Prominence of Big Data in the Digital Transformation Era

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Abstract

This dissertation was written as part of the MSc in Management at the International Hellenic University and explores how big data contributes to the digital transformation of organizations. Most organizations rely on big data for improving the reliability, speed, quality and efficiency of their business processes. Big data is known for collecting, storing and maintaining huge volumes of information, which contributes to the competitive advantage of companies. Lack of holistic analysis on the use of big data for digital transformation is the primary research gap addressed from existing literature studies, which is resolved by examining the strategic advantages, opportunities and challenges of big data as businesses digitally transform their infrastructure. Through systematic literature review and multiple case study approach involving Amazon, Facebook, Google and Wells Fargo, this research contributes to a greater understanding of the overall concept of big data. The findings of this study demonstrate how firms implement collaborative strategies for leveraging the opportunities offered by big data analytics, especially for decision making, information synthesis, profitability and market expansion among others. Furthermore, this study also recommends the use of long-term planning strategies and business intelligence practices for ensuring data privacy.

Keywords: big data, digital transformation, importance of big data, impact of big data

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Contents

List of Abbreviations

CSM   Customer Relationship Management

ERP   Enterprise Resource Planning

GPS   Global Positioning System

IT   Information Technology

MNC   Multinational Corporation

SCMS   Supply Chain Management Systems

UPS   United Parcel Service

1. Introduction

In recent years, organizations have started embracing information technology (IT) applications for several purposes. Increasing development of new technologies has occurred that provide enormous opportunities for organizations to improve information systems usage and take their businesses to the next level through digitization (Yoo et al. 2010). Despite the existing trend towards business outsourcing, most firms prefer operating their own IT infrastructures for better control, compliance, cost-savings and security. Digital transformation has changed the way organizations work by automating business processes both internally and externally, which has led to the emergence of new products and services. Besides these advantages, digital transformation also tends to change organizational management by revolutionizing enterprises in terms of their reliability, speed, quality and efficiency (Baker 2012).

This phenomenon has led to a new concept coined as big data. Big data facilitates the collection, storage and maintenance of huge volumes of information, which is characterized by its velocity, veracity and variety (De Mauro et al. 2015). This concept has revolutionized the organizational strategies of most businesses by digitally transforming their business operations. Increased transparency and availability of information through big data offers great competitive advantage to companies engrossing digital transformation. Big data is also known for its innovative capabilities in organizations at higher hierarchal levels, which was previously impractical in the absence of this phenomenon (Loebbecke & Picot 2015). From an economic and managerial perspective, big data renders a plethora of organizational benefits in the decision-making process as well as performance.

1.1. Research Gap

Many firms have started making huge investments in big data analytics to explore the potential of this technology; however, most research publications are generic and do not offer industry-specific information as to how companies should transform to avail the maximum benefits offered by these technological innovations (Fischer et al. 2012; George et al. 2014; Wixom et al. 2013).

Big data is a relatively novel concept and various research studies conducted on this subject have primarily emphasized the theoretical aspects of big data, while little attention has been paid to its prominence in the digital transformation era. Despite much hype around this technology, major gaps exist in terms of how big data generates business value, which in turn hinders its strategic and business potential (Wamba et al. 2015b). Most studies have contributed to the understanding of the infrastructure, tools and other resources pertaining to big data; however, they have seldom focused on the role of big data in the digital transformation of organizations (Bughin et al. 2010; Brown et al. 2011; Bennett et al. 2013). Furthermore, since digital transformation requires companies to possess certain skills and resources that are beyond their current capabilities, scant research about these prospects necessitates more understanding of how firms use big data to match the increasing technological standards towards flexible and feasible work environments. Furthermore, no holistic analysis has been carried out to understand this concept in detail. The primary gap persistent in the current context is lack of literature studies that discuss the contributions of big data to organizations in an attempt towards digital transformation (Agarwal & Dhar 2014). Therefore, this research seeks to add more insights to understand the role of big data in the digital transformation of organizations and demonstrate how an under-researched area could be addressed more elaborately.

1.2.   Purpose of the Research

The main purpose of this study is to examine the prominence of big data in the digital transformation era. Although several scholars have investigated the big data concept from a technology perspective, there is limited research in this subject area from a managerial perspective (Waller & Fawcett 2013). Moreover, academicians and practitioners have seldom paid attention to the role of big data in the digital transformation of organizations for accomplishing dynamic business demands (McNeely & Hahm 2014). So, this research intends to discuss the overall concept of big data with a major emphasis on its strategic advantages, opportunities and challenges as businesses digitally transform their infrastructures. Furthermore, since big data is a relatively new domain, this research tends to address the existing gap by recognizing big data as an enabler of digital transformation in organizations. Another important objective of this research is to enable a greater understanding of big data among managers who have already started using big data or seeking to expand their possibilities.

Most importantly, this study aims to present the challenges encountered by companies while dealing with big data, in addition to discussing its advantages and opportunities. Hence, it would be of great help to companies aspiring to implement big data into their organizational practices.

1.3.   Research Questions

The following research questions have been formulated to achieve the purpose stated in the research.

- What is big data and what strategic advantages does it offer?
- What is the role of big data in digitally transforming the organizations?
- How does big data influence the innovative capabilities of organizations?
- How do companies deal with the opportunities and challenges presented by big data?

2. Methodology

This research employs a critical literature review to answer the research questions specified in the previous sections and appraise the current knowledge in the subject area. Systematic literature review methodology has been adopted due to the subjective nature of this research and, therefore, a transparent process is followed to make the review less biased (Kitchenham et al. 2009). The research questions identified above guide this study through precise identification of the topic and relevant sources, including the exclusion criteria. The literature review also aims to offer practical solutions to the aforementioned research question by comprehending meaningful information through the help of empirical evidence (Ramdhani et al. 2014). The validity of this research has been ensured by following the exclusion criteria that limits the selection of journal articles within a particular period. Therefore, relevant journal articles from renowned publications will be reviewed with the primary focus being on literature studies published from 2006 to 2017. The lower limit has been set to 2006, since it was in this year that Davenport (2006) published a major seminar paper on big data, especially its significance and prominence in different fields. This study highlights also essential publications from previous years to understand appropriate definitions and conceptualization related to big data and its role in digital transformation.

Since big data is relatively new, qualitative research methodology would be employed in this research to obtain an overview of the topic. This study will also focus on exploratory research techniques and contribute to a deeper understanding of the subject area. Most importantly, this research will consider secondary resources and comprehend significant terms and theoretical frameworks, depending upon the abstract and introduction sections presented in each journal articles. These sources include press releases, company reports and news publications among others. This study will also examine the current state of research in the subject area, based on the credibility and reliability of the selected articles. Since the nature of the research topic is interdisciplinary, epistemological approach has been followed for the search criteria. Therefore, various keywords, such as "big data", "digital transformation", "importance of big data", "impact of big data" and "big data and digital transformation" have been used for researching appropriate literature sources from renowned databases, such as Google Scholar and Science Direct.

Apart from a literature review, this research also implements the case study approach. According to Thomas (2011), the case study approach plays an important role in examining a particular phenomenon from a qualitative perspective. As stated by Creswell (2013), the case study explores a contemporary case or multiple cases through "detailed, in-depth data collection involving multiple sources of information". It generates knowledge from a real-time context and helps in refining and elaborating on a specific subject. The case study approach is also employed since this research pertains to how and why companies embrace big data in the digital transformation era. Case studies do not analyze a particular case, rather they help in exploring a specific setting for understanding in-depth information (Baxter & Jack 2008). Consequently, this paper intends to analyze four case studies to gain in-depth information about the topic. Four companies have been selected from distinct industries to understand how big data is utilized by each company. These companies include Amazon, Facebook, Google and Wells Fargo. While Amazon belongs to the retail industry, Facebook is a social networking platform, and Google and Wells Fargo are technology and banking companies respectively. Since this study involves more than one case study, it is categorized as multiple case study approach. Furthermore, multiple case studies are more convincing, since they are intensely supported by empirical evidence. This research also applies a qualitative case study approach to obtain a comprehensive overview of these four companies.

3. Literature Review

3.1. Definitions

3.1.1. Big Data

The term "big data" was officially introduced by Roger Magoulasin (2005), which refers to huge volumes of data that cannot be processed and managed by conventional data management practices due to the size and complexities of these data (Ularu et al. 2012). Big data is known for its size, which comprises complex and independent data sets that could not be handled with regular practices, since the data combinations are not only inconsistent but also unpredictable. According to Gandomi and Haider (2015), big data is defined as "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation" (p.138). While volume refers to the size of data sets ranging from terabytes to zettabyte, variety refers to the type of data source, which could be internal or external, such as traditional enterprise information, machine-generated data, web data, social data and sensor data among others (Kwon et al. 2014). On the other hand, velocity refers to the speed at which large amounts of data are refreshed into data streams on a real-time basis. From a management perspective, the capacity of big data is beyond standard database software and requires specialized tools for capturing, storing, analyzing and managing huge volumes of data.

3.1.2. Digital Transformation

Digital transformation refers to the radical use of technology for enhancing organizational performance through technological changes in the organizational infrastructure (Berman 2012). Digital transformation involves distinct aspects of an organization ranging from business models to operational strategies, funding and organizational culture. This concept leads to the creation of an integrated digital organization that can generate innovative products, processes and services with more scope for greater profits and performance. Companies often digitize their businesses to gain competitive advantage in the market through maximum returns, minimal costs, improved business operations and effective strategies (Westerman et al. 2012). Moreover, organizations have started experiencing greater scalability, safety and better quality by creating highly automated business processes through digital transformation.

Since digitization plays an important role in increasing corporate growth and accomplishing technological demands, most firms have invested huge amounts towards digital infrastructure.

Besides implementation of strategic business changes, such as enterprise resource planning (ERP), customer relationship management (CSM) and other relevant technology-related practices, organizations are also seeking digital transformation by enhancing their online presence and promoting mobile customer engagement (Karimi et al. 2009). Especially, three areas have been of significant importance to companies in their effort towards digital transformation. These areas include business models, operational processes and customer experience. Business models focus on augmentation of products and services, restructuring organizational boundaries and redistributing the decision-making process (Matt et al. 2015). Similarly, operational processes emphasize improvements in firm performance through broader communication, knowledge sharing and operational transparency. On the other hand, customer experience intends to expand customer understanding through socially-informed knowledge, digital sales and better customer service. All these elements contribute to the creation of digital capabilities in organizations through IT integration, unified data processing and efficient delivery of solutions.

3.2. Digital Transformation and New Business Models in Management

According to Davenport et al. (2012), big data is an important driver for digital transformation as it enables organizations to showcase their innovative and creative skills by stimulating technological changes in the knowledge domain through the integration of IT infrastructure. Similarly, Cuzzocrea et al. (2011) signified the necessity of big data in storing and accessing large amounts of data in digital format to enable accurate monitoring and performance management with the help of various parameters that could be easily shared across the organization. In a survey conducted by Fitzgerald et al. (2014) among 1,559 executives, over 600 respondents affirmed that they have digitally transformed their businesses by creating new business models that can add value to their existing operations. Big data automates standard business processes as companies utilize their prior technology investments to codify existing knowledge for creating a strong set of business rules and logics.

3.2.1. Use of Big Data in the Retail Industry

Big data has also played an important role in digitizing the retail industry by producing predictive models that enable managers to make optimal decisions in terms of price discounts, sales, marketing and advertising among others. According to La Valle et al. (2011), big data offers immense benefits to the retail industry by automating the analysis of stock utilization and stock replenishment, and minimizing costs, delays and lead times during product delivery. Furthermore, it is responsible for monitoring alternate pricing scenarios to minimize inventories, increase profit margins and offer better budget planning and forecasting. There has been a substantial increase in the use of various applications, such as knowledge sharing tools, blogs and social media platforms for better information sharing, enhanced collaboration and greater expertise (Manyika et al. 2011). Big data has also facilitated the fragmentation of functional silos to improve organization's resource utilization and innovation capabilities.

Companies use big data as an essential medium for digital transformation to find new opportunities for tapping into new profit potentials and developing better revenue streams. For instance, Amazon has recently launched Amazon Web Services to design end-to-end management services that facilitate logistics services, unbundled computing and secure payment systems (Davenport 2006). Big data also creates integrated supply chain management systems (SCMS) as businesses digitize their product designs and implement robust business processes, which include computer-aided algorithms and delivery tracking systems. Shanks et al. (2010) analyzed the impact of big data on SCMS and stated that it enables organizations to forecast demand on the basis of incoming supply, which in turn benefits retail, transportation as well as logistics industries. Davenport (2006) investigated the impact of big data on a major multinational company, Amazon, and signified how the former introduced a unique option termed "search-inside-the-books", to store over 120,000 books. Through this feature, Amazon generates search results that include every single word inside a book rather than the author or title of the book. This feature has been included to replicate the users' reading experiences that are often encountered in brick-and-mortar stores. On the other hand, Manyika et al. (2011) analyzed how Wal-Mart harnesses the potential of big data by creating a warehouse that stores over 2.5 petabytes of information pertaining to inventory, supply and demand.

Furthermore, Ferguson (2012) researched the contribution of big data towards enhanced customer experience as organizations use big data for storing large amounts of customer details, including their purchases and viewing history. For instance, eBay Inc. digitally transformed its business processes through big data, especially data storage systems, which faced severe data replication problems of up to 50-fold through traditional data storage tools (Kiron et al. 2012b). This has in turn helped eBay to identify accurate geospatial information and organize promised deliveries. Similarly, Waller and Fawcett (2013) signified the role of big data in creating on-demand supplier networks that are capable of serving as real-time intermediaries between businesses and suppliers in various aspects, including payments and product deliveries. These data are also used for communicating seamlessly with customers through multiple channels and support tools facilitated through big data. The best example in this context is Wal-Mart, which uses big data in its decision-making process for optimizing the supply chain and achieving higher efficiency (Manyika et al. 2011). This company tracks user data from events and purchases, and shares it among different departments to ensure transparency in the business process. In this way, retail e-commerce organizations use big data to avail the benefits of consumer interactions, and improve customer service and revenues by 15 to 20 percent, which is not possible through traditional business models.

3.2.2. Use of Big Data in Technology, Manufacturing and Banking Industries

In case of technology organizations, such as Microsoft and Dell, big data not only minimizes workload by automating business processes, but also leads to significant improvements in terms of customer satisfaction and retention. For instance, Microsoft uses big data to improve its products and services by conducting controlled experiments and analyzing variability (La Valle et al. 2011). On the other hand, Dell's unique database powered by big data resources can store over 1.5 million customer records related to sales and marketing (Davenport 2006). Investments in new technologies through digital transformation ease the knowledge-sharing process to facilitate business transparency in the real-time. In this context, big data enables the creation of complex systems that segment business processes into separate sectors based on product volumes. Tufekci (2014) examined how big data automates data storage in social media platforms, such as Facebook and Twitter, which generate billions of data every day.

All these examples suggest that big data has significantly penetrated the marketplace and large organizations have already started embracing this concept for automating their business processes through digital transformation. According to a survey conducted by Lee et al. (2013), digital transformation of the manufacturing process through big data minimizes costs by 15 percent, while simultaneously reducing lead times. Therefore, most manufacturing companies, such as General Electric integrate their engineering, manufacturing and research and development (R&D) departments to facilitate concurrent engineering and save the time consumed for marketing their products (Manyika et al. 2011).

Additionally, Fuschi and Tvaronavičienė (2014) investigated several banking institutions that have been successful in developing innovative customer data strategies aimed at increasing the sales efficiency and streamlining the existing business processes for better risk management. For example, Wells Fargo and Bank of America made distinct technical improvements to their existing data architecture to develop common processes and systems that can track real-time customer transactions (Davenport & Harris 2007b). Wells Fargo uses big data analytics for delivering real-time reports, training employees by managing study materials and visualizing financial data for better performance. These banks have generated annual sales of over $1billion through digital transformation, and this is considered as a bold move for better exposure. Moreover, big data helps in selecting investments by evaluating the probability of gains over losses through huge amounts of internal and external data collected from diverse sources. Banks use big data tools to segment their customers on the basis of transactions, repayment status and other relevant parameters, which facilitate the integration and quantification of risk profiles and helps in mitigating risks (Davenport 2012). On the other hand, big data is a major profit driver in the e-commerce sector, as it enables firms to improve their cost and process efficiency. According to Biesdorf et al. (2013), big data leads to higher conversion rates and customer empowerment, as firms improve their decision-making processes through automated systems.

3.2.3. Use of Big Data in Public Institutions

Big data also creates immense value across governmental institutions by improving staff productivity and performance through digital monitoring tools, such as digital scorecards, dashboards and predictive key performance indicators (Kim et al. 2014).

Additionally, big data enables departments to streamline their strategic objectives with the user outcomes and enhance the efficiency of the system. It helps in preventing fraud across government institutions through automated fraud detection mechanisms. These institutions also exploit the potential of big data to perform faster analyzes for the detection of suspicious activities (Joseph & Johnson 2013). It allows firms to store a large amount of customer details, which are of great importance to government agencies. Most importantly, big data leads to process automation through the integration of technological tools and human resources for achieving competitive advantage. It plays a vital role in offering timely and accurate information for identifying crime suspects.

Successful implementation of big data analytics in public institutions also leads to the establishment of innovative management structure required for offering real-time insights to prevent crime, human trafficking, terrorism and other anti-social activities (Hipgrave 2013). Most importantly, big data-driven cities and municipalities are more successful in addressing concerns related to transportation, urbanization and unemployment. Public institutions and organizations also use big data for real-time surveillance, policy proposals and statistical research among others. For example, China uses big data as a key technology for tax payments and verification, which helps to address issues like tax evasion and fake documentation (Zhou et al. 2014). A similar approach is also implemented in the US by the New York Police Department. It uses big data for capturing crime-related data to allocate resources for combating higher crime rate.

4. Business Value of Big Data for Digital Transformation and Financial Gains

4.1. Strategic and Competitive Advantage

One of the primary reasons why companies digitally transform their business processes is to generate business value through the possibilities offered by big data. From the big data perspective, value refers to the creation of economically commendable benefits through the extraction and analysis of big data. Big data offers a plethora of transactional, strategic and informational benefits to organizations by enhancing efficiency, minimizing costs, achieving competitive advantage and improving the decision-making process (McGuire et al. 2012). For instance, managers could use big data for serving consumer needs, exploring new markets, increasing sales volumes and revenues, which in turn generate immense business value for companies. Amazon is one of the best examples in this context, as it has been successful in generating over 30 percent of its sales through big data analytics by recommending products to customers based on their search history and browsing patterns (Bose 2009). Besides adding business value from a financial perspective, big data also aids in achieving customer satisfaction and retention through the automation of business processes.

4.2. Personalization and Product Pricing

Big data facilitates personalization of products and services as customers use multiple channels to connect with their retailers. This in turn helps companies to design specific promotions and content to meet the expectations of consumers. According to La Valle et al. (2011), personalization contributes to a 10 percent increase in the sales volumes and over eight times increase in the return on investment on marketing and advertising. Firms also have the opportunity of segregating loyal customers from new customers through the use of big data so that appropriate promotional strategies could be applied to these customers. Furthermore, identifying customers with the greatest profit potential are more likely to purchase a specific product offering and, therefore, their loyalty could be retained by fixing prices that could yield maximum profits (Davenport et al. 2009).

Big data enables organizations to set dynamic prices depending upon the competition in the marketplace by analyzing competitors' pricing information, product sales and geographical preferences among others, which is not possible through traditional data analysis tools (Sagiroglu & Sinanc 2013). This in turn generates business value for firms as they serve diverse groups of customers.

4.3.   Better Customer Service through Transparency

Alternatively, firms also use big data for providing valuable customer service, proactive maintenance and preventive measures through data that has been acquired from the sensors placed in products. Big data also enhances the visibility of the supply chain by providing real-time data to customers so that they can periodically track their products while the goods are still in transit (Brown et al. 2011). Furthermore, customers can also avail enhanced services as big data systems facilitate the collection of multiple data from multiple channels and subsequently integrate them to provide precise information to customers. Big data also provides predictive analytics service, which refers to the discovery of events even before they occur. Using big data for data-driven marketing enables companies to gain valuable information about consumer preferences and interests, including revenue budget planning, to realize future sales patterns based on past sales (Morey et al. 2015). Organizations also derive business value by solving business problems through the integration of people, technologies and business processes. For instance, United Parcel Service (UPS) has a dedicated division known as the "Customer Intelligence Group", which is responsible for examining customer usage patterns and grievances to predict and resolve consumer defections (Russom 2011).

5. Case Studies

Big data might be a new concept for start-up companies; however, it already exists in major multinational companies. This section will analyze the impact of big data on renowned multinational companies, such as Amazon, Facebook, Google and Wells Fargo, to understand how it impacts their overall business performance in the digital transformation era.

5.1. Amazon

5.1.1. Overview of the Company

Amazon was founded by Jeffrey Bezos in 1994 when the Internet was being considered as one of the potential media for businesses. Initially Amazon was established as a retail brick-and-mortar store and gradually expanded to the online platform as Bezos started selling books through the online medium. Since standard brick-and-mortar stores could not simultaneously store over 200,000 book titles, Bezos decided to build an online empire that stores thousands of book volumes. In the initial years after going online, Amazon faced competition from Barnes & Noble, Inc., although it did not have significant online presence, it captured over 10 percent of the market share. Therefore, Amazon availed this first mover advantage to operate its business through the digital medium and prioritized customer loyalty for increasing sales and penetrating deep into the marketplace. Within a month, Amazon was able to serve the entire United States and 45 world countries, while still functioning from a garage. This company gained wide popularity through word-of-mouth as customers recommended Amazon to their friends and family.

5.1.2. Amazon's Use of Big Data

Being a leading online retailer, Amazon utilizes big data for enhancing its business performance and better serving customers. This company created a large database to store customers' preferences, purchase history and browsing information (Chen et al. 2012). Through using big data resources, Amazon recommends relevant products to its customers and aims at improving customer service quality. This organization develops specific customer profiles through big data tools and has succeeded in personalizing marketing content.

Besides business performance, Amazon also uses big data for preventing theft and duplicate book volumes. Most importantly, this company collaborates with several small e-commerce enterprises to use its big data services and launched the Amazon Webstore in 2010 with the main motive of building shopping websites for small companies (Chen et al. 2014). The technology offered by big data also facilitates Amazon to store huge volumes of data at cheaper costs (Chen et al. 2012). Furthermore, this company collects data from customers' profiles, interactions and preferences, and uses it for market segmentation as well as improving and customizing services.

Amazon has realized the significance of big data since the early years and started harnessing its potential to the core. It leveraged big data tools for upgrading its CRM system and establishing long-term customer relationships through frequent promotions and product suggestions (Bryant et al. 2008). Analyzing customers' data through big data techniques also helps Amazon to impress first-time buyers depending upon their needs and preferences. From a customer perspective, Amazon achieved quality customer care services by providing quick solutions to customers' queries and grievances. Over the years, this company started relying immensely on big data to create an invaluable database of user data, which could be used for revolutionizing business processes and performance (Bughin et al. 2010). Besides that, it uses big data for formulating its marketing strategies, such as cross-selling and up-selling to offer highly-customized product recommendations. Big data has enabled Amazon to handle customer interactions from multiple channels. Amazon teamed up with major technology and mobile companies to host their products and launched a product review system that allows customers to rate the purchased products. This mechanism helped Amazon to build a sophisticated customer community through which customers can make their product purchasing decisions based on reviews and ratings provided by other customers (Demirkan & Delen 2013). Through the integration of structured and unstructured data, this company dramatically reduced its marketing costs and the time consumed for motivating customers to make buying decisions. Structured data refers to information that has a defined format and length, and well-organised for easy access and interpretation, such as text files, dates, numbers and groups of words. Unstructured data refers to information with no identifiable structure, such as emails, audio and video files, digital images, social media posts and word processing files among others. Interacting with customers in the real-time also contributed to better customer experiences and placed Amazon at the top of other retail companies.

Furthermore, Amazon created unique programs that use big data for new product development based on customers' suggestions and improvements (Sagiroglu & Sinanc 2013). From an internal perspective, Amazon uses big data for making internal business decisions in core areas, such as product pricing, inventory, supply chain and risk management among others.

Through big data, Amazon analyzes technical and financial capabilities of suppliers, including their market reputation, reliability and quality management. This technology has motivated Amazon to transform its traditional hardware solutions with packaged solutions and new business intelligence tools to drive business innovation (Gandomi & Haider 2015). Amazon also utilizes big data for introducing specialized features into its website, which make this organization diverse from other e-commerce retailers. Amazon has recently obtained patent for predictive dispatching, a service that predicts the purchasing behaviour of customers before they have even decided to buy a particular product (Katal et al. 2013). This service is based on the tools offered by big data analytics, which help to forecast the futuristic behaviour of a particular event on the basis of previous transaction patterns.

5.2. Facebook

5.2.1. Company Overview

Facebook is one of the largest social networking platforms. It was founded by Mark Zuckerberg in 2004 and has a user base of 1.25 billion and total revenue of $27.6 billion. Headquartered at California in the United States, Facebook allows users to interact with each other by creating profiles, publishing posts and videos and creating groups among others. Through its instant messaging service, Facebook also enables users to make video and voice calls in addition to chatting with other users. This platform also facilitates subscriptions, games and financial transactions among others. Since its inception, Facebook has been in the news for its profound use of big data. With the primary aim of connecting people, Facebook relies on sophisticated algorithms, such as Edge Rank, and offers newsfeed to its users based on their interests and suggestions. This platform is considered by most organizations as an asset, since it facilitates marketing with minimal cost and efforts. Due to low entry barriers and higher scalability, Facebook is a preferred destination for most online and offline companies, which has been possible through efficient use of big data techniques.

5.2.2. Facebook's Use of Big Data

Facebook has a large repository of user data, which is primarily obtained from customers' profiles, interests, chat conversations and postings. This data is consolidated and used by Facebook to advertise products and services to users. Although Facebook does not sell data to other companies, it uses this data for monetizing its business through marketing campaigns and events (Walker 2014). Companies pay huge premiums to get their products advertised on this platform, which is relatively cheaper in comparison to direct marketing. Facebook formulates specialized algorithms through active monitoring and uses data strategies for predicting users' buying behaviour (Davenport et al. 2012).

Furthermore, this company uses big data for personal quantification in the sense that it uses user-generated data to optimize its business processes and performance of data warehouse. Big data is also utilized by Facebook from a security perspective to prevent cyber-attacks and fraudulent activities. In this way, companies gain more trust to advertise their products through Facebook platform (He et al. 2011). This company employs big data for managing huge amount of structured data through a sophisticated distributed storage system known as Cassandra. Facebook also relies on big data to optimize user communication within its established social boundaries, since data collection is the primary basis of its business model. This company offers a simple user interface in combination with user privacy, which motivates businesses to build up their time and efforts, as they convey important marketing content to targeted users (Smith et al. 2012).

When compared to other social media platforms, Facebook's use of big data is distinguished in terms of its direct approach. This social media platform has a dedicated data science team that regularly analyzes user data with the help of big data resources and identifies potential users based on their communication patterns and browsing patterns. These patterns are in turn used for suggesting Facebook pages, which is an innovative marketing feature used by most companies advertising on Facebook to advertise their products and services (Chen et al. 2014). This platform not only generates significant ad revenues through the use of big data tools, but also uses geo-tagging feature to distinguish users geographically. It is also known for using several big data analytics applications, such as Scuba, Prism, Peregine and Hive. Each application is different and plays an important role in helping Facebook analyze large chunks of data.

This social media platform also uses big data resources for monitoring user preferences and actions on their profiles, such as "status update" and number of "likes" to determine relevant ad postings and earn higher revenues (Cukier & Mayer-Schoenberger 2013).

Further, Facebook uses big data to track cookies when users are simultaneously browsing other websites while on Facebook (Wu et al. 2014). One of the latest developments of big data being utilized by Facebook is facial recognition feature. This platform tracks users' images across the Internet through its image processing capabilities, which has all been possible through the resources offered by big data. Facebook also uses big data tools to analyze data and predict users' attributes, which could be employed for marketing and advertising purposes (Chen et al. 2012). Through the use of open-source big data analytics tools, this organization designs its personal hardware solutions at relatively cheap costs. Facebook has recently introduced a new feature known as topic data to display user responses to marketers in terms of events and activities, while simultaneously keeping their sensitive information private (Cukier & Mayer-Schoenberger 2013). This data is facilitated by big data resources and marketers use it to transform their marketing patterns and activities if they find that a potential user is not satisfied with their marketing efforts. While this information was previously served by third-parties, Facebook has integrated users' personal information to offer a comprehensive overview of the target audience to businesses (Boyd & Crawford 2012).

Additionally, Facebook has launched the "I voted" feature that actively engages users during elections and election campaigns. This feature primarily uses big data tools to motivate users to vote for their desired candidates in addition to suggesting reminders and directions to users' polling booths.

5.3. Google

5.3.1. Overview of the Company

Google was founded by Larry Page and Sergey Brin in 1998 as a search engine and it is currently a subsidiary of the parent company, Alphabet Inc. Headquartered in California, this American company handles over 75 percent of the global search requests. Within a few years, Google has ventured into a plethora of products, and services, including email, online documentation, tablets and mobile phones among others.

Some of the renowned services offered by Google include, YouTube, Gmail, Google Books, Google Maps, Google Chrome, Android Operating System, cloud computing and Google+ among others. This company has an employee base of 74,000 and total revenue of $89.46 billion, which places it among the four largest technology companies.

This company is also known for its innovative products, such as the Google self-driving car and Google smart glass, which are based on big data analytics tools. Through its pioneering technologies, Google is considered as one of the major players in the usage of big data and has recently launched several applications that are capable of transforming the entire landscape of big data.

5.3.2. Google's Use of Big Data

Google has developed several tools and applications that run through big data analytics and, therefore, it has been successful in examining several petabytes of data to answer customers' queries in milliseconds. Through its famous applications, Map Reduce and BigQuery, Google has attempted to manipulate and manage big data on a large scale. It plays an important role in ad-hoc reporting, data segmentation, dashboard monitoring, regional advertising and interactive analysis of large datasets among others (Walker 2014). Unlike other search engines that match search queries with relevant keywords in the database, Google has shifted its attention from keyword-based search to semantics-based search to establish a connection between different objects in the search query (Lazer et al. 2014). Whether it is language database, sports statistics, weather report or financial data, this company uses big data to generate accurate results. Google collects data by monitoring real-time user interactions and analyzes it through big data tools for better decision making and improved services. Google's search engine uses big data for improving its type corrector through the addition of new words from user-generated content and correcting the type errors by presenting the right webpage even through users misspell their search keywords (Davenport et al. 2012).

Google is currently designing its most ambitious project known as the self-driving car, which uses big data for analyzing massive amount of data obtained from GPS devices, sensors, tracking devices and cameras. It is integrated with real-time data obtained from other applications, such as Google Maps and Street View to ensure that the car is capable of driving safely on the road in the absence of human input (Boyd & Crawford 2012).

Google also uses big data in the human resources area for systematic improvement of employees' performance and leadership through its big data analytics tool known as People Operations. Furthermore, this company employs big data tools for understanding customers' preferences for its AdSense programme. Through the analysis of customers' browser logs, Google has succeeded in creating predictive models that can predict customers' behaviour and interests (Agarwal & Dhar 2014). It has also been successful in optimizing its core business area through big data, especially in terms of stock prediction, talent acquisition, research improvisation and privacy protection. Google has incorporated big data tools in its Dremel application, which is responsible for executing ad-hoc queries in the real-time from different search engines (Dobre & Xhafa 2014).

Google's use of big data infrastructure also extends to delivering business insights to large companies at minimal up-front investments in complex software solutions and servers. Through user-familiar interfaces, Google has been able to provide a wide range of applications that primarily run on the tools provided by big data analytics (Cui et al. 2014). Due to high availability of data sets, this company guarantees multi-layered security at all levels and helps in exporting data at ease. Furthermore, it ensures greater transparency and control through optimal usage of big data tools at lower costs. Google's extensive use of big data solutions is highly visible in its Google Mail service, which requires the integration of structured and unstructured data through flexible partitioning for seamless accessibility (Padhy 2013). This organization also implements big data resources into its cloud platform that offers a plethora of services, such as storage, networking, security, computing and machine learning. Google's services support geographical replication through big data analytics so that customers are aware of their data storage location (Davenport & Dyché 2013). Moreover, this company uses big data analytics for improving the scalability, flexibility and accessibility of its services and gain competitive advantage among other companies.

5.4. Wells Fargo

5.4.1. Overview of the Company

Wells Fargo is an American multinational banking institution based in California, US. It is the second largest bank in the country with total revenue of $88.26 billion and total assets worth $1.9 trillion. Founded in 1865 by Henry Wells and William Fargo, this banking institution also offers a wide range of financial services, including consumer lending, student loans, equipment lending, securities, cross-selling and wholesale banking among others. This company also provides other financial services such as, mortgage banking, agricultural finance, investment banking, brokerage services, data processing services and capital investments among others. Wells Fargo has always been in the limelight for providing customer satisfaction due to its diversified services. This company digitized its business operations to accomplish customers' changing needs and stay ahead of fin-tech startup companies that have been gaining significance in recent years. Wells Fargo also uses biometric tools to ensure utmost security of customers' financial transactions. This bank has also collaborated with technology companies to offer personalized financial services to customers through artificial intelligence-enabled systems.

5.4.2. Wells Fargo's Use of Big Data

Wells Fargo uses big data analytics for storing customer details and revealing their real identities. In recent years, this bank made huge investments in big data analytics to simplify customers' lives, improve customer experience, minimize financial risks and ensure compliance with governmental regulations and Wells Fargo's privacy policies (Davenport & Dyché 2013). Through big data analytics and other software tools offered by big data, Wells Fargo gained a 360-degree view of its customers by matching customers' banking data, such as credit card purchases, investments, loans and repayment patterns to understand their behavioural patterns (Bennett 2013). This institution also uses technology to integrate different sets of data to calculate the value of customers with utmost accuracy. This is accomplished by storing and analyzing structured and unstructured data with special ID numbers. Wells Fargo uses big data tools to segment its customers based on their future income to allocate its financial resources efficiently.

This bank also integrates operational data with financial transactions to ensure agile management and obtain a holistic overview of customers (Davenport 2014). By matching consumers' spending data with their income patterns, Wells Fargo targets customers with relevant offerings. On the other hand, customers also show significant buying interest in the promotional offers and refer their bank to friends and family.

A dedicated data analytics team at Wells Fargo integrates 32 data sets belonging to internal and external resources to customize customers' dashboard and simplify the analysis task for managers. In contrast, managers also use big data tools for better decision-making and ad-hoc meetings, including self-service through data visualization tools (Kiron et al. 2013). The big data tools implemented by Wells Fargo are integrated with business intelligence packages offered by Tableau. This bank has been successful in serving its client base through digital transformation and grab unexpected opportunities. Wells Fargo also qualifies credit requests through big data tools, since most banks often deny credit offerings to credible customers due to improper data analysis (Demirkan et al. 2015). Wells Fargo also reassesses customers' risk profiles through big data resources, which has led to an increase in loan qualifications in recent years. Most importantly, there has been significant increase in Wells Fargo's revenue, especially in the mortgage sector, as it has predicted whether a client is willing to purchase new home based on his searching patterns on Wells Fargo's website (Bennett 2013). This in turn helps Wells Fargo to prevent sales pitch when a customer has filed his grievance. Agents are also increasingly using big data tools to gain better leads and improve future business prospects.

Through real-time data analysis, Wells Fargo has become a major game-changer in the banking sector. Amidst competitive trends from other banks, the emergence of Wells Fargo's digital wallet replaced the credit card clutter with smart phone technology. Predictive findings from data analytics tools play an important role in suggesting targeted recommendations (Fang & Zhang 2016). Wells Fargo's big data tools integrate wide variety of data, including website clicks, bankers' notes, customer transactions and voice recordings among others to understand attrition rate and enhance quality of customer service. This bank has been using propensity models to analyze whether a customer could approach competitor banks for refinancing. In such cases, Wells Fargo designs special offerings for identified customers through its branches and call centers (Davenport 2014). This bank also integrated several sales channels through big data tools to generate better revenues. In this way, customers failing to sign up through their online application could be followed up through personalized emails or appointment with sales representatives.

Wells Fargo has also modified it existing organization to make effective use of big data (Kudyba 2014). Although this bank has employed thousands of quantitative analysts, it utilizes big data tools to consolidate and reconcile the financial reports with specific business units, which can be directed to the centralized data analytics team.

6. Discussion

Based on the above case studies, it is evident that multinational firms are major drivers in conceptualizing big data from a management perspective. These firms have played an increasingly important role in taking big data analytics to the next level. However, the effective use of big data analytics is primarily dependent on the availability of abundant data and accessibility to appropriate resources. The four case studies discussed above involve retail, social media, technology and banking organizations in which customer data is available in abundance. Furthermore, these firms are multinational corporations (MNCs) with efficient data analysis tools and infrastructure that can interpret the information. In the retail industry, firms have significant access to meaningful information, such as customer data, which could be analyzed through big data tools to leverage increasing demand (Bose 2009). The case studies also suggest how big firms are using collaborative strategies for leveraging the opportunities offered by big data analytics. They have also been able to take important decisions through the futuristic insights offered by big data tools.

It is important to understand the role of corporate culture in encouraging firms to implement big data into their business processes (Katal et al. 2013). Firms with an open culture are keener to evaluate and implement big data into their business processes, especially when their business is dependent on multiple actors. This case is true for all the four companies discussed in the case study analysis. Firms are also showing increasing interest in capitalizing on the opportunities offered by big data analytics through information synthesis (Cui et al. 2014). Irrespective of the industry type, many organizations base their decisions on big data sources with organizational growth as their chief agenda. Firms have started embracing big data for creating new products, expanding their current markets, driving profitability and improving revenues. In the above case study, it is observed that Google creates new products through big data technology for increasing its revenues and penetrating the global market (Dobre & Xhafa 2014). Similarly, Amazon uses big data tools for driving profitability and increasing revenues in its retail business (Chen et al. 2014). On the other hand, Wells Fargo has started embracing big data tools for expanding its current business operations in various markets, while Facebook is using this technology for improving its revenues and driving profits.

Big data offers greater insights for improving the decision-making process, since the data analyzed through big data analytics tools is accurate and reliable (Davenport 2014). Based on these case studies, it is evident that Amazon is making greater use of sophisticated analytical tools and practices for optimizing its channels of product distribution, fixing right prices to drive customer satisfaction and increase share value (Chen et al. 2013). This company has also leveraged big data capabilities for minimizing fraud and making product recommendations. Similarly, Wells Fargo has analyzed large datasets from new sources without any availability and confirmation bias, which has in turn helped to make strategic decisions even in an uncertain economic environment (Davenport & Dyché 2013). It has also contributed to value creation in this banking firm. This is one of the reasons that this company was not impacted much by the economic crisis in the past decade. In contrast, Facebook uses big data analytics for achieving competitive advantage in the social media platform as it is an important tool for analyzing and managing large volumes of data obtained from users' conversations (Cukier & Mayer-Schoenberger 2013).

Big data has contributed to Amazon's quick entry into new markets when compared to its competitors and led to tremendous increase in its market share (Sagiroglu & Sinanc 2013). The same is also true for Wells Fargo, which incurred higher returns on investments and overall financial growth through big data resources (Bennett 2013). However, it important to note that both these companies have made huge investments in big data analytics infrastructure and, therefore, it cannot be generalized whether the same could be true for smaller firms with less financial resources and technical capabilities. In most financial institutions, no coherent sharing of data exists between different business lines, which prevent them from obtaining a comprehensive view of customers with respect to the current market trends (Bennett 2013). However, Wells Fargo has been able to grab this opportunity through big data and exploited new knowledge for better customer experience (Davenport & Dyché 2013). Most importantly, since big data environment is an integration of people, technology and management, the firms discussed in the case studies have been able to formulate optimized business models for better performance.

In case of technology companies, big data helps to accomplish complex projects in time within the specified budget and according to pre-defined plans. Furthermore, such companies are also able to achieve the desired change a given project or business project to help employees generate new business insights in innovative business contexts (Davenport et al. 2012). The four organizations discussed in the case studies managed to foster a cooperative culture satiated with transparency and information exchange to reap the benefits of big data analytics. This is especially true in case of financial institutions like Wells Fargo. Big data helps Wells Fargo to integrate huge volumes of data related to customers' bank accounts, property ownership, loans, tax payments and other financial transactions to scrutinize fraudulent accounts (Kiron et al. 2013). This is also similar in retail companies like Amazon, which use big data for detecting redundant orders, fraudulent payments and incorrect product returns (Sagiroglu & Sinanc 2013). Google also uses this technology to maintain transparency in its email services and prevent possible security breaches.

The Wells Fargo case study signifies how banking institutions use data-driven approaches for extracting innovative insights from existing as well as new data sources for supporting business opportunities (Davenport & Dyché 2013). Some financial institutions implement big data strategies for identifying business requirements, leveraging existing data infrastructure and analytics. It is also evident from the case study that banking industry involved huge amount of structured and unstructured data, which should be analyzed effectively by financial advisors, investment bankers, loan accountants and other front-end bankers to make better decisions, while simultaneously maintaining compliance (Bennett 2013). Based on the case study of Facebook, it is evident that social media platforms embrace big data for analyzing huge volumes of statistical data, such as audience distribution, user interactions, impressions per post, tweets and retweets, URL embedment and transactional history among other information (Walker 2014). This information also assists social networks to measure the effectiveness of social media strategies and promote their brand loyalty and recognition.

7. Challenges Encountered by Organizations Using Big Data

Big data plays a crucial role in leading organizations towards digital transformation. It involves several challenges as companies transform their organizational structure, processes and policies to adapt themselves to the opportunities provided by big data. According to Labrinidis and Jagadish (2012), while the primary objective of big data is to allow users to handle huge volumes and variety of information at a greater velocity, organizations fail to react to the increasing inflow of information in a given time. Big data also creates challenges regarding storage and scalability, since companies should process large chunks of data that arrives faster than the processing capabilities (Tole 2013). This in turn causes concerns in terms of developing sophisticated data processing systems for accommodating present as well as future data storage needs. Companies using big data for digital transformation also encounter difficulties in representing heterogeneous data, such as images, videos and social media posts, which are not only unstructured, but also complex to store and process using traditional database tools (Ammu & Irfanuddin 2013.).

Another significant concern that challenges businesses is data privacy and security. Big data could be easily stored and accessed through "cloud computing devices", which refer to a type of Internet-based computing technology that uses servers and applications for storing and accessing information in a virtual location. However, there is potential threat in terms of data privacy since sensitive information, such as call details, credit card details and confidential information may increase privacy concerns for both companies and customers (Tene & Polonetsky 2011.). Handling a multiplicity of data formats from different types of sources is also another crucial challenge confronted by companies embracing big data. Big data requires diverse system architecture with technological advancements, which necessitates huge investments, which not only arise from the system setup, but also the time required for loading large volumes of data into the system (Hashem et al. 2015). Unless automated, big data analysis incurs more time, in addition to several data analysts and interpreters to segregate structured and unstructured data into meaningful information. Ethical issues arising from storing and analyzing users' personal data is also considered to be one of the major challenges confronted by companies adopting big data resources in their organizational tasks (Slade & Prinsloo 2013).

Most organizations often find difficulties in using big data due to inadequate staff, insufficient infrastructure and inability to adapt to this technology. In some cases, lack of governance and investments also prevent companies from digitally transforming their organizations through big data (Morabito 2015). Lack of governance impacts the quality, integrity and completeness of big data, which poses a significant threat to organizations. Most importantly, organizations often withdraw their efforts towards digitization due to the incompetence in terms of scalability, usability and integration of big data into core business processes. On the other hand, aligning big data analytical tools to organizational tasks for accomplishing business goals seems to be a common concern for most companies (Sagiroglu & Sinanc 2013). This is because organizations may not be able to completely transform their business cases to maintain compatibility to big data tools. Although big data poses several challenges, its benefits outweigh these challenges and present organizations with superior business performance.

8. Recommended Strategies for Efficient Management of Big Data

Efficient management of big data requires implementation of distinct technology approaches. Instead of discarding classic data management practices, organizations should primarily decide whether these resources could be effectively integrated into big data tools or require new infrastructure (La Valle et al. 2011). Organizations implemented a well-planned strategy are often successful in reaping the benefits of big data, while those failing to abide by a committed strategy face failures and costs due to their inefficiency. Therefore, businesses should invest their time and efforts in the ownership of big data platforms, since it is one of the greatest sources of an organization's performance management. Long-term planning is primarily important for successful implementation of big data, since this technology requires physical architecture and logical designs that should be incorporated into core business processes (Boyd & Crawford 2012). Rather than implementing big data as a separate entity, businesses should use coexistence strategies for creating roadmaps between traditional and newer big data platforms. Another possible recommendation to minimize costs arising from using big data is partnership with third-party providers, which in turn helps to direct focus towards core business competences to extract business value from large volumes of data (Kambatla et al. 2014). This process should start with formulating big data strategies with major emphasis on customer centricity to offer better services and achieve maximum customer retention.

Additionally, companies should guarantee transparency while using big data and embed innovation into the existing data sets for creating a greater impact. Since big data can revolutionize the entire business setting, the top management should support big data projects with standard business intelligence practices to ensure data privacy and prevent uncertainties arising from data insecurity (Ghazal et al. 2013). Furthermore, organizations should anticipate business growth and increase their capabilities of capturing, storing, and analyzing big data in the real time. This is possible only when they are ready and adaptable to different formats of data. Efficient management of big data also requires well-trained staff with significant expertise in real-time data monitoring, advanced data analytics and data management on multiple platforms (Davenport 2014).

Most importantly, big data strategy should be extended to the entire organization rather than a particular department, which is possible by developing a clear roadmap with appropriate business requirements.

The tools and techniques offered by big data analytics should be used for problem solving rather than technology deployment (Morabito 2015). Improving business value from big data extends beyond analytical tools and requires an environment in which people can utilize data for their own knowledge for improving its strategic and operational performance.

9.   Conclusion and Implications for Future Research

To conclude, this study has contributed to a greater understanding of the prominence of big data in the digital transformation era. It has added several insights to the existing literature and described the importance of big data from a management perspective. The organizations discussed in the case study have been reaping the benefits of big data in terms of managerial control, decision making, process improvements and customer satisfaction. However, there is still major lacking in terms of technology and resources in many companies, which proves to be a considerable challenge. Both literature and case studies analyzed in this research suggest that the strategic advantage of big data resources could be achieved only through well-formulated business strategies aimed at long-term rather than immediately. This study has also addressed the technological challenges faced by companies using big data, such as data security and customers' privacy. Even so, these challenges seem to be a minor issue if organizations implement effective infrastructure and skilled personnel for effective use of big data tools and resources. Based on the case studies, it can also be concluded that it is not easy to achieve the advantages offered by big data unless companies transform their business structures and corporate cultures to foster innovation.

Altogether, this research has attempted to reflect the significance of big data in digitally transformation and illustrated its distinctive characteristics through the help of case studies. Future research should focus on understanding the extent to which organizations can tackle forthcoming developments in big data. Since each organization is different in various aspects, future studies should also analyze representative samples to evaluate the actual impact of big data on organizations' business metrics. The social and ethical implications of big data on organizations should also be analyzed in detail to ease its implementation and balance the interests of customers as well as companies. Furthermore, businesses using big data are often confronted with information overload and, therefore, researchers should develop new tools that are capable of overcoming this challenge. Capitalization benefits of big data and its use for creating business value in organizations should also be investigated in further research. Most importantly, researchers should develop appropriate guidelines for mitigating the challenges presented by big data in various industries in terms of governance, data costs and security among others.

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