, of the data stored in HDFS. It eliminates the need for users to have knowledge of SQL or other databases hence making working and analysis extremely efficient and easy.

According to Oracle, different purposes require different type of analytics, or so to say, different results. Research may require an analysis of trends

for instance, drug safety, whereas patient care may require fast query responses to patient medical history, type of medication etc (Oracle, 2012).

They also provide In-Database Analytics, as the name suggests provides analysis of data stored using various technologies. Hence by using the packages provided by Oracle for Big Data Analysis, great insights into the data stored in the data warehouse can be obtained providing trends, data exchange and financial analysis effectively used for improving patient care and research.

D. Caselet: DELL

DELL has a modular, “start now, start small” approach towards applying Big Data Analytics. According to them, small projects can act as a model for implementing analytics for larger more cumbersome projects. DELL too provides scalable technology that can utilize existing data. The following chart shows the DELL model for Analytics (Dell, 2014).

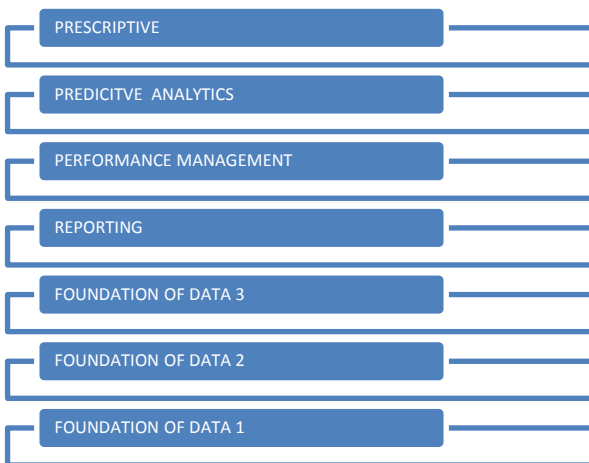


Fig. 2. DELL Model for Analytics

The above chart has three data foundation layers. They perform first, basic governance in terms of strategic alignment. Second, integration of data and third, overall management of data stored in the data warehouse.

Their approach to improving healthcare through big data analytics is four tiered:

- IT Platform should be easily modifiable or adaptive, at the same time scalable such that exiting technology can also be used.
- Secure digitized access to data anywhere anytime
- Healthcare staff including doctors must have deep insights to stored data to improve patient care

- Investing in improving technology reaps benefits in terms of better patient care and advancement in research (www.dell.com)

This way, all the data is turned analysis ready that is into normalized data that can be used to obtain valuable insights once analyzed. For instance, an analysis of medicine effects on patients suffering from thyroid can be done to get to know the duration it takes for patients to get stabilized thyroid secretion etc.. A basic hospital growth analysis can be done by extracting data regarding number of patients visiting the hospital per day and at what time the influx is the maximum. This way, the Hospital can provide equivalent number of staff and resources for saving lives and improving patient care. This and much more is possible with analytics.

DELL believes in predictive and retrospective analytics. That means it helps in predicting trends by retrospection that is by analysing historic data like patient medical records etc. to predict what kind of trends will emerge in the current scenario.

Deloitte provides services for digitizing records and making them available online, creating meaning out of a variety of data, that can be used. An instance is wherein, Deloitte provided services for Intermountain Healthcare (Salt Lake City), digitizing its patient records, thus improving healthcare facilities across 22 hospitals or 90 million patients. They were covered under a program of Deloitte called ConvergeHEALTH, part of a \$150 million to \$200 million investment in healthcare analytics. "Healthcare systems are facing multiple pressures now that really make analytics and in particular the secondary use of healthcare information really move from a nice-to-have to really, truly an imperative for survival in the coming years," says Brett Davis of Deloitte Consulting Principal and General Manager of ConvergeHEALTH. Andrew Vaz, Chief Innovation Officer, Deloitte Consulting says “Healthcare is our biggest industry in revenue, both in the U.S. and globally. We’re making roughly a \$150 million to \$200 million dollar investment in health analytics, and our clients are telling us since we started making these investments that this tight combination of product, content and transformation services is dramatically accelerating their transformation journey”. (Oracle, 2012) (www.healthcareitnews.com). This way Intermountain Healthcare was able to excel with services provided by Deloitte.

In the world of mobiles, Ginger.io provides an application that helps patients without having to visit the doctor. It is based on a predictive model, that analyses patient disease pattern and sleep pattern, such that abnormal behaviour in patient health can be cured. This can in turn be used in research (www.prezi.com).

Healthcare industry lays forward a wide sector for Big Data Companies to invest and provide solutions. It has great scope of business and advancement.

V. CASE ANALYSIS

A. IBM Clients

- 1) *Seattle Children's Hospital:* Seattle Children's Hospital generated huge amounts of patient data for which they had to hire experts to analyse, record and synchronise the data into excel spreadsheets such that they could be used for meaningful data extraction when required. But, such a huge amount of data is difficult as well as tedious to handle, apart from a lot of time required to generate responses for queries thus stagnating patient care. They faced a huge volume and variety of unmanageable data.

The hospital recorded 375,000 outpatient visits and 77,000 inpatient visits in 2013 (www03.ibm.com). The Hospital required an efficient mechanism to improve data management and retrieval and integrate the increasing Big data to initiate a program called Clinical Standard Work, CSW (www.brightlightconsulting.com).

Until June 2013, the Seattle Children's Hospital was storing its data on 31 SQL servers, which were successively breaking down, becoming unfit for handling data. Their eight-person IT team was stuck trying to maintain the large stack of ever-growing data and was unable to make any future plans for improving patient care through a well managed database. They wanted to automate the process of data categorization and integration to decrease response time and increase accessibility. In order to solve this concern, they started working with BrightLight Consulting, a data

warehousing and business intelligence consultancy, to find a better system. The hospital switched to IBM's PureData System for Analytics. Using it, they got rid of failing SQL servers and modified the existing systems with IBM technology which is scalable and easily works on existing technology and frameworks (data-informed.com).

The number of patients as quoted above is very huge and to analyse and integrate their data, the Hospital used IBM PureData System for Analytics powered by Netezza Technology, provided by Brightlight Consulting, giving support and expertise in implementing the System.

The hospital used this analysis for better understanding of the patient's history hence improving healthcare. It eliminated manual processing/searching and speeded up query responses by 50 to 100 percent (www.slideshare.net) (www.youtube.com). They have more than doubled the number of projects that they can deliver to the business.

The system has been successful in Seattle Children's Hospital because it uses Netezza Technology embedded within, integrating data and managing it upon which IBM PureData System for Analytics works well and gives desired results. The Hospital also has a team of dedicated employees (with good knowledge of the system) in the Data Warehouse Department working jointly with Brightlight Consulting to deliver premier healthcare.

- 2) *Harvard Medical School:* Division of Pharmacoepidemiology and Pharmacoeconomics at Brigham and Women's Hospital in Boston, Massachusetts, at Harvard Medical School was created in 1998 led by Dr. Jerry Avorn, Professor of Medicine at Harvard. The division performs analysis on patient claims data for comparison of drug safety and its subsequent effects on patients. It is a globally recognised leader in drug safety and effectiveness research. Since its inception, the division has been highly computation intensive and the growing volumes of data from insurance registers to

prescriptions had made it difficult for the research team to analyse data and detect emerging trends. IBM PureData System for Analytics powered by Netezza Technology proved to be a positive step towards creating a platform for computational pharmacoepidemiologic analytics. Apart from this, they used their own high-dimension analysis algorithm. It is a multistep algorithm to implement high-dimensional proxy adjustment in claims data. They experienced an increase in speed of computation and facilitated automation of drug safety analysis and effectiveness monitoring. The IBM PureData System delivered high speeds of computation at a low cost. It is optimized for analytic workloads. Resultantly, the team was able to feed data faster without much modification to the SQL and SAS code and minimal administration and maintenance. The system was up and running within 48 hours (www.slideshare.net) (IBM, 2013) (http://www.business-software.com). This too was a success because it used Netezza with the system, delivering desired results. Increased speed of computation and facilitated automation of drug safety analysis and effectiveness monitoring. The IBM PureData System delivered high speeds of computation at a low cost. It is optimized for analytic workloads.

B. MICROSOFT Clients

- 1) *Leeds Teaching Hospital, U.K.*: Ascribe, a Big Data solutions provider included Leeds Teaching Hospital in a project for getting insights into how Analytics can provide a BI solution. The Hospital generated about a million unstructured records per year. This is a huge volume of data and to improve healthcare facilities at the Hospital, Ascribe chose the Microsoft Stack as a solution. It used Microsoft SQL Server 2012 and Windows Azure HDInsight Service. They worked with Two10Degrees to map unstructured data into an ordered data format. This way, they combined structured and unstructured data, analyzed it and gained insights to trends in medicine and diseases. Doctors experienced fast responses to queries and patient records.

The data stored and analyzed also pointed out many ways in which the hospital facilities in terms of resources and finances could be improved to provide better healthcare. It kept track of the number of emergency cases registered and hospital stays etc to identify any unusual trends in patients so as predict epidemics timely. It improved efficiency, cut down cost and provided fast query responses along with insight (Microsoft).

- 2) *Beth Israel Deaconess Medical Centre (BIDMC), Boston*: "Some of our queries have a 45 second execution time. With SQL Server 2014 that dropped to 10 seconds. That's a huge improvement", says Don Wood, Manager of Database Administration, BIDMC. BIDMC is a leader in biomedical research and was given "Best Hospital" US News and World Report. BIDMC was facing a huge volume of piling data or Big Data, that is prescriptions, bills etc. Their traditional databases gave delayed query responses which was not acceptable. It irritated staff and posed a threat to patient care in crucial situations, where seconds matter and the situation can turn from bad to worse in an instant. The databases could also, not retain data more than thirty days old. Archiving of historical data delayed the query response time and also made it difficult to retrieve and locate valuable data. To solve this problem they used Windows Azure HDInsight and Microsoft Power BI for Office 365. They used a hybrid cloud that made access to big data easy.

They experienced a 75% reduction in query response time, greatly improving efficiency, especially in critical situations. The data retention duration increased from thirty to ninety days. Apart from this, the hybrid cloud made it very to get data whenever needed, exploiting the benefits of cloud services along with Big Data Analytics, greatly improving performance. The IT Team did not have to wait long before they could manage and retrieve data as opposed to previously sitting down for hours. All this was achieved with minimal changes. This way, they could gain insights into patient data and improve Business Intelligence (Microsoft).

IV. IMPLEMENTATION ISSUES AND CHALLENGES FOR BIG DATA

Many clients have not been fully satisfied with Big Data Solutions provided to them. All clients that opt for a Big Data Solution or the organisations that provide these solutions, in some cases, do not use normalization of data that can be achieved using ERP or Enterprise Resource Planning. When an ERP Solution does not run before sending data for analysis, the analysis takes more time increasing the query response time. It takes time to map unstructured data whereas that time should be utilized for analysis and providing fast and valuable insights into patient medical history or trends in diseases, whatever is the need. Hence by using uniformly formatted data, analyses can be sped up tremendously

Since Big Data is a separate concept altogether requiring experts, what most healthcare organisations do is hire experts which takes time and causes delays. It is better to hire a good consultancy firm that does the job for the organisation. It saves time spent in searching for experts and subsequently installing the solution. The best solution can be the IT team already working at the client side work along with the experts of Big Data from the consultancy providing the Solution as explained in the two instances of IBM clients in previous sections. This way, the consultants can save time in trying to understand the client's root problem and mechanism and can install the solution faster.

Two separate teams may also be employed, one for starting/installing the solution and the other for interoperability. This will ensure divided work and good communication can make this model successful since they will not have competing priorities enabling smooth flow of work (Dell, 2014).

V. CONCLUSION AND DISCUSSION

IBM PureData System for Analytics has been a great success as explained in the instances of Seattle Children's Hospital and Harvard Medical School. This is so because of the initial normalization of data powered by Netezza Technology which sped up analysis and reduced query response time. Netezza embedded within IBM PureData System for Analytics shows to be a great combination and a good tool.

Solutions provided by Microsoft mostly use SQL Servers and HDInsight. It maps unstructured data into an ordered taxonomy thus serving the purpose of speeding up analysis. The two instances explained show how they got faster query response times and better insights.

Oracle uses a rigorous four step mechanism for analysis. Along with using connectors and integrators, it uses Hadoop for fast query responses and the data on HDFS can be accessed directly increasing efficiency.

As for Dell, it provides solutions in a modular manner from small to larger projects, which is a good approach.

Expert opinion also points towards the benefits of using Big Data Analytics. "We, as a society, need to start creating our own metrics for how healthcare quality is defined. In the sense of looking at costs, we know where there's avoidable cost in healthcare. We just need to get folks the data they need to avoid those pitfalls," said Dr. Anil Jain, senior VP and chief medical officer at Explorys. Manmeet Singh, co-founder and CEO of Dataguisé says, "Earlier, data warehousing and analytics was restricted to larger organizations because it was cost prohibitive. What big data has done has brought it down to smaller organizations. But the biggest challenge with these smaller markets and mid-tier organizations are resources" "Cloud is becoming very prevalent. They're going to store a lot of data in the cloud. They'll outsource a lot of that data to the cloud. Automation of compliance is important." "From my perspective, security and compliance should be discussed from the get go. It should be part of their overall strategy." (www.informationweek.com).

Apart from serving as a great tool for improvement in the healthcare industry it is a great business development opportunity for companies into Big Data Solutions. It is a sector that has huge scope for the same and will grow even more over time, with more and more healthcare organizations realising its benefits and opting for Big Data Analytics.

Big Data Analytics is a relatively new field, extremely novel and beneficial and has great scope for growth. The current scenario is such that many of the hospitals and healthcare centres have not realised the importance of using Big Data Analytics. The ones that do use these solutions have benefited immensely but are still at initial

stages of usage. Some clients are even dissatisfied with the results due to reasons stated in previous sections. The organisations that are using Analytics with a combination of ERP are moving in the right direction. They are experiencing results like never before, with seamless management of data and insights into data that were previously impossible with tremendous speeds of query responses. There are many success stories of clients who undertook Big Data Analysis Solutions hiring consultants who worked with their IT Team. They were able to deliver better healthcare and advance in Research and development of trends. Big Data is the tool to success but it has to be used in consonance with other solutions to reap unmatched results. It can lead to early predictions of diseases, preventing them from occurring altogether. It can enable personalized care of each and every patient, easy access to help even without visiting a doctor, based on trend analysis of the person's health and historical data. This can in turn reduce healthcare costs. There lies huge scope for advancement in the Healthcare industry which is sure to improve patient care in the near future.

VI. LIMITATIONS

Digitizing of data and wide availability may hamper patient privacy

Healthcare Trade or sharing of healthcare data although for a good cause, can hamper the patients' rights

Big Data is a new and different concept hence not all organisations around the world have realised its importance and scope of advancement in their fields. Many Hospitals in some countries don't use digitized records hence applying Big Data Analytics is a farfetched concept.

Big Data Analytics is currently, even if adopted by some, at a very early stage in the Healthcare sector. Most hospitals are only at stage two or three of exploiting the benefits of Big Data Analytics.

The issue of securing the data plays a role here as well. Since the data is readily available, measures need to be included in the overall strategy to secure the data.

It is important to choose the right kind of Big Data Solution based on factors such as affordability, company viability, IT team at site, scalability of system, ease of execution and modification. These factors need to be kept in mind

lest the results are dissatisfactory (www.informationweek.com) (www.prezi.com) (data-informed.com) (www.slideshare.net).

REFERENCES

- [1]. <http://www.technologyreview.com/view/519851/the-big-data-conundrum-how-to-define-it/>
- [2]. <http://www.informationweek.com/healthcare/analytics/healthcare-dives-into-big-data/d/d-id/1251138>
- [3]. Wullianallur Raghupathi and Viju Raghupathi, Healthcare(2014), Big Data Analytics in Healthcare, Information Science and Systems Journal
- [4]. Oracle (February 2012), Reforming Health Care through Technology: The Intersection of Accountable Care Organizations and Health Information Technology
- [5]. <http://prezi.com/muxyidkye185/copy-of-data-analytics-transforming-the-healthcare-sector/?html5=0>
- [6]. <http://www-01.ibm.com/software/data/puredata/>
- [7]. IBM (2012), IBM PureData Sytem for Analytics N1001
- [8]. <http://www-01.ibm.com/software/data/puredata/analytics/nztechnology/analytics.html>
- [9]. Information Builders, Netezza and Information Builders
- [10]. <http://www.microsoft.com/en-in/server-cloud/solutions/big-data.aspx>
- [11]. Oracle (June 2013) , Oracle: Big Data for the Enterprise
- [12]. DELL (2014), Healthcare Analytics Adoption: Start Small and Start Now
- [13]. <http://www.dell.com/learn/us/en/70/healthcare>
- [14]. <http://www.healthcareitnews.com/news/deloitte-taps-zen-data-analytics>
- [15]. <http://www03.ibm.com/software/businesscasestudies/us/en/corp?synkey=P149231U57524E10>
- [16]. <http://www.brightlightconsulting.com/clients/client-stories/seattle-childrens-hospital>
- [17]. <http://data-informed.com/seattle-childrens-hospital-upgrades-to-ibm-puredata-to-improve-care/>
- [18]. <http://www.slideshare.net/davidpittman1/seattle-childrens-hospital-turns-big-data-into-better-care>
- [19]. <http://www.youtube.com/watch?v=bjGWlectvkl>
- [20]. Brigham Women's Hospital, case study <http://www.slideshare.net/davidpittman1/big-data-in-healthcare-case-study-on-brigham-womens-hospital>
- [21]. IBM (2013) , Harvard Medical School
- [22]. <http://www.business-software.com/customer/harvard-medical-school/>
- [23]. Microsoft, Big Data Solution transforms Healthcare with Faster Access to Information
- [24]. <http://www.slideshare.net/dalesanders1/choosing-an-analytics-solution-in-healthcare>
- [25]. Microsoft, Beth Israel Deaconess Medical Center