

Full Length Research Paper

Using big data in telecommunication companies: A case study

Sajjad Rehman* and Dhary Al-Raqom

Department of Information Studies, Faculty of Social Sciences, Kuwait University, Kuwait.

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The study was aimed at examining big data management in three telecommunication companies. The case of Big Data management was studied using a qualitative research approach with the primary method of open-ended interview. Websites and documents were examined for developing company profile. Observations augmented data collection from other sources. Companies have widespread operations with substantial stakes. Big Data was managed by using diverse systems such as Cloudera Data Hub (CDH) and SaaS. For data security, these companies made different arrangements. Three companies used big data systems for diverse functions and applications. These companies needed to develop competent professionals for data management, security, and other applications. It was a study of its own kind conducted in this context. Companies in different sectors may benefit from these findings and suggestions. This study may have wider implications for regional organizations. These are credible findings for these companies in managing big data. Other companies may also benefit from these findings.

Key words: Big data, telecommunication companies, data security, big data management.

INTRODUCTION

Telecommunication companies need to deal with Big Data. Big Data is a combination of structured and unstructured data that need advanced statistical and instructional methods. "Big Data combines information from diverse sources to create knowledge, make better predictions and tailor services" (Martin, 2015: 11).

Big Data must be secured by setting policies and regulations. There is a relationship between Big Data and privacy and security issues including collection, storing, sharing and accessibility (Kshetri, 2014). The challenge of preventing advanced threats must be solved using Big Data analysis. Both data security and data privacy are needed for telecommunication companies and

organizations. Telecommunication companies are struggling with privacy issues because of the increase in security and privacy issues (Inukollu et al., 2014). Big Data security saves organizational data from being misused and stolen by hackers or competitors. Most companies use security policies to protect their Big Data analyses.

In terms of Big Data in telecommunication companies, Khan et al. (2018) showed that in Big Data Telecom Sector, about 40% of the world population, has an internet connection. The number of Internet users has increased tremendously from 0.4 billion in 2000 to 3.4 billion in 2016. Mary Meeker's annual internet trend

*Corresponding author. E-mail: rehman05@gmail.com.

report in 2016 showed that China has the biggest internet population, followed by India and the USA. Big Data in telecommunication companies require data governance which is considered of special importance.

The primary aim of this study is to examine how telecommunication companies manage Big Data since it includes personal and sensitive information for clients. Various ways and measures are used to ensure Big Data is managed and secured inside and outside telecommunication companies in Kuwait. It would cover access, control, data codes, and data segregation (Chen et al., 2014). In addition to policies and safeguards, the security rules also contain several standards and implementation specifications that address organizational requirements. It is required to protect electronic systems' equipment and data from threats, environmental hazards and unauthorized intrusion. They include restricting access to organizations' servers, computers, and information and retaining off-site computer backups.

Problem statement

There is a need to examine the use of Big Data in telecommunication companies in Kuwait. Also, it is needed to study how telecommunication companies deal with Big Data and implement it in addition to security and privacy issues. It is needed to know how policies and regulations help in protecting Big Data in telecommunication companies. Besides, there is a need to investigate how Big Data is used for providing the required information in the telecommunication sector to overcome the challenges faced in implementing Big Data. This study may increase awareness among stakeholders and may build positive perceptions toward using Big Data in the telecommunication sector. Besides, the study may clarify the privacy and security issues of using Big Data.

Research questions

According to the objective of the research, we have formulated the following research questions:

- (i) What were policies, processes, and regulations Kuwaiti telecommunication companies use to implement and manage Big Data?
- (ii) What were the challenges Kuwait telecommunication companies face in implementing Big Data?
- (iii) What were the skills the staff need to have to manage and implement Big Data?
- (iv) What were the strategies and processes Kuwaiti telecommunication companies need to deal with Big Data issues of security and privacy?

Literature review

Here we examined how other studies viewed the issues

being addressed in this study. It explains divergent viewpoints on related issues of managing Big Data in organizations. Relevant concepts and applications, reviewed in various studies, are covered subsequently.

Big Data: Conceptual framework

There are many aspects of Big Data. Géczy (2014) posits that complex systems can generate a huge amount of serviceable data. The data reflects various operational aspects such as the functionality of systems, interactivity of humans with environments and digital devices. Data also reflect internal and external stimuli from sensors. Crawford and Schultz (2014) assert that the big reliance on existing data and analysis created detailed individual profiles. Big Data exploded the scope of personally identifiable information ("PII"), which is effectively marginalized schema by avoiding current privacy protections. Furthermore, poor execution of Big Data may create additional harm by inaccurate profiles that impact an individual's life. One of the Big Data features is the "Bought" feature. It prompts users to buy additional items that are selected by a collaborative filtering tool (Tene and Polonetsky, 2011).

Big Data needs many requirements for infrastructure. Martin (2015) contends that "Big Data combines information from diverse sources in new ways to create knowledge make better predictions or tailor services" (p. 72). Big Data requires special technology such as computers and servers where data can be stored and analyzed. Big Data has a great impact on the future of the organization's development. Furthermore, governments serve their citizens better, hospitals are safer, and firms become more systematic.

Implementation of Big Data

According to Martin (2015), Big Data is a combination of huge and complex data with advanced analytics to improve security and marketing and reduces risks. The implementation of Big Data is valuable and useful in the business sector. Frizzo-Barker et al. (2016) noted that there are several key insights into the investigation of Big Data. In terms of the theoretical foundation, Big Data remains the early-stage domain of research. The rise of Big Data starts up as a socio-technical phenomenon. Large-scale search data help business organizations to create better tools, services, and products (Boyd and Crawford, 2012). On the other hand, Géczy (2014) states that the technological explosion produced data presenting various challenges and opportunities. Big Data provides opportunities to explore new scientific domains. However, Big Data also highlights challenges ranging from acquisition and technological issues through processing and maintenance to business and social consequences.

Phases in implementation of Big Data

Big Data has many implementation phases to achieve the desired goals for a business organization. Chen et al. (2014) focused on the four phases of the value chain of Big Data: data generation, data acquisition, data storage, and data analysis. Data generation means generating data to get something new. This phrase shows up the creativity and innovation of Big Data. Data acquisition refers to collecting data from articles, databases or other sources. Data storage refers to saving and storing it in storage for retrieving data whenever it is needed (Gamage, 2016). For each phase, there are several steps since it is a systematic way to deal with data. Each phase has a background, technical challenges, advantages, and disadvantages. Finally, it is important to examine several representative applications of Big Data, including enterprise management, Internet of Things, online social networks, medial applications, collective intelligence, and smart grid.

The features of Big Data made all sectors active in implementing Big Data. Géczy (2014) noted that the quantity of generated and stored data and the size of the data determine the value of Big Data implementation. Velocity is the speed at which the data are generated and processed to meet the demands and challenges that lie in the path of growth and development. Variability helps to handle and manage data. Veracity is the quality of captured data that also affects the analysis of Big Data. This helps people to analyze data effectively. Kshetri (2014) viewed benefits associated with implementing Big Data might be privacy, security and consumer welfare. So Big Data is not easy to be used in the business sector.

Ouyang et al. (2018) pointed out measures of network structure, determined by the network itself. The network is affected by an individual's social interactions and individual characteristics. Data quality depends on Customer Relationship Management (CRM) in a telecommunications company. The strategy of data management requires the implementation of a CRM system to avoid poor customer data quality. Also, integrating data quality and data architecture management is based on findings from the telecommunications industry. A clear example of developing data currency metrics was reported at German mobile phone providers where they provided a means of economic impact estimation of measures to improve data currency (Otto, 2011). Telecommunication companies are marked by high IT spending, Big Data volumes, legal and regulatory requirements related to security and privacy of customer data. Further, it depends on intensive consumer interaction and complex application systems.

Implementing Big Data in different sectors

Joseph and Johnson (2013) noted that government

agencies, such as the US Department of Veterans can extract and analyze Big Data to more efficient and effective delivery services. Using Big Data in the public sector helps to achieve desired goals and exploit knowledge effectively. Desouza and Jacob (2014) noted that the role of Big Data in the public sector shows the limits of Big Data in the public sector need huge space and storage. Big Data needs regular updates due to continuous changes in the business and economic sector. For that reason, most organizations conduct workshops and training courses about using Big Data effectively in the public sector. Organizations implement Big Data to achieve business goals and objectives.

Challenges in Big Data implementation

Big Data, also known as "data analytics," is criticized as a breach of privacy and distorting the power relationship. Hence, most organizations generate large and complex data using new predictions and generalizations. Firms making use of Big Data have targeted individuals for products based on their computer type (Martin, 2015).

Big Data helps in achieving the best results and best understanding. Big Data helps an organization to overcome weaknesses and keep strengths. Mithas et al. (2013) noted that most enterprises do not know how to use this "Big Data" in order to make decisions or solve problems related to business advantage. Big Data helps enterprises to deal with complex decisions and problems by creating a virtuous cycle for better approaches, techniques, tools and provides new insights for business analytics (Maheswaran and Asirvatham, 2018).

Data analytics helps the business to understand online communities and political movements to make better decisions (Boyd and Crawford, 2012). Analytics of Big Data can be used in the offline environment to study customers' in-store behavior to improve the layout of the product (Tene and Polonetsky, 2011).

Khan et al. (2018) made a forecast that in the year 2050, about 95% of the world population will be connected via the internet using wireless mode to connect as GSM that generates a huge amount of data for the telecom industry. Unfortunately, telecommunication companies are not ready to deal with these issues. Data mining tools and techniques are required to dig out the required data and avoid redundant data.

Joseph and Johnson (2013) claimed that descriptive analytics produce standard reports and alerts. Predictive analytics is concerned with forecasting and statistical modeling. Prescriptive analytics focuses on optimization and randomized testing. For that reason, organizations must know how to apply statistical results to improve organizational functions and achieve organizational goals.

The first challenge is the huge cost of Big Data requirements as technology, trained staff, and specialists. The second challenge is the difficulty of analyzing data

since it needs special methods. Also, storing Big Data in huge spaces is a big challenge for most companies (Joseph and Johnson, 2013). The other challenge is the organization's view toward using Big Data since some of them refuse using Big Data. However, there are some challenges related to the governments in adopting Big Data applications. In order to realize the benefits of Big Data, policy-makers need to conduct research, plan, design, and create incentives to encourage employees using it for both private and public sector entities to share, generate, implement, codify data, and set up programmers to develop appropriate skills (Saxena and Sharma, 2016). The challenges of implementing Big Data improve the understanding of the state of Big Data in decision-making for the business sector (Frizzo-Barker et al., 2016).

Big Data must be secured by setting policies and regulations. The relationship between Big Data and privacy and security issues must be examined from the standpoints of data collection, storing, sharing, and accessibility (Kshetri, 2014). Also, privacy, security, and welfare vary across consumers of different levels of sophistication and vulnerability.

Security considerations

Most companies use security policies to measure their Big Data analyses. Big Data security saves organizational data from being misused and stolen by hackers or competitors and measures are used to ensure security for Big Data inside and outside the organization as access control, data codes, and data segregation (Chen et al., 2014).

In addition to the policies and safeguards, the security also contains several standards and implementation specifications that address organizational requirements. It is required to protect electronic systems, equipment, and data they hold from threats, environmental hazards and unauthorized intrusion. They include restricting access to organizations' servers, computers, and information and retaining off-site computer backups. Various ways and measures are used to ensure security inside and outside the organization (Chen et al., 2014).

Big Data has many predictive privacy harms. "Personal harms emerge from the inappropriate inclusion and predictive analysis of an individual's data without their knowledge or express consent" (Crawford and Schultz, 2014: 94).

Big Data has serious privacy problems. The content of Big Data is gathered from online user interactions and infrastructure sensors, online transactions, search queries, health records, communication networks, and mobile phones. Various types of data collection are used in contexts of direct marketing, behavioral advertising, third-party data brokering, or location-based services.

These data types should be solicited and granted. The focus should direct to express consent and data

minimization with little appreciation for the value of data uses (Tene and Polonetsky, 2011).

Thus, Big Data is an effective tool that telecommunication companies can use beneficially. The implementation of Big Data has various ethical issues. The ethical issues include the security and privacy of Big Data. The afore-cited studies have pointed to the need that, each public Company and organization should resolve ethical issues of security and privacy in the process of implementation and eventual evaluation of Big Data.

METHODOLOGY

This study uses an exploratory and explanatory research design to "better understand the problem on hand and reduce the latter's degree of ambiguity" (Hejase and Hejase, 2013: 113). In addition, a qualitative research approach is implemented whereby the data collection used in this case study had a combination of reviewing website content, the conduct of interviews, and observation of sites of these companies. For the sake of anonymity, we have used labels of Company A, Company B, and Company C in this study. The interview contained a list of open-ended questions.

Sampling

A non-probabilistic sampling is used whereby participants of this study were chosen conveniently based on their willingness to participate. Participants were the managers in three companies working in the telecommunication sector in Kuwait. From each company, three participants were selected to be included in the study for a face-to-face interview. The participants were nine officials having different positions as managers, team leaders, and other responsible officers for Big Data in these companies.

Review of websites

This review provided a basic profile of the three telecommunication companies of Kuwait, their background, operations, services, and contact details for officers.

Conduct of interview

An interview was used to collect data. It included different types of questions. The first section included demographic questions seeking information about the participants and general information. The second section included open-ended questions about facts, perceptions, and opinions about using Big Data in three telecommunication companies. The focus of the interviews was around the following points:

- (i) The system used to manage Big Data
- (ii) Management and organization of Big Data in Company
- (iii) Challenges faced in Big Data management
- (iv) Staffing situation, potential, and prospect for managing Big Data
- (v) Handling and managing security of Big Data
- (vi) Policies and regulations used for protecting Big Data
- (vii) Skills needed for Big Data management and applications, particularly about privacy and security
- (viii) Challenges in managing Big Data
- (ix) Strategies used to deal with emergency issues in dealing with

Big Data

Use of observation

The interviewees were keenly observed for their extra-verbal cues and expressions. Also, available documents were used to ascertain profiles of the participant companies, their stakes, clientele, and market penetration. This provided valuable input that was useful in drawing suggestions for this research.

Data collection

Interviews were conducted with participants from three telecommunication companies A, B, and C. Interviews were conducted during working hours in the morning and it took averagely 25-30 min. Data collected through interviews were qualitatively analyzed.

Findings

The participants in this study were both male and female. It was found that 4 participants were male and 5 were female. As per the positions of participants, they were 4 managers, 3 directors, 1 operation manager, and 1 manager of billing operation (Table 1).

Company profile

Table 1 shows the number of employees, categories of staff, founding date, market capitalization (in millions of Kuwaiti dinars), authorized share capital, and principal activities. In terms of the number of employees, Company A had 530 employees, Company B had 487 employees, and Company C had 420 employees. It is a close range, as numbers fell between 420 to 530.

Concerning categories of employees, Company A provided cloud data services, mobile, software, telecommunications, Company B had the business of mobile and telecommunications, while Company C dealt with infrastructure, mobile, and telecommunications. In terms of market capitalization, Company A marked 1,968 million, Company B recorded 365 million, and Company C had 365 million. Company A was founded in 1983, Company B in 2008, and Company C in 1987. The authorized share of Company A is 432 million Kuwaiti Dinar, while Company B had 50 million Kuwaiti Dinar, and Company C also had 50 million Kuwaiti Dinar. In terms of principal activities, Company A dealt with purchase, delivery, installation, management, and maintenance of mobile telephones, paging systems, and investing in financial portfolios managed by specialized companies and institutions. Company B had principal activities of purchase, supply, installation, operating and maintaining wireless telecommunications devices and equipment (mobile telecommunication, calling system, and other wireless services). Company C dealt with the supply and provision of mobile telephone and paging systems and related services in Kuwait. Portfolio managers invested surplus funds in shares and other securities.

Table 2 shows that the three telecommunication companies are using different analysis and operations in using Big Data. Company A used technical and business (Revenue generation and customer experience) for data analysis. The number of employees using Big Data was about 25. Company A used Big Data for data mining and report analysis. Company B used it for customer analytics and behavioral analytics. The number of employees using Big Data was 25+. This Company did not specify any operations for using Big Data. Company C used database offloading and log analysis for Big Data analysis.

Only 2 employees used Big Data in Company C. In terms of operations of using Big Data, Company C used database analysis. All the participants responded to the interview questions. Their statements were in text form, which has been analyzed subsequently.

Systems used for Big Data and management

The participant from Company C responded that they used Cloudera Data Hub (CDH) and the participant from Company B said that they used SaaS. Company A also used Cloudera. Two companies A and C used the same system. The participant from Company A responded that they had outsourced to Cloudera Enterprise to manage their Big Data. Company B used an enterprise's data warehouse which works as the base to supply data to the SaaS platform. The participant from Company C responded that it was business as usual and they found it part of any typical system.

Challenges in implementation

In Company A, challenges were reported to be knowledge-related and their applications of five Vs, which are volume, velocity, variety, veracity, and value. In Company B, the major challenge noted was how to pool data into a single source of database. It is also recommended to maintain a single source for data such as EDW/BI solutions. The participant from Company C found that their challenges included lack of experience of staff, need to learn new technologies, and managing performance.

Security management

The participant from Company A said that security issues can be resolved by using different authentication channels and integrating with sources like Kerberos and directories. It was found that in Company B, privacy issues and access to data were strategically compartmentalized, based on the level of authorization. Further, a data analysis solution was used as a premise-based solution, making data inaccessible to general consumers. The participant from Company C responded that by using commercial Big Data product of Cloudera or Norton works, they have added many security features to open source.

The participant from Company A stated that they used different policy regulations for Big Data specifically for their organization. National regulation policies were applied to avoid a data breach. The participant from Company B stated that they did not see any specific regulation for data protection in the Middle East. There are general GDPR regulations that organizations need to comply with. Data classification levels are implemented to restrict sensitive information for customers because data in the telecommunication sector is internal and confidential. Company C respondent viewed that internal security policy has been updated to match new Big Data technology. For managing security, the participants were asked about the skills staff should possess. In Company A the participant stated that their staff needed knowledge of Linux Administration, System Administration Knowledge, and Cluster Administration. In Company B staff was expected to be proficient users of CISA and having sound experience of information security practices. The participant from Company C noted that OS skills were useful strategies for staff.

Challenges in Big Data management

The participant from Company A observed that dealing with new

Table 1. Company profile.

Information	Company A	Company B	Company C
Number of Employees	530	487	420
Categories	Cloud Data Services, Mobile, Software, Telecommunications	mobile telecommunications service	Infrastructure, Telecommunications Mobile,
Founded Date	1983	December 2008	1987
Market Capitalization (Million)	1,968.812	365.488	365.424
Authorized share capital	432,705,890.900 Kuwaiti Dinar	50,000,000.000 Kuwaiti Dina	50,403,276.000 Kuwaiti Dinar
Principal activities	The purchase, delivery, installation, management, and maintenance of mobile telephone and paging systems. Investing in financial portfolios managed by specialized companies	Purchase, Supply, install, operate and maintain wireless telecommunications devices and equipment (mobile telecommunication, calling system, and other wireless services).	Supply and provision of mobile telephone and paging systems and related services in Kuwait. Investing surplus funds in shares and other securities managed by portfolio managers.

N=9.

Table 2. Big Data Analysis and Operations.

Companies	Company A	Company B	Company C
Areas of using Big Data	Technical (cost saving) and business (revenue generation and customer experience)	Customer analytics and behavioral analytics	Database offloading and log analysis
Number of employees using Big Data	Appx. 25	25+	Only 2
Operations done by using Big Data	Reporting analysis Data mining	NO	Database analysis

N=9.

systems was problematic if the users did not have the right skills and knowledge. Besides, Big Data is a major asset with its large volume and a wide variety of components. This becomes a challenge that these data are appropriately used. The participant from Company B stated that dealing with Big Data was not problematic if the expectations were crafted. The participant from Company C maintained that Big Data was not problematic, but hard work and knowledgeable staff provided solutions.

Managing emergencies

The participant from Company A noted that prompt availability and disaster recovery were the keys to alleviate issues of data loss. The participant from Company B responded that the strategies for dealing with emergency issues followed Company's management strategies, as they have contingency plans for emergency issues. According to the participant from Company C, they followed the same incident management process, which was used in other practices in the organization.

DISCUSSION

Big Data are a critical resource telecommunication companies have to deal with. It has privacy and security issues, which cost these companies significantly. Big Data requires intellectual assets and skills and capable professionals can manage it. Telecommunication

companies use different systems to deal with Big Data in Kuwait, depending on their needs and goals. Big Data's application may provide an edge to telecommunication companies against their competitors.

Telecommunication companies need more awareness about the volume of data requiring deeper analysis of customer behavior, interests, and service usage patterns. Big Data have definite values for telecommunication companies in adding value-added services. The increasing adoption of smartphones is causing major innovative initiatives for the expanding market of mobile applications using the internet. Telecommunication companies have access to huge amounts of data sources, for example, customer profiles, location data, apps downloaded, device data, network data, customer usage patterns, etc. These are major opportunities for these companies despite their challenging overtones. Many requirements are required for Big Data infrastructure. Big Data benefits from a combination of information from different sources to create knowledge, make better solutions, and offer valuable services.

Telecommunication companies are expected to serve their consumers better if the information is well treated for the privacy of personal information and the security of transactions. These ideals can be achieved as these companies' Big Data is managed systematically. The

security concerns have widely been discussed in many studies (Chen et al., 2014; Crawford and Schultz, 2014; Tene and Polonetsky, 2011). This way Big Data should have a major impact on the development of the telecom industry, Big Data management requires special skills and techniques such as computers and IT skills and problem-solving skills.

Saxena and Sharma (2016) were concerned about human resource aspect of the big data management. We have noted the difficulties of dealing with Big Data can be overcome by promoting employees' competencies about Big Data use, implementation, and critical aspects of privacy and security. Big Data need to be protected from misuse and damage by hackers and security breaches. These companies need to enforce strict measures for ensuring the protection of security and privacy of Big Data.

Big Data may create serious concerns for millions of subscribers of these three companies if appropriate strategies and policies are not developed. These companies need to manage this vital resource with the utmost care, foresight, and vision. Millions of records are transacted regularly in these companies and the amount of traffic needs to be monitored with keen attention. Telecommunication companies use Big Data to bring value to the telecom industry in the country. These companies need to resolve the issues of customer retention, network optimization security, and preparation of stakeholders in a different section of these companies by delivering better opportunities. Telecommunication companies should manage Big Data by paying adequate attention to customer perspectives. This concern was also shared by Joseph and Johnson, (2013).

Telecommunication companies need to be able to prioritize their fund flow and control so that Big Data operations are continually managed without technical breakdowns, system failure, and remittent shutdowns. Big Data have additional pressures on these companies for the provision of space and other infrastructural commitments.

Khan et al. (2018) had forecasted that in the year 2050, about 95% of the world population will be connected via the internet using wireless mode to connect as GSM that generates a huge amount of data for the telecom industry. It has become obvious that Big Data management is exposed to changes in systems, files, and transactions. These companies need to update their systems and facilities continually and systematically. Concerned staff members need to be trained for the changes by conducting workshops, training courses, and using other staff empowerment initiatives.

This study was conducted in a member nation of a 6-nation consortium of Gulf Cooperation Council (GCC). Other nations are Saudi Arabia, United Arab Emirates, Qatar, Oman, and Bahrain. This is a natural entity having a cultural, linguistic, religious, social-politico-economic affinity. This study has its natural ramifications for

companies in these countries. While these findings cannot be generalized as no sampling was possible that would cover these countries, yet these findings may provide general guidelines for business organizations in the region. This study is limited in scope and conduct. Other sectors may be covered in additional studies. A survey may be practical with random sampling at national or regional levels. More intensive treatment is desirable if the companies are not too shy and constrained in providing data. Other business sectors may not be as secretive in allowing interviews and physical visits as was experienced in this study.

Conclusions

This study has meaningful implications for Kuwaiti companies as well as other enterprises in the six-member nations of the Gulf Cooperation Council (GCC). A striking derivation is the desired diversity in the use of systems and applications. This diversity affords flexibility to enterprises, having distinct identities in terms of size, asset value, clientele, and managerial peculiarities. Big Data is managed in view of the specificities of each enterprise. The findings of this study are reassuring for business organizations in the ingenious adoption of appropriate systems and utilities.

Data security is one of the vital concerns for business organizations. A constant increase is evident in investing enormous resources in making consumer data secure. The service sector organizations are seriously mindful of their obligations that their data is secure from any threat that breaches individual rights of protection of personal and financial transactions. Innovative developments for enforcing encrypted systems, firewalls, anti-virus systems, and security guarantees bring fresh opportunities in the face of an increase in data breach incidents. It is a tug of war and the organizations must make big data secure for all the stakeholders.

The three companies expressed the need for developing competence among those professionals who have the responsibility to manage big data. Big data management requires the expertise of system analysis, design, database management, teamwork, networking, and launching portal. These professionals have to collect data from different sections and deal with different managers of the company. These competencies are varied and require befitting training of these professionals. They need to have the opportunity for continuing development, using on-the-job training and reaping other benefits of self-development. External opportunities for attending short courses, workshops, etc. may also provide additional avenues for skill enhancement of this workforce.

One company outsourced big data management to an outside company. If other risks of data abuse are neutralized, it may be a viable option and the need for

engaging a large number of experts may be minimized. Outsourcing requires rigorous negotiations and licensing. Top management of a company may have to strategize this option with foresight and consideration for the long-term benefits. One thing cannot be overemphasized about enterprise management. Companies sustain, survive and prosper if these use a strong profile of innovation and constant rejuvenation. Big Data management needs constant updates in system design, fresh applications, and new applications. It is a challenge how these companies have new initiatives for the emerging market of social media, smartphones, and innovative approaches for sharing and networking.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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