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BIG DATA ANALYTICS ON DECISION MAKING BY SMART FIRMS IN KENYA

Jackson Kipchirchir Machii[1]

Tutorial Fellow, School of Information Communication Technology, Zetech University

Email:machiijack@gmail.com; jackson.machii@zetech.ac.ke

Miriam Kaara[2]

Tutorial Fellow, School of Information Communication Technology, Zetech University

Email: miriam.kaara@zetech.ac.ke

ABSTRACT

Big data designates huge data-sets which demand unique advanced tools and techniques to collect, analyze, control and envision. Today, big data has captured an extensive interest from researchers and smart firms. This paper embarked on using desk-research to address the following objectives: to analyze the technological concepts of big data analytics; to establish application and uses of big data and its effects on business decisions; to examine the challenges of big data in decision making by smart firms. The study involved reviewing literature resources comprising of scientific research reports, journals, theses, and conference papers. The study concluded that Information Systems techniques, tools, and new intelligent technologies are paramount in organizations' strategic decision and planning for a life-long business success and to meet Kenya's vision 2030 economic projections. The concepts of Business Intelligence (BI) and the Internet of Things (IoT) development have supported the application of big data by smart firms enabling efficient quality service delivery such as smart energy, smart healthcare, smart grids, smart water, smart transportation, smart retail and smart homes.

Keywords: Big Data, Analytics, Business Intelligence, Internet of Things, Information Systems

INTRODUCTION

Big data evolution and the Internet of Things (IoT) have taken precedence in many organizations with the intent of spearheading decision making and enhancing productivity. A study conducted in the US shows that big data and analytics impact above 10% of the growth in 56% of the firms (Hashem &Anuar, 2016). Hashem and Anuar reported that 91% of affluence 1000 companies invest in big data analytics projects of which 85 % have achieved massive success. Power, (2014) asserts that big data has taken an extensive interest from researchers and firms have built a great expectation. Machii and Kyalo (2016) stated that the key pillars of Kenya Vision 2030

(social, economic and political) should be spearheaded by macroeconomic stability, equity, wealth fabrication opportunities, technology in addition to innovation. Therefore, Information systems techniques and all its aspects are paramount in an organizational strategic planning for a life-long business productivity and to meet Kenya's vision 2030 economic projection.

Today, organizations are interacting with massive data in an effort to extract relevant and valuable information to be used in various management levels including operational, tactical and strategic in making smart decisions. Usually, managers do rely on numbers, tables, charts and statistics extracted from information systems such Expert Information System (EIS), Management Information System (MIS) and Decision Support System (DSS) in making management and business decisions. Numerous firms have seized this opportunity to offer software solutions by selling information System modules to companies, with intent to improve and increase companies' productivity. However, managers swiftly become disillusioned, in the big data ambiguity concept. Power (2014) states that 'Data, either big or small, has no meaning in itself. Its data usefulness is unlocked through context and presentation'. Therefore, managers are required to clearly know the handling of voluminous data sources. Moreover, a few managers often do blindly expect magic from a highly-salaried data scientists employed in their organizations. Managers probe more on what a data scientist intends to do, how and why they are suitable for that role. They seem hesitant to invest in costly software and hardware to analyze data useful to the company.

Information systems such as MIS, DSS, and EIS, have facilities and tools which allow managers to access useful information for making informed executive decisions so as to put the company at a competitive edge. The systems have been developed to store, fetch and extract key information to support strategic decisions processes, procedures, policies including various activities involved. The data sources utilized by these systems include; transactional databases, ubiquitous Online Transaction Processing (OLTP), external news and market trends. This extraction of facts within large data sets requires Business Intelligence (BI) which allows information become available for top management to make a decision and strategic planning. The activities involved in a business intelligence system include data integration, data cleaning, and preparation (Silahtaroğlu & Alayoglu, 2016). Firms are required not only to share data in real-time between diverse investors but must modify their responses based on precise,

personalized, and uniqueness of knowledge in order to convert customer's data and information into valuable insights.

Firms progressively use Big Data Analytics(BDA) for example in search analytics, web analytics, customer analytics, search engine optimization, customer analytics, as well as pay per use management in order to customize knowledge of a customer's like lists of sites, product, suppliers, competitors, blogs, retailers, user details and data analytic from or about those sites (Xu, Frankwick, & Ramirez, 2015). According to Dinh, Phan, & Bui, (2016) recent studies, have dealt with management of knowledge aspects such as business analytics, business intelligence, knowledge discovery and data mining. This means they have focused strongly on the exploration of knowledge, but exclusively not absolutely supported knowledge exploitation. Often than not, there has been slight effort to assess the influence of big data on the entire organizational process, knowledge management as well as service orientation trends. Therefore, this study embarked on an empirical analysis on the use and impact of big data, analytics and business intelligence in decision making.

Objectives

The specific objectives of the study include:

i. To analyze the technological concepts of big data analytics;
ii. To establish the uses and application of big data and its effects on business decisions;
iii. To examine the challenges of big data in decision-making experience by the smart firms.

LITERATURE REVIEW

Big Data

The BDA possess competency for firms to appreciate insights from large data in different sources and IoT enables the integration of sensors, Bluetooth and identification of radio frequencies within a real-world environment enabled by well-networked services (Hashem &Anuar2016). On daily basis, there are a number of profit-making applications creating big data (Venkatram, et al. 2017) within smart firms; for example Enterprise Resource Planning (ERP-payments and purchases), Customers Relationship Management System, (CRM-offers and segmentation etc.) and web technologies (i.e. weblogs). Big data principally entails large data sets i.e. Terabytes headed for Exabyte's (Figure 1 below) involving unstructured complex heterogeneous sources such as smartphone applications, sensor, political science, social media

along with Internet-based tools which demand unique advanced technologies to collect, store, analyze, control and envision or visualize, its growth was estimated to be 25 billion by 2015 (Acharjya & P, 2016). For instance, Facebook holds data of more than 500 terabytes each day comprising of updated status, likes, posts and photos (Xu, Frankwick, & Ramirez, 2015). According to Katal, Wazid, & Goudar (2013) organizations experience rapid data from heterogeneous sources and varied formats growing at a huge speed. As a consequence, they experience a challenge in handling such enormous volumes of data.

Bigdata is mainly characterized by 5 V'sproperties: variety, volume, velocity, veracity, and value (Akter &Wamba 2016; Katal, Wazid, & Goudar, 2013). Power (2014) notes that'variety as digital format of numerous formats takes account of photos, email and text documents';(2) Volume where IoT brings about Big Data, for instance, researchers are initiating contemporary knowledge domain sites as collaborative forums, blogging and streaming of videos on top of e-commerce platforms or e-government sites of which acts as digital setting designed for business operations online (Katal, Wazid, &Goudar, 2013).(3)Velocity represents the speed at which data is collected, processed and analyzed at real time (Akter & Wamba 2016). (4)Veracity refers to the reliability, truthfulness, and accuracy of the mined data (Akter &Wamba 2016). (5) Value is the informational benefits (Akter & Wamba 2016) achieved after data mining.

According to Power (2014), big data is a 'high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision-making'. Based on a research by International Data Corporations (IDC), big data has data sets impossible for current databases architectures to store as well as manage. International Data Corporation insinuates that 'technologies and innovation generation of know-how shave been designed to extract values economically from volumes of a wide variety of data by enabling high-velocity capture, discovery in addition to analysis'. To certify credibility, consistency along with accuracy, cleaning, and integration of data are key parameters amid dissimilar data sources (Silahtaroğlu & Alayoglu, 2016).

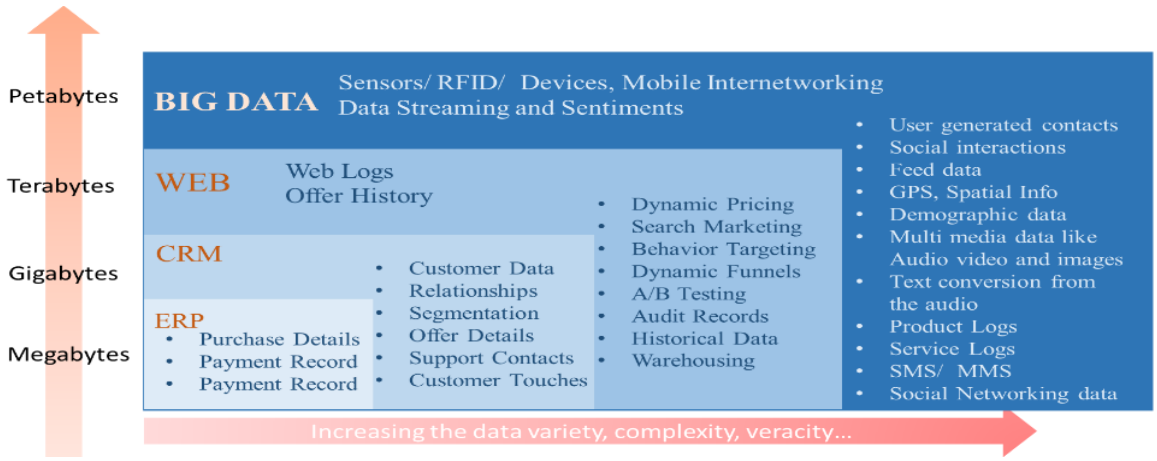

Figure 1: Data growth and technological evolution (Source: Venkatram.et al.2017)

Business Intelligence (BI)

According to Olszak & Zurada(2015), BI is a key aspect that has interested a number of researchers. There is no conclusive definition of BI but it has been referred to as (1) software's, technologies and tools, (2) process, (3)decision support system(DSS), (4) knowledge management (KM), (5) analytics, (6)big data, (7)competitive intelligence and so on.Ram et al. (2016), cited a finding steered by Thomson in 2004 showing the key advantages of BI which include; spawning fast and more accurate reports generation at 81%, good business decision at 78%, delivery of customer services at 56%and amplifying firm's revenues at around 49%. Business Intelligence (BI) involves mining information from colossal data sets (Silahtaroğlu & Alayoglu, 2016). The steps engaged in are data preparation, cleaning, integration and preprocessing taking on machine learning algorithm, techniques, employing Online Analytical Processing(OLAP) and mining tools, performing analyses and envisioning or visualizing data. This increases productivity and quality, creating product and marketing segmentation, determining current customer profile, predicting future customer profile, establishing product pricing strategies, planning human capital, formulating strategic plans, establishing customer tendency and loyalty prediction. As a result of the Internet of Things (IoT) development, a number of applications rollout by smart firms involved business intelligent systems that enhanced services delivery on areas such as smart: energy, retail, healthcare, grids, water, homes, and transportation (Hashem &Anuar 2016). Based on an argument made by Chan (2013) the data sources such as structured data through systems like OLTP systems processed data at warehouses. The analytical tools involveOLAP, data mining, query, and reports allowing

business intelligent information expedite business operations including making decisions. Additionally, sources of data(such as unstructured and semi-structured data)from social media, recordings of calls, scientific research, satellites or weblog can be channeled to analytical technologies such as Hadoop and MapReduce. Marín-Ortega, et. al. (2014), argue that the key facilities making up Business intelligence are:

i. Data Management-This involves data extraction, data integration, data cleaning, storage, and maintenance.
ii. Data Analysis- This includes querying, generations of reports, and visualizing data.
iii. Knowledge Discovery- This encompasses extraction of insightful information from data warehouses.

METHODOLOGY

The study is centered on desk research. Various sources of literature were critically analyzed. comprising of secondary sources of information such as case studies, scientific research journals, reports, theses, and conference proceedings reports from management information system, management and computer science field of study.

BIG DATA TECHNOLOGIES

Big Data Analytics

Today's technology advancements allow smart firms to acquire the thorough potential of data mining and analytics of big data. For instance, big grid environments; cheap, plentiful storage; quick processors; reasonable open source; distributed platforms; parallel processing; virtualization and high throughputs cloud computing (Bolohan & Ciobanu, 2013). Smart firms have to automate their decision-making process by optimization techniques that build up data reliance to facilitate tactical and routine staff planning, inventory control other than back-office operations (Liebowitz, 2013). Nair & Shetty (2014), term data analytics to be challenging with respect to data compilation and storage.

The types of analytics designed for countless data sources among data manipulation technologies include:(i) Retrospective data analytics – encompasses historical data along with quantitative tools for patterns and outcomes identification to formulate future inferences. It involves business intelligence; (ii)Predictive data analytics – the custom for simulation and modeling to fashion scenarios grounded on past historical data; (iii) Prescriptive data analytics – insinuates planned, quantitative analyses involving real-time data triggered events (Power, 2014).

SAS High-Performance Analytics

The SAS High-Performance Analytics involves not only querying, descriptive statistics, summarizations reports but also solves complex business problems scenarios using high-end analytical techniques at high speed. It makes organizations enjoy and confidently grab opportunities for good decision making permitting high competitive edge and valuable insights from big data (Bolohan & Ciobanu, 2013). High-Performance Analytics have aided analysts to predict markets through running of algorithms and routines to process the firm's huge data extracted askey insights (Liebowitz, 2013).HPA uses three modern distributed processing power to handle these data volumes. They include grid computing, in- memory, and in- database (Figure 2 below). They allow firms to enjoy a competitive edge by utilizing HPA advancements whereas providing scalability, flexibility, IT- resource utilization and extraordinary returns.

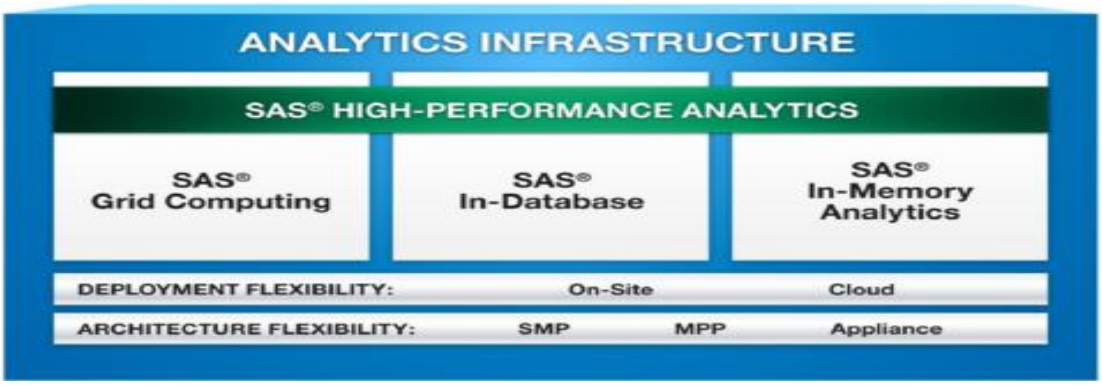

Figure 2: Modern Analytics Infrastructure (Source: Bolohan & Ciobanu, 2013)

Grid Computing Analytics

According to Liebowitz (2013), the grid computing employs a shared storage to manage vast volumes of data and programmed analytics which executes smaller segments of task concurrently over a multiple SMP (Symmetric Multi-Processing). Bolohan & Ciobanu (2013)

stated that SAS grid computing involves a fundamental grid infrastructure that ensures automatic control to realize workload offset, parallel execution, and high resources computing within a shared environment.

In- Database Analytics

This is an architecture based on massive Parallel Processing (MPP) to efficiently execute data in databases or data warehouse(Liebowitz, 2013).To minimalize data conversion and distribution rate, its working implements models, procedures and SQL queries (Figure 3 below)within the database thus responses to queries are obtained not in hours but minutes. Thereby, minimize expenses and improve data governance, delivery of more intensive and predictive models optimization performance (Bolohan&Ciobanu, 2013; Liebowitz, 2013).

Figure 3: In-Database Analytics (Source: Liebowitz, 2013)

In- Memory Analytics

It distributes analytical computations through a more convoluted data exploration and deployment model (Bolohan & Ciobanu, 2013). Specific nodes collect heightened and accurate intuitions to provide solutions to a complex based problem to achieve highly accurate information to make reliable decision almost in real-time (Figure 4 below). Moreover, IMA enhances decision-making, improves clarity and precise response from the dataset, and institute scalability, and reliability of BDAinfrastructure (Liebowitz, 2013).

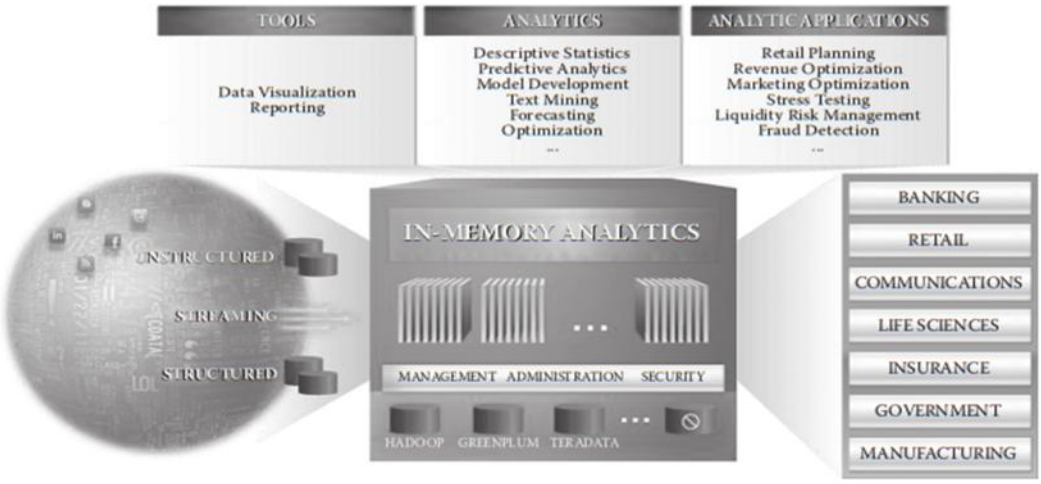

Figure 4: In-Memory Analytics. (Source: Liebowitz, 2013)

The users throughout the organization level should understand, appreciate, embrace and trust it in their every day in making decisions. The Managers should strike balance in the processes, people, and technology for the firm to develop trust, reliability and achieve their strategic goals, mission, and objective. Some of the new emerging technologies that facilitate interactive analysis, batch processing (Apache Hadoop) and stream processing (Strom, Splunk etc.) and comprise of MapReduce, Apache Spark and Storm (Acharjya & P, 2016). As a consequence, various firms have to adopt new technologies (Sathya, et al. 2015) of collecting, processing, analyzing and visualizing big data including Hadoopbesidesrelated tools such as YARN, Hive, Spark, Pigas, Map Reduce, and NoSQL databases.

Apache Hadoop and MapReduce

These are analytical software grounded on programming model used to solve problem cases (Assuncao et al. 2014) and consist of MapReduce, Apache Hive, Hadoop kernel and Hadoop Distributed File System (HDFS). Hadoop is an open source implementation of MapReduce application. Liebowitz (2013) pointed out that the master node segments and distributes data input into manageable sizes and the worker node converges subproblems results. The 'divide and conquer technique (i.e.Map Step, Reduce Step) can be used in Map reduce to process the voluminous data set. Hadoop and MapReduce data processing are intensive and storage is fault

tolerant. For instance, Amazon EMR allows clientele to instantiate Hadoop cluster using Amazon Elastic Compute Cloud and Amazon Web Services for scalable computing and transferring of the huge data (Assuncao et al. 2014). Hadoop implements HDFSto reproduce and segment data sets in multiple nodes.MapReduce is presented via Google to create a hardware abstraction and enhance concurrent execution of programs based on various clusters (Nair & Shetty, 2014). Apache Mahoutdeliversan application intelligent learning techniques for large-scale and intelligent data analysis applications(Liebowitz, 2013). Core algorithms of mahout including clustering, classification, pattern mining, regression, dimensionality reduction, evolutionary algorithms and batch based collaborative filtering run on top of Hadoop platform through a map-reduce framework.

Text Mining

The text mining is the most used for analyzing web content which consists of unstructured content. The unstructured data that organizations collect from heterogeneous sources (i.e. social media, emails etc.) requires text analytics to process into insight value (Olszak & Zurada, 2015).

Data Warehouse and Datamart

The data warehouses are a subject-oriented, nonvolatile and integrated collection of numerous data for cleaning, integration, aggregation, and queries. It consists of operational databases or historical data mine for corporate decision makers(Ranjan,2009). The Data warehouses allow consolidation of varied data sources and formats by process of extract, transform and load (ETL) in order to normalize information throughout systems to optimized querying(Marín-Ortega, et al. 2014). A Data Mart focuses on departmental data thus reducing database complexity (Heang & Mohan, 2016).

Dashboards

Dashboards are used by smart firms as visualization tools to facilitate a better presentation of business value and historical trends in terms of charts, graphs, and tables in a friendly interface at real-time(Silahtaroğlu & Alayoglu, 2016; Olszak & Zurada, 2015).

Web Mining

This involves analyzing web content using methods and tools grounded on Internet protocols as well as Application Programming Interfaces. It facilitates data integration of different sources and formats through web-enabled systems (Olszak & Zurada, 2015).

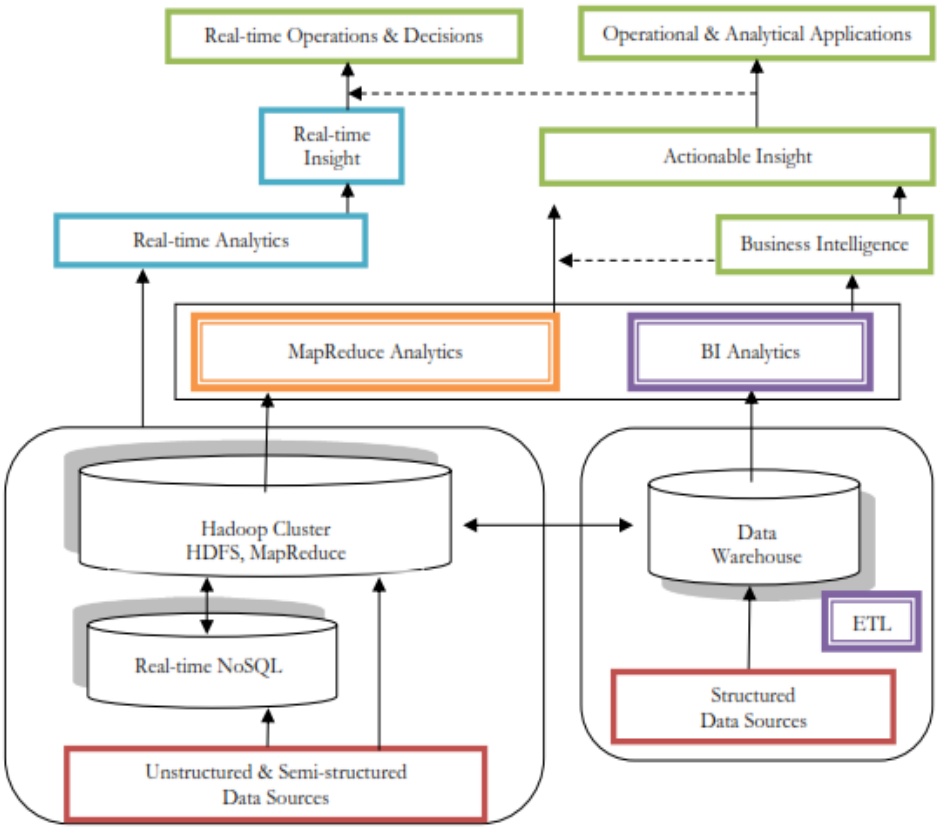

Figure 5: Summary Architecture for Big Data Analytics (Source: Chan, 2013)

APPLICATION OF BIG DATA ANALYTICS

According to Ram et al. (2016), BDA helps smart firms to significantly enjoy big data to better customer satisfaction, manage risk, create a competitive edge, enabling real-time insights for business optimization and decisions making. According to Ranjan (2009), a retailer who correctly utilizes big data intelligence could fully enjoy the full capabilities of upscale of about 60% working margins through acquiring of market shares compared to its competitors. Generally, the five major benefits of BDA include:

i. It allows data to be more accessible hence gives rise to visibility;
ii. It enhances the performance index as well as variability exposure through accurate data collection of performance;
iii. It aids in achieving the needs of the customers through proper population segmentation;
iv. It helps in making decisions by using automated algorithms thus realizing valuable insights;
v. It bears novel business models for efficient delivery of services and products.

Ranjan, (2009) further notes that business value realized from BI on decision making to a company include: (1)identification of customer profitability, loyalty and future customers; (2) products and service segmentation in relation to customer's needs; (3)Reduction of downtime of equipment via predictive maintenance; (4) Fraudulence detection; (5) Profitable rates selection for insurance premiums; (6)Improved e-commerce or business strategies; (7) Stock control; (8) Detection of warranty-reported problems reducing product design deficiencies.

Smart firms can use BDA to clearly comprehend insightful and valuable information flow by probing the huge data volumes in real- time. Organizations can use BDA to clearly comprehend their customers better to realize optimal engagement of customers. Regardless of its use; the big data at itself is not a solution but acts as a raw material. The challenge being faced is to convert and obtain insights and knowledge from data for use in solving problems and better the performance of a firm. BDA can enable managers to make enriched business decisions (Xu, Frankwick, & Ramirez, 2015). Dinh, et al (2016), argue that characteristics of big data and the knowledge management systems seem to drive big data to influence competitive advantage. The intelligence approach to BDA aids data-driven organizations to create a novel-generation of Knowledge Management Systems on the service-oriented basis to enhance the development and knowledge unification. By harnessing service-oriented approach, firms can manage, control and run business with techno-innovation revolution thus enabling a competitive edge from those they are competing with. The payback will be a unified integration, cloud solutions, all-inclusive commercial acumen for better organizational responsiveness.

Big Data analytics provide a variety of prospect and opportunities (Ram et al. 2016), for facilitating productivity, quality and critical thinking in problem-solving and decision making. The key applications posed by Big Data analytics involved utilization of business intelligence

and other technologies to advance efficient decision making, customer needs customizations, creating strategies and plans for segmentation of new markets exploration, services, and products, better turnovers of inventory, reduction in complaints made by customer, improving staff development, productivity as well as efficiency. Hashem & Anuar (2016) argued that usage of big data technologies facilitates data processing and storage to realize meaningful information for quality services. Likewise, big data enables managers to make decision strategy for any services and resources growth. For smart firms to achieve their objectives they must be aligned with right tools and techniques for better and efficient data analytics. The tools facilitate collaborative communication to enable quality service, customers' experiences as well as the realization of business potentials. Organizations with common interests can easily be known using data analysis to enhanced collaboration and development between them. Moreover, data analytics allows governments to implement suitable policies in such areas as people's social care, health, governance, education, etc. In addition, smart firms have contributed a big role by transforming various aspects of human life in all sectors such as business ventures, education, transportation, health, energy, and so on.

Table 1: Smart Applications of Big Data (Source: Authors, 2018)

Application	**Use cases**
Smart Transportation	• Route selection and destination management (Hashem &Anuar, 2016); Quick order of goods and delivery or emergency postal delivery; Dynamic time calculation for emergency vehicles like ambulance, fire service car, police van (Jony, 2016). • Predict ticket confirmations for trains (Verma et. 2016)
Smart Education	• Enhance the education processes' efficiency, effectiveness, and productivity; Active learning environments; create a knowledge-based society (Nuaimi, et al. 2015).
Smart Stock Market	• Prediction of share prices (Jony, 2016). • Gaining insights into shopping behavior; Customer Retention; Portfolio, product or economy-level

	prediction; marketing (Verma et. 2016).
Smart Clinical Care	• Correct prediction in real-time for better treatment; Facilitate real-time prognosis and diagnosis (Jony, 2016). • Health monitoring (Hashem &Anuar, 2016).
Smart Defense	• Analyze information as vehicles used in war; opposition strengths or any movement; current situation or historical information related to the war; the number of soldiers(Jony, 2016) • Fraud detection; Surveillance application; Video Analytics for investigation (Video Search); Detection of Threats (Verma et. 2016).
Smart Events/Festivals	• Real-time decisions based on crowd movement, increasing parking lots, traffic control, medical supports, or a number of security force presence in areas of the events (Jony, 2016).
Smart Natural Disasters	• Early prediction and warnings of natural disaster as earthquakes, floods, tsunami, cyclones, volcanoes, etc.(Jony, 2016).
Smart Daily Resources (electricity, gas, water, etc.)	• Real-time monitoring of usage; Production prediction; Future usages rate prediction; efficient resource allocation (Jony, 2016) • Water leakages detection; Proper water supply; Product development improvement (Verma, et. 2016).
Smart Governance	• smart policies creation and implementation(Hashem &Anuar, 2016) • Quality service delivery, participation, and engagement; elections winning(Verma, et. 2016).
Smart Grid	• Power supply management(Hashem &Anuar,2016) • It improves the efficiency, reliability, economics, and

	sustainability of the production and distribution of electric power (Nuaimi, et al. 2015).

CHALLENGES OF BIG DATA ANALYTICS

According to Marín-Ortega, et al. (2014), some of the challenges encountered in BI in the realization of its potential include:

i. Insufficient business information context;
ii. Poor alignment of business needs and technologies;
iii. BI solutions are mostly based on structured data thus, lacking integrating unstructured information;
iv. Lack of focus on the analyst needs and recommendations.

The standard algorithms regularly used for applications are not effectively and efficiently supporting big data. As a consequence, unique requirements, high volume and speed of processing are necessary (Nuaimi, et al. 2015). The computational intelligence algorithms such as genetic algorithm, neural networks, etc. and their attributes are more robust, efficient and effective in knowledge processing and management including soft computing data mining as well as Machine-Learning. However, these properties are restrained to only small data sets thus insignificant on big data analytics. As capacities of datasets escalate, attributes (such as efficiency, effectiveness, scalability, robustness etc.) of intelligent computational algorithms generally lessen, therefore inapplicable in exploring knowledge from big data created (Hashem &Anuar, 2016). The key challenge during knowledge discovery and visualization of big data analytics involves a disconnect between database systems and analysis tools. Therefore, smart firms should address the computational complexities and advanced algorithms problem.

Nuaimi, et al. (2015) argues that privacy and security issues need to be carefully addressed. The massive big data analysis allows meaningful patterns to be correlated and analyzed. The resulting information mandate organizations to enhance protection and confidentiality of users' crucial and sensitive information. This can be achieved through authorization, authentication and encryption techniques or measures (Acharjya & P, 2016). The ability of smart firms to collect, process and store individual or group big data brings about privacy concerns (Chan, 2013). The storage of this massive data is expensive and a shortage of storage space is the main challenge (Acharjya& P, 2016). The adoption of novel technology including integrating new systems features for

collecting, processing, searching or monitoring of information by firms is a great deal and expensive to implement (Nuaimi, et al. 2015). Furthermore, implementation of such a project might not be correctly done from the beginning based on needs of organization which might cause a big problem or not realize its potential. Thus, data storage and analysis cost challenge need to be critically considered. Scalability and visualization is also a great challenge for big data analysis techniques (Acharjya& P, 2016).In addition, data sources integrity and authenticity need to be scrutinized for analytics to find out the trustworthiness of each idea since machine learning has to be investigated to limit malicious data(Sathya, et al. 2015).

CONCLUSION& RECOMMENDATIONS

BDA has been recognized as a new techno-innovation that influences business operation. The study has looked at the technological aspect of big data analytics, business intelligence, data mining, IoT, SAS high-performance analytics (HPA) and cloud computing in smart firms. The study focused on the various characteristics of big data and established the various roles and effects of big data on business decisions. It also explored its challenges in decision making as experienced by smart firms. It was noted that business intelligence plays a significant role in streamlining a firm's which includes increasing productivity and creating quality products; market segmentation; determining current customer profile; predicting future customer profile; establishing product pricing strategies; planning human capital; formulating strategic plans and customer loyalty prediction.

The study recommends that the firm's need to invest more in big data analytics and technologies in order to make trendy decisions and strategies for quality services and resources growth. For firms to achieve smartness level as well as improve service delivery, there must be the deployment of right tools and techniques for BDA. However, big data should not be regarded as an ultimate solution in itself but barely as a raw material. Managers ought to convert data into insights and knowledge for use in decision making for better performance. They should strike a balance between three key measures i.e. processes, people, and technology for their firms to develop trustworthiness, reliability and achieve their strategic goals. This addresses the challenge of knowledge discovery and visualization of big data analytics which includes a disconnect between database systems and analytics tools.

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