

A Research Framework on Big Data awareness and Success Factors toward the Implication of Knowledge Management: Critical Review and Theoretical Extension

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Abstract

People have access to more data in single day than most people that have access to data in the previous decade. This data is created in many forms and it highlights the development of big data. Big data have transformed the way organizations across industries implement new approach to handle huge amount of data. It means change in skills, structures, technologies and architectures. Organizations rely to this data to achieve specific business priorities. The challenge is how to capture this data to be considered relevant for the specific organization activities because determining relevant data is a key to delivering value from massive amounts of data to support organizations knowledge. This paper proposes a framework to evaluate the level of big data awareness and success factors toward the implication of knowledge management in organizations. The framework incorporates big data and knowledge management. It will allow domain experts and entrepreneurs to evaluate the level of big data in their organizations by looking at the level of understanding, usefulness and effectiveness of big data. The contribution of this paper serve as a first step in understanding the relationship between big data and knowledge management.

Keywords: Big Data; Knowledge Management; Level Of Experience; Level Of Effectiveness; Level Of Usefulness

1. Introduction

Government agencies and large, medium and small private enterprises in many domains, such as engineering, education and manufacturing, are drowning in an ever-increasing deluge of data. This is because they create and collect massive amounts of data in their daily business

activities. In today's competitive marketplace, executive leaders are racing to convert enterprise insights into meaningful results. Successful leaders are infusing analytics throughout their enterprises to drive smarter decisions, enable faster actions and optimize outcomes. For example, the IBM Institute of Business Value surveyed 900 business and IT executives from 70 countries. The result shows that leaders are 166 percent more likely to make most decisions based on data (Shani, 2015). Another good example is National Australia Bank (NAB) wanted to eliminate inconsistencies arising from storing data in 34 different financial and operational systems (Baum, 2015). However, they lacked consistency in how to manage data. Therefore, it is very difficult for them to produce results in consistent manners that lead to their goals.

Big data refers to the dynamic and large volumes of data and it requires analytical process to manage vast amount of data in order to derive real-time business insights that relate to consumers, profit and productivity management. In this era of big data science, it is critical for organizations and businesses to be able to embrace this new facility and to accurately integrate the knowledge-bases from multiple sources into the organizational information repository. The availability of a mechanism that allows seamless consolidation of knowledge from external sources will enrich the capability of the organization to make accurate decision-making. These heterogeneous external sources are growing very significantly in the last few years, especially due to the availability of wireless and mobile technologies, crowd-sourcing facilities, Internet of Things and sensor networks, as well as social media and web data. All these technologies generate huge amount of data and together they can be extracted to generate values to the organization and to establish situational awareness of the community or market trends.

1.1 Challenges

Organizations refer to technologies to create, store, retrieve and distribute knowledge in order to support their decision-making. Technologies such as knowledge management system (KMS) allow organizations to gain vast amounts of business intelligence. It allows support to report, store current and historical data, and consolidate data for management analysis and decision-making.

Data scientists were trained to analyze data, but with the huge volume of data generated everyday makes it harder to identify which data is relevant to the organization's specific activity. As a result, it poses an issue on how to effectively utilize this data to support decision-making processes (Izhar et al., 2013). Big data is important to organizations because more data can create more accurate analysis which can lead to more confident decision-making. Taking advantage of big data opportunities is a challenge for organizations (Berber et al., 2014). In order to ensure the effectiveness of the data, organizations need to store the data reliably across a number of databases. Once the data is distributed, and when the needs arise, the organization must find a way to extract the data again, identify which data is needed, assemble it and analyze it. The challenge now is how to capture relevant data from this massive amount of data, which can deliver values to support organizations knowledge. The real issue is not how the organizations will acquire the huge volume of data, but how they can harness the value of this data that counts (Davenport & Dyché, 2013). Therefore, having an understanding and ability to analyse the data in a timely fashion can ensure a competitive edge to for efficient decision-making.

The impact of big data analytics touches every area of the enterprise. Even though there are studies have been done in knowledge management, there is still little debate these days

about how big data play it roles in knowledge management for efficient decision-making compare to could computing, data warehouse and data mining. There is yet no consensus about how best to incorporate big data and knowledge management in the organizations to improve business analytics and in-time decision-making. Research contributions in this area continue to enlighten industry on how to handle the various organizational and technical opportunities and challenges when working with big data, knowledge management and analytics. It must simultaneously develop effective approaches for updating the knowledge of the organization to underpin the creation and delivery of knowledge in big data era.

The aim of this research is to evaluate the level of big data awareness toward the implication of knowledge management in the organizations. In order to achieve this aim, we propose a framework incorporating big data and knowledge management. The proposed framework elaborates if by understanding big data can drive better process of knowledge management in organizations. The proposed framework identifies concepts of complexity and use as a basis for awareness of big data integration processes suitable for efficient decision-making. This framework aims to evaluate the level of big data awareness that covers the characteristics of good management of big data. The contribution of this paper may serve as a first step in understanding the relationship between big data and knowledge management.

The remainder of this paper is organized as follows. Section 2 discusses the background together with the literature review. Section 3 discusses the research framework. Section 4 is future works. Section 5 discusses on the expected outcome from the framework. The final section contains some concluding remarks.

2. Background

Companies like Google, eBay, LinkedIn and Facebook were built around big data from the beginning (Davenport & Dyché, 2013). Big company like Apple's Corporation has the amount of data that is generated has risen steadily every year. For example, with the arrival of Apple's Watch, Apple presumed millions of people who will soon be using it for everything from monitoring their heart rate to arranging their social calendar to remote controlling their home entertainment (Marr, 2015). This will doubtlessly bring with it a tsunami of data. Apple's Corporation itself has operational storage capacity from kilobytes to terabytes (Aluya, 2014). However, how organizations turn this data into value that can support organizations knowledge is always questionable. This section aims to identify the shortcomings in the previous work by examining the existing issues and gaps in order to enhance the development of the framework. However, evaluating whether all approaches are applicable or not in proposing the framework is beyond the scope of this paper. This is because other approaches and issues might exist which have not been identified in this paper.

2.1 Big data

Big data provides significant opportunities for enterprises to impact a wide range of business processes in organizations (Izhar et al., 2013). Organizations can create huge volume of data in their daily business activities. The problem though is that, this data was created and captured in many different formats, which make it almost impossible to understand the existing relationships between different data. As a result, this huge volume of data may get redundant and hard to identify which data is relevant to the organization's goals. Big Data may be created in petabytes or exabytes scale and much of which cannot be integrated easily. For example, the government agencies, the large, medium and small private enterprises in

many domains such as engineering, education, manufacturing, are drowning in an ever-increasing deluge of data. Companies like Google, eBay, LinkedIn, and Facebook were built around Big Data from the beginning (Davenport & Dyché, 2013).

Even though data scientists were trained to analyze data, but with the huge volume of data generated everyday makes it harder to identify which data is relevant to the organization's specific activity. As a result, it poses an issue on how to effectively utilize this data to support decision-making processes (Izhar et al., 2013). Connected devices are already transforming our world and the competitive forces in business. For example, ATMs went online in 1974 and considered as some of the first IoT objects.

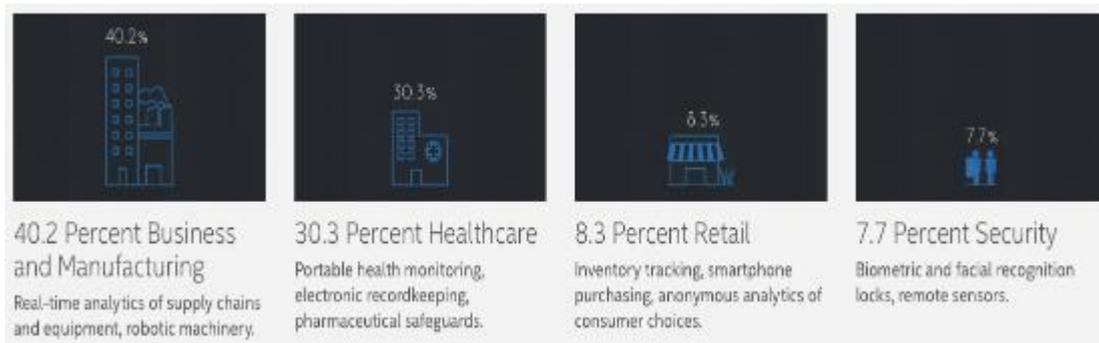


Figure 1. IoT Infographic¹



Figure 2. IoT in old time²

A study by AT&T* in May 2015 shows nearly 4-in-10 smartphone users tap into social media while driving and almost 3-in-10 surf the net. And surprisingly, 1-in-10 video chats. The study shows that many motorists have expanded their behind-the-wheel activities beyond texting to include using Facebook, Snapchat and Twitter, taking selfies and even shooting videos³.

The world already has cars that can drive on their own. Google's self-driving cars currently average about 10,000 autonomous miles per week. Google Self-Driving Car Software (A Google Prius model autonomous vehicle (AV)) already been used since 2009. The cars have sensors designed to detect objects as far as two football fields away in all directions, including pedestrians, cyclists and vehicles. The software processes all the information to help the car safely navigate the road without getting tired or distracted. For example in May 2015, Google Self-Drive Car was tested using Lexus RX450h SUVs on public streets at Mountain View, California. The car has the ability to respond to emergency vehicles. As shown in Figure, the

¹ Source: <http://www.intel.com/content/www/us/en/internet-of-things/infographics/guide-to-iot.html>

² Source: <http://www.intel.com/content/www/us/en/internet-of-things/infographics/guide-to-iot.html>

³ Source: http://about.att.com/story/smartphone_use_while_driving_grows_beyond_texting.html

car was stopped at a stoplight. The car light had turned green, but the car driver detected an ambulance approaching from the right (the purple rectangle with two little red and white symbols on top), so the driver remained stopped as it passed through the intersection.



Figure 3. System detection that allows the car to stop detects any emergency vehicles⁴.

Big data will be important to business organizations because more data can create more accurate analysis which can in turn lead to more confident decision-making. Taking advantage of Big Data opportunities is a challenge for organizations (Berber et al., 2014). In order to ensure the effectiveness of the data, organizations need to store the data reliably across a number of databases. Once the data is distributed, and when the needs arise, the organization must find a way to extract the data again, identify which data is needed, assemble it and analyze it. The challenge now is how to capture relevant data from this massive amount of data which can deliver values to the organization's specific activities. Here, the real issue is not how the organizations will acquire the huge volume of data, but how they can harness the value of this data that counts (Davenport & Dyche, 2013).

2.2 Managing Big Data

In the past couple of years, we have seen a significant increase in the use of big data analytics that bring data under management (Davenport, 2014). Big data provides significant opportunities for enterprises to impact a wide range of business processes in the organizations. Organizations create huge amount of data in their daily business activities.

The problem is this data is created and found in many different forms such as databases, paper based document, mobile applications, various websites and social media. All these data captures in different formats and makes it almost impossible to understand the existing relationship between different data. The size and complexity of data make it difficult for companies to unlock the true value of their data. In fact, some data is so far out of date that it does not belong in an active data storage at all. A key challenge in current environment is determining how to identify data that still relevant for information professionals who receive output of analysis based on this data. Unfortunately, this data cannot be treated disparate information. As a result, this data might be redundant with huge volume of data and make it

⁴ Source:<https://static.googleusercontent.com/media/www.google.com/en//selfdrivingcar/files/reports/report-0515.pdf>

hard to analyse relevant data into information. Organizations need to use this collection of data and create meaningful information and gain knowledge out of it.

High structure and high quality of data is vital. It is the foundation for organizations to analyse relevant data into information in formal reports and dashboards. This information has to be used to make actions and decisions based on actual facts. This stage is known as information spectrum and it is important to apply this stage across the organizations in the consistent action. Therefore, the entire organization can benefit.

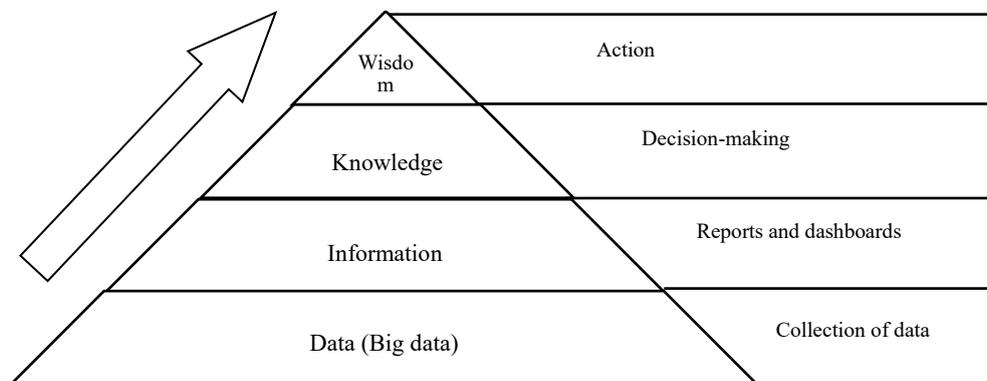


Figure 4. Big data and information management.

The implementation of big data highlights the development of big data analytics. Big data analytics could be used to examine large amounts of data from variety of types to discover useful information. Such information can provide a competitive advantage for better decisions. The primary goal of big data analytics is to help companies make better business decisions by enabling data analysts to analyze huge volumes of transaction data, which remains an unresolved challenge for conventional business intelligence programs.

Big data analytics can be done with the software tools commonly used as part of advanced analytics disciplines such as predictive analytics and data mining but the unstructured data sources used for big data analytics may not fit in traditional data warehouses. Furthermore, traditional data warehouses may not be able to handle the processing demands posed by big data. As a result, a new class of big data technology has emerged and is being used in many big data analytics environments. For example, the technologies associated with big data analytics include Hadoop, MapReduce and Hortonworks. These technologies form the core of an open source software framework that supports the processing of large datasets across clustered system.

Big data is a rather vague term that describes the application of new tools and techniques to digital information on a size and scale well beyond what was possible with traditional approaches, as studied by Lohr (2012). Big data are typically involving datasets that are so large and complex that they require advanced data storage, management, analysis, and visualization technologies (Chen et al., 2012; Perrons & Jensen, 2015).

Recently, Polato et al. (2014) studied on the valuable knowledge that can be retrieved from petabyte scale datasets that led to the development of solutions to process information based on parallel and distributed computing. The authors developed a model-based computer to process information from large datasets. Organizations need to understand the flow of their data in order to process it into valuable information. Data flow is an ordered sequence which is consecutive, high-speed, infinite and time varying. For example, it's a great importance in internet management, internet security and internet experiment. However, with the rapid development of internet technology, the number of internet applications in

organizations keep rising, and the data is growing exponentially which make it hard to manage (Zhi et al., 2011).

Esposito et al. (2015) studied on big data analytics. The authors focused on an imperative aspect to increase the operating margin of both public and private enterprises. The paper represents the next frontier for their innovation, competition, and productivity in big data era. Big data are typically produced in different sectors, often geographically distributed throughout the world, and are characterized by a large size and variety.

Based on the above discussion, we can see that most of the studies focused on big data process from large amount of datasets. The studies focused on big data creation (Chen et al., 2012; Perrons & Jensen, 2015), big data analytic (Esposito et al., 2015), computing approach (Polato et al., 2014), internet data (Zhi et al., 2011) and big data tools (Lohr, 2012).

Table 1.

Review on big data.

Authors	Big data				
	Creation	Computing	Internet	Tools	Analytic
Esposito et al. (2015)					✓
Polato et al. (2014)		✓			
Zhi et al. (2011)			✓		
Lohr (2012)				✓	
Chen et al. (2012)	✓				
Perrons & Jensen (2015)	✓				

2.2 Knowledge management

The fields of knowledge management have always distinguished between data, information, and knowledge. One of the basic concepts of the field is that knowledge goes beyond a mere collection of data or information, including know-how based on some degree of reflection (Erickson & Rothberg, 2014). Organization needs to be more consistent towards the development and exchange of knowledge within and among organization. Higher management plays the important role in influencing knowledge sharing culture among employees (Shoid & Kassim, 2013). This may be improving organizational performance. Knowledge sharing or transfer of knowledge is the main element in the organization in order to generate competitive advantages and improve organizational performance when employees vigorously substitute their knowledge (Shoid, Kassim, & Salleh, 2012; Shoid & Kassim, 2013).

The concept of Knowledge Management (KM) has been implemented in many organizations in the world and becoming more popular in many organizations in Malaysia. Almost the whole world continues to migrate towards a knowledge-based economy, KM has emerged as a methodology for capturing and managing the intellectual assets of an organization as a key to sustaining competitive advantage (Hussain et al., 2004). Thus, many organizations recognize it as a value method and have begun to support this practice to meet business needs and objectives. According to recent research findings, KM is one of the foundations for competitive advantage (Han & Kang, 2007; Kiessling et al., 2009; Massa & Testa, 2009).

Organizations have recognized the importance of knowledge management in New Product Introduction (NPI). Typically, an NPI process uses a combination of data, information and knowledge as inputs during the various stages. In recent years, organizations have realized the need to tap into the data generated from various sources, and use it in their New Product Development (NPD) processes, since such data offers huge potential to improve product performance, bring about efficiency in the product development process, contain costs, and enhance customer experience (Rajpathak & Narsingpurkar, 2013). In order to benefit from data, organizations must have a well-defined strategy to collect, store, synthesize, and disseminate it in the form of knowledge required for various business functions.

Table 2.

Integration between big data and knowledge management.

Authors	Big Data	Knowledge Management
Erickson & Rothberg (2014)		✓
Polato et al. (2014)	✓	
Zhi et al. (2011)	✓	
Esposito et al. (2015)	✓	
Rajpathak & Narsingpurkar (2013)		✓

Table 2 shows the results from the previous models on big data and knowledge. Based on Table 2, none of the studies incorporate big data and knowledge management in their studies. There is no study focus on big data awareness, effectiveness and usefulness in organizations.

In this section, we identified the gaps in the research in the recent literature and conclude that most of the recent literature does not propose any approach to evaluate big data awareness in organizations. Hence, there is no way to determine whether it is possible to apply knowledge management, no way to be sure that planned action will achieve knowledge management effectiveness and no way of determining if understanding big data is relevant toward the implication of knowledge management. In this paper, we propose a framework to address these issues. We develop a framework incorporating big data and knowledge management. We identify different variables to investigate the level of big data awareness in organizations. We consider these variables are important toward the implication of knowledge management in organizations.

3. Theoretical framework

In recent years, the ability to manage (big) data, information and knowledge to gain competitive advantage and the importance of business analytics for this process has been well established. Organizations are investigating ways to efficiently and effectively collect and manage the data, information and knowledge they are exposed to via various internal and external sources in the networked society.

In this research, we propose three different variables to evaluate the level of big data awareness in organizations. The variables are considered important in this framework to drive better understanding of big data and how these variables relate to the implication of knowledge management. The framework shows the relationship between the variables and how these variables incorporating to each other. The framework is structures based on the discussion in the previous studies to evaluate the proposed variables (Andreou et al., 2007;

Assuncao et al., 2015; Davenport & Dyché, 2013; Erickson & Rothberg, 2014; Galbraith, 2014; Grossman & Siegel, 2014; Kwon et al., 2014; Manyika et al., 2011).

First we evaluate the level of personal experience on big data to see if organizations have experience on big data. This is important because some organizations might experience big data issues that help them to come out with a strategy in managing big data. Second we evaluate the usefulness level of big data in organizations and lastly we evaluate the effectiveness level of big data in organizations. The variables are important because if by understanding big data is useful for the organization then organizations should have an effective and efficient strategy to manage big data.

3.1. Experience level of big data

Understanding big data is very important and it can be gained through personal experience. Personal experience includes knowing the definition of big data, understand the creation of big data and knowing the types of data in their organizations. At the same, to investigate if their organizational data are part of big data itself. Personal experience on big data can be considered important to evaluate the level of big data awareness because experience can prepare organization with better strategy in managing big data.

Even though some leading companies are actively adopting big data analytics to strengthen market competition and to open up new business opportunities, many organizations are still in the early stage of the adoption curve due to lack of understanding of and experience with big data (Kwon et al., 2014). Understanding big data can gain insights from the produced data and it is a key to competitive advantage (Assuncao et al., 2015).

3.2. Usefulness level of big data

Evaluating the usefulness level of big data will assist organizations to understand big data in their daily business activity. It emphasizes if big data create value in their organizations by creating useful information and knowledge for better decision-making in supporting organization certain priorities (Davenport & Dyché, 2013; Grossman & Siegel, 2014; Manyika et al., 2011). The evaluation of usefulness will determine if big data is matter in their organizations from the aspect of tools analysis, improving data analysis and improving and optimizing better decision-making. The most likely to initiate big data technologies are either existing analytics groups or innovation groups within IT organizations (Davenport & Dyché, 2013). Level of usefulness includes if understanding big data can improve the process in managing large volume of data in organizations.

3.3. Effectiveness level of big data

Effectiveness of big data emphasize if organizations have successfully manage big data in their organizations to extract insights (Galbraith, 2014). At the same, by managing big data organizations can improve their competitive edge, decision-making, innovation and organizational capital (Andreou et al., 2007). More effective big data analyses can lead to more confident decision-making and better decision can mean greater operational efficiencies in organizations (Davenport & Dyché, 2013). It will drive the process of knowledge creation and also understand their knowledge culture (Erickson & Rothberg, 2014). In the end, it will resolve the problem of knowledge pitfalls and create knowing culture in their organizations as part of organizational culture itself.

Effectiveness of big data analytics is considered an imperative aspect to be further improved in order to increase the operating margin of both public and private enterprises,

and represents the next frontier for their innovation, competition, and productivity (Esposito et al., 2015).

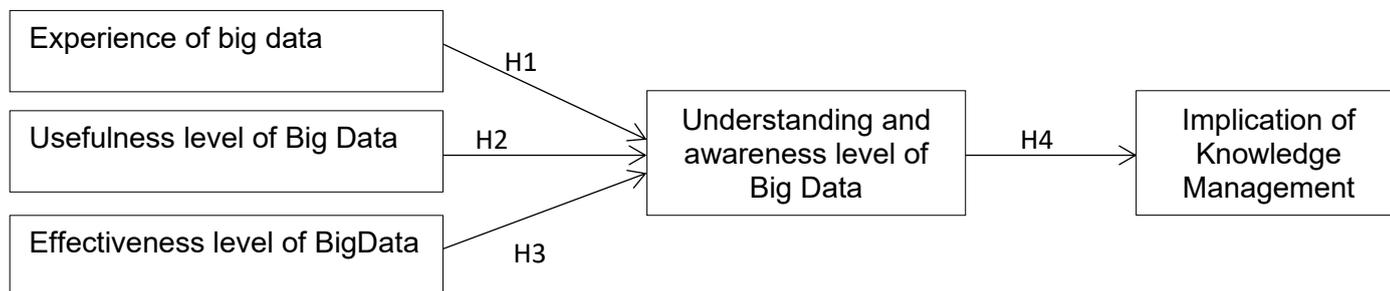


Figure 5. Theoretical framework: big data awareness toward knowledge management implication.

H1. High degree of Big Data experience is positively associated with good understanding and awareness level of Big Data.

H2. High degree of Big Data use is positively associated with good understanding and awareness level of Big Data.

H3. High degree of Big Data effectiveness is positively associated with good understanding and awareness level of Big Data.

H4. Benefits perception of Big Data understanding and awareness drives better implication of knowledge management.

The proposed framework is initially contains three main variables based on big data awareness and success factors, as shown in Figure 5. The originality of this framework lies in the creation of the big data integration 'road-map' that contains references to concepts and properties from three different variables that relevant to evaluate the level of understanding and awareness of big data. This road-map will enable accurate integration between big data and knowledge management. This approach will enable the organizations to have an overall view of big data connectivity within and outside the organizations, and to enable them to harvest interconnected information for analytics purposes which will improve the implication of knowledge management in organizations. The expected outcome of the framework is to gather the measurement data and to come up with more effective results to evaluate the level of big data awareness and understanding toward the implication of knowledge management. Beside business enterprise, the proposed framework aim to be applied to other areas which are highly impacted by things that are external to the organization (environmental conditions, weather, public sentiments, etc.), such as the agricultural industry, health care systems, transport industry, animal husbandry, and other industries in which decision-making is critical. This is because these industries face the issues of big data in their daily activities. Therefore, it might provide them with an alternative to implement knowledge management in their industry.

This research leads to some experimental results that can lead to some new methods and evaluation in big data era from different perspectives. The outcome offer an enormous opportunity to advance the science of data analysis so future researchers have new understanding of what is needed to improve the implication process of knowledge management in the organizations.

4. Conclusion

In this paper, the proposed framework associated with big data and knowledge management is developed based on the review of the issues. The framework is important to specify to what extent the organizations are aware of big data toward the implication of knowledge management. Future approaches can be suggested to address any gaps in the existing research to incorporate big data and knowledge management. The presence of this research ensure the projects agility in responding to unfolding events, and substantially enhance its ability to engage in and impact on organizations and societies. Finally, the results will lead to publications in major scientific journals and speeches in the conferences that can lead to improve the university rank.

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