



Proceedings of GLOGIFT 17

December 11-13, 2017

Delhi School of Management, Delhi Technological University, Delhi
pp. 665-674



Intersection of Big Data and Knowledge Management for Organizational Competitiveness

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Abstract

The success of any organization depends on the precision and aptness of the decisions made by the employees who are the assets of the organization. The employees are the possessors and processors of knowledge in an organization. Knowledge Management (KM) helps any business to synergise the tacit and explicit knowledge available and use them to make quality decisions for the organizational excellence. These decisions help the organizations to strategize and reinvent in tough times. Big Data helps to scrutinize, organize and arrange the huge amount of data available in the form of knowledge to extract the best and most valuable information out of it and provides a competitive edge to the organization. The purpose of this paper is to understand the relationship between big data and KM and also to understand how big data can act as an enabler for effective KM.

A systematic review of peer-reviewed research papers and articles has been carried out to understand the intersection between big data and KM obtained mainly through various sources like Emerald, Google Scholar and other databases.

This study provides a conceptual model reflecting linkages between big data and KM, contributing to divulge clarity to a greater extent.

Although big data is gaining attention in research but a limited research exist putting big data and KM in one framework hence, it remains underdeveloped within the KM literature. This study is a conceptual paper that needs empirical testing.

This paper contributes to reveal the intersection between big data and KM resulting in a conceptual model and shed some more light on the aforementioned topic adding on to the literature.

Keywords - Big Data, Knowledge Framework, Knowledge Management

Introduction

Since the formation of knowledge economy, organisations have become familiar with the concept of KM. However, it still remains a challenging domain for them and contemporary procedures have to be acquired in order to cope with the challenges. Employees are the knowledge assets

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in present times as they usher the process of novel knowledge creation. This knowledge is more valuable than the information generated by organisation itself. This emerging inclination towards KM has led to innovation in the sphere of technology at a swift pace, knowledge is being given enormous significance as a way of gaining competitive edge. KM helps any business to synergise the tacit and explicit knowledge available and use them to make quality decisions for the organizational excellence. These decisions help the organizations to strategize and reinvent in tough times. Big data helps to scrutinize, organize and arrange the huge amount of data available in the form of knowledge to extract the best and most valuable information out of it and provides a competitive edge to the organization. This way big data and KM both are value creation approaches that exploit the technological and knowledge assets in order to maximize opportunities and achieve business goals. Merging these two disciplines of big data and KM has become an area of interest in business and research. This paper has been arranged in the following parts: The first part deals with the review of management literature on the discussed topics: big data, KM and intersection of big data and KM. This section aims to provide a detailed summary of the prevalent literature in order to identify the crucial areas for prospective research and also to comprehend the intersection of big data and KM. In the next section a detailed view of intersection of big data and KM, introduced in literature review, and is presented in a way leaning towards identifying the probable role of big data in the different dimensions of KM. The focus of this paper is to look at the concept of big data and KM in unison with each other. It also aims to understand the association between big data and various areas of KM and to comprehend its effectiveness for the same, based on which a conceptual model is constructed. Final section presents conclusion, limitation and future scope of research.

Literature review and theoretical underpinning

Big Data

Big data has garnered a lot of curiosity in recent years. Now-a-days, due to the immeasurable dissemination of information via electronic devices and innovation in IT industry, the volume of data is on a whole new level than before. Davenport and Patil (2012) have acknowledged big data as a revolutionary force to analyse big volume of data. Due to the immense amount of data available around us, business houses have recently realised the need and significance of tackling this data and storing and using it for making meticulous decisions (George et al., 2014). Decisions based on factual information are always better than those based on instincts and this potential is provided by big data to the organisation using which the companies can gain competitive edge (Mc Afee et al., 2012). The current prevailing technologies are too traditional to handle huge amount of data available these days, therefore big data as a special tool helps to extract knowledge from this data (Manyika et al., 2001; Kabir et al., 2013). Many companies have suddenly realised the significance of big data for gaining competitive advantage as it is considered to be a source for new knowledge, innovation and valuable insights. Big data helps to view business holistically and transform the knowledge into something more valuable in order to gain a competitive edge (Kabir et al., 2013). The actual worth of big data is derived only when it is utilized for decision making. The approach adopted for conventional practices of data analysis cannot hold true for big data. Big data is attributed by three major aspects namely the 3V's: Variety, Velocity and Volume (Sagiroglu & Sinanc, 2013; Zikopoulos & Eaton, 2011; Russom, 2011; Kaisler et al., 2013; Katal et al., 2013; Dong & Srivastava, 2013; Elias & Carayannis, 2017).

Variety: Since there are innumerable sources of data available around us owing to information technology, the variety of data increases significantly, these resources can be classified into three categories: structured, semi structured and unstructured. The data residing in a secure file

which makes it easier to retrieve can be termed as structured data. The data which is gathered from vague sources can be hard to scrutinize is the unstructured data and semi structured data on the other hand is the one which is not organised into some specialised source but still has some tags to make it more prone to processing than raw data.

Volume: This is a great challenge encountered by the organisation since there is a tremendous amount of data available running in terabytes and petabytes. As a consequence of which the long-established techniques of data analysis cannot be used to process this enormous amount of data.

Velocity: The rate at which the data is created and analysed is extremely important these days. Faster streaming would enable the organisations to make better use of the processed data which can be utilized to make valuable decisions.

Knowledge Management

Knowledge has been perceived to empower individuals, organisations resulting in to the rise of knowledge economy. Knowledge has acquired a vital position in this era. Knowledge has been defined as “set of justified beliefs, which can be managed to enhance the organization’s capability for effective action” (Nonaka, 1994; Alavi & Leidner, 2001; Zaheer & Tim, 2017). The transfer of knowledge becomes a very cumbersome task as it is quite personal in nature. The organisations have now begun to realise the significance of tapping in and managing this knowledge which is immersed in the brain. To control knowledge resources within an organisation, KM recognizes, captures, and processes all organizational knowledge (Wolf 2012). There are known to be three KM processes namely the acquisition, conversion, and application of knowledge (Gold, Malhotra & Segars, 2001; Alavi et al., 2006; Kulkarni et al., 2007; Gasik, 2011; Khan, Zaheer, et al., 2017). According to Gao et al. (2008), KM can be classified into two groups namely hard groups and soft groups. Hard groups deal with the explicit knowledge that works on the assumption that knowledge comes from information which is a result of data processing and data is obtained from events where as soft groups which deals with the tacit knowledge which say that knowledge is different from information and resides in human mind.

Intersection between Big data and KM

The conversion of knowledge from one type to the other is not always an easy task for organisations, as organisations have to make systematic efforts to reap the benefits of tacit knowledge. It is in this context that the role of big data becomes vital in capturing, acquiring and sharing huge volumes of explicit knowledge using big data text analytics and may be interpreted through tacit insight (Khan & Vorley, 2017; Davenport, 2013; Scarbrough & Swan, 2001). According to Pauleen & Wang (2017), knowledge is the fundamental aspect of any deliberation around big data. In the absence of knowledge, big data and analytics cannot prevail as it is the knowledge of the capital assets which has expanded the potential of big data. The judgement of the aspect of collection of data and using the techniques to analyse it entirely relies on the experience of the humans. Hence the impact of knowledge cannot be neglected when debating about the impact of big data. Knowledge plays a critical role in big data as it is human knowledge that will confer how the information extracted from big data will be used, whether the data generated is used in operational, tactical or strategic areas, knowledge will guide its use. Big data is considered as a source with great potential to create novel knowledge. Beyond the transactional data used by many organisations, there exists a potential treasure of non – traditional, less structured data which is big data that can be mined for useful information (Rajpathak & Narsingpurkar, 2013; Upadhyaya & Karaki, 2015). Big data and information derived from big data, is considered as a base for decision making, creating novel knowledge, which in

the end is proposed to increase quality and trustworthiness. Kabir and Carayannis (2013) has outlined the basic requirements like management support, infrastructure, people, data driven culture, absorptive capacity as prerequisites for a big data initiative that aims at creating competitive edge. Few of the selected studies which show linkages between big data and various variables of KM have been listed below:

Table 1. Linkage Between the Variables

Title of the Paper	Main Findings	Source
Interrelationship Between Big Data and Knowledge Management: An Exploratory Study in the Oil and Gas Sector	<ul style="list-style-type: none"> • Generation of predictive knowledge • Improve KM capabilities • Effective decision making 	Sumbal et al. Journal of Knowledge Management (2017)
Big Data Systems: Knowledge Transfer or Intelligence Insights?	<ul style="list-style-type: none"> • Similarity between Big data and KM structure 	Rothberg, Helen N., et al. Journal of Knowledge Management (2017)
Creation of Knowledge-Added Concept Maps: Time Augmentation via Pairwise Temporal Analysis	<ul style="list-style-type: none"> • High correlation between temporal assessment and subjective assessments 	Sasson, Elan, et al. Journal of Knowledge Management (2017)
Cognitive Big Data: Survey and Review on Big Data Research and Its Implications. What's Really New in Big Data?	<ul style="list-style-type: none"> • Five Trait Framework for Big Data <ol style="list-style-type: none"> 1. Socio-technical system 2. Data space 3. Data richness 4. Knowledge management 5. Decision making 6. Sensory/visualization 	Lugmayr, Artur, et al. Journal of Knowledge Management (2017)
Facilitating Knowledge Management through Filtered Big Data: SME Competitiveness in an Agri-Food Sector	<ul style="list-style-type: none"> • Big data consumer analytics helps in tapping explicit and tacit knowledge • Effective implementation of KM processes needed in SMEs 	O'Connor, Christina, et al. Journal of Knowledge Management (2017)
Big Data Text Analytics: An Enabler of Knowledge Management	<ul style="list-style-type: none"> • Empower KM 	Khan, Zaheer et al. Journal of Knowledge Management (2017)
Big Data and Knowledge Management; A Case of DÉJÀ VU or Back to the Future?	<ul style="list-style-type: none"> • Pattern analysis and prediction with application of algorithms • Data driven decision making • Big data as a contributor to KM 	Tian, Xuemei & Xuemei Tian Journal of Knowledge Management (2017)
Information and Reformation in KM Systems: Big Data and Strategic Decision Making	<ul style="list-style-type: none"> • Identified 4 types of data based decisions which aids KM systems in handling big data and advanced analytics 	Intezari, Ali, et al. Journal of Knowledge Management (2017)

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The Concept of Big Data Applied in Personal Knowledge Management	<ul style="list-style-type: none"> • 5 areas of personal knowledge management with application of big data <ol style="list-style-type: none"> 1. Time management 2. Computer usage efficiency management 3. Mobile device behaviour management 4. Health management 5. Browser surfing management 	Liu, Che -Hung et al. Journal of Knowledge Management (2017)
Big Data and Knowledge Management: Establishing a Conceptual Foundation	<ul style="list-style-type: none"> • Connection between KM, IC and application of Big data and Business analytics exists • With advance use of Big Data Knowledge assets can be beneficial 	Erickson, Scott & Helen Rothberg Leading issues in Knowledge Management (2015)
Big Data, Tacit Knowledge and Organizational Competitiveness	<ul style="list-style-type: none"> • Inhabited knowledge in Big data has potential of creating economic value • Major source of competitive advantage 	Kabir, Nowshade & Elias Carayannis ICICKM (2013)
Big Data Customer Knowledge Management	<ul style="list-style-type: none"> • Integration of CRM , CKM and bigdata as value creation strategies • increase quality • Improves trustworthiness 	Chan, Joseph O. Communications of the IIMA 14 (2014).

Research Methodology

An extensive literature review was conducted to develop a deeper understanding on linkage of bigdata to KM. A systematic review of the literature has been performed using various data base such as Emerald, Google scholar, Research Gate and other database and it was found that very little work has been done on linkage of big data to KM. Various combinations of key words, such as bigdata, analytics, KM, organisational KM, personal KM, customer KM, interrelation of big data and KM, knowledge creation, predictive analysis were used to search the articles. Articles from the field of computer sciences were not included. Almost all the work discussed in literature review just provides an overview and few with empirical research. Although big data is gaining attention in research but a limited research exist putting big data and KM in one framework. This paper contributes to reveal the intersection between big data and KM resulting in a conceptual model and shed some more light on the aforementioned topic adding on to the literature.

Proposed Conceptual Framework

Knowledge reconstruction from one form to another is an onerous task and has always presented a great amount of complications in organisations. Consistent and efficient endeavours are required by the organisations for attainment of its goals with the help of tacit knowledge and hence the contextual relationship of big data analytics with managing of the explicit knowledge arises (Davenport, 2013; Scarbrough & Swan ,2001;Khan et al., 2017).

Bigdata analytics is imperative in order to encapsulate and dispense explicit knowledge which can further be expounded via tacit cognizance using big data analytics and produces new depth of knowledge as a foundation for making more effective decision making (Grant,1996; Kitchin, 2013; Laney, 2012; Khan et al., 2017)which clearly states that there is a contextual relationship of big data analytics and knowledge sharing .The experiential knowledge in any organisation possesses greater value than the explicit knowledge .The congruence of experiential with tacit knowledge leads to novel knowledge creation which can be employed for better decision making in organisations. Bigdata analytics can secure and make effective use of the different sources of knowledge for enhancing organisational performance.

The 21st century economy is a knowledge economy contingent on information and relying on the available intellectual capital. KM is an integral part of every organisation. Organisations rely on the facts, figures and specifically on the knowledge of its employees for decision making process. Bigdata and KM have similar pursuit i.e., disseminating any kind of knowledge and producing conclusive results for an organisation.According to Davenport and Pusak (2000) “Knowledge is a fluid mix of framed experiences, values, contextual information and expert insights that provides a framework for evaluating and incorporating new experiences and information.” Malhotra (1998) in his study defined KM as “a synergistic combination of data and information processing capacity of information technologies and the creative and innovative capacity of human being “, Bass (1997) explains KM as “the process of creating, capturing and using knowledge to enhance organisational performance”(Rai,2011;Sumbal et al. ,2017). Big data is taking individual data points across multiple activities and across a large universe of subjects and deriving broad and meaningful sense, it's vast and exponentially growing data sets that may run into Petabytes or even Exabytes. Enormous amount of data that gets collected by online activities like the time we spend on the page, every click and action, location, access modes everything gets anonymized, analysed and trend lined not only for post facto analysis but also predictive and future analysis. It is seen as an opportunity for competitive advantage by all organisations and researchers (Davenport,2013;McAfee and Brynjolfsson, 2012;Intezari& Gressel ,2017).Thus, if we look at the explanation of Big data and KM, a link can be seen as how knowledge can be created through bigdata and further used for enhancing organizational performance. An analogy can be drawn to link big data with KM using the base as data to information, knowledge and wisdom (DIKW) model (Ackoff,1989).

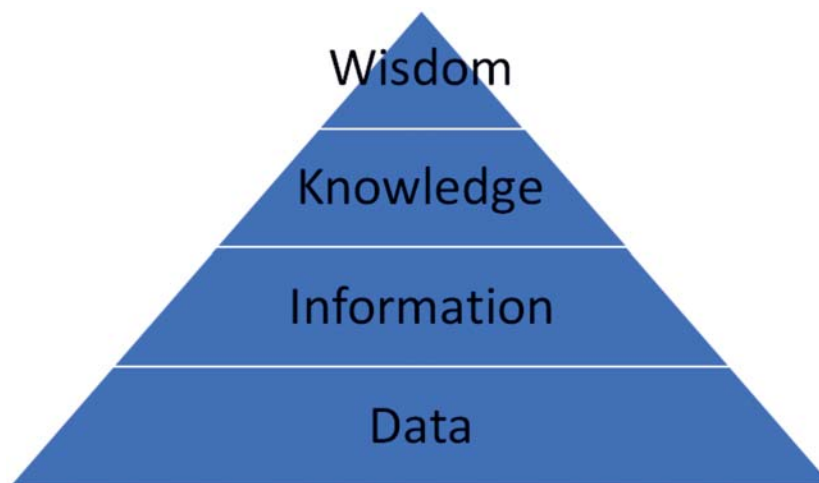


Figure 1: The Knowledge Pyramid (Source: Sumbal et al. (2017))

Data is basically discrete facts, and is in its explicit knowledge form, the flow of activities and events in organisational system without any context but when it is transformed by adding context, it becomes information often in form of metadata. This information which is transformed by reflection based on intuition, personal experience and learning is then converted and transformed into knowledge. On the other hand, big data is the structured, unstructured or semi-structured data available through a variety of sources. When analytics are applied by adding the context to large volume of operational and transactional data which is explicit knowledge it becomes information and resulting in not just information but valuable information and showcases meaningful picture as it organises and structures the data to study underlying trends and patterns.

A central part of the knowledge creation is Information. When this meaningful information is fed into business intelligence tools actionable knowledge is generated which is termed as KM. Knowledge creation according to Nonaka's SECI (Socialization, Externalization, Combination, and Internalization) model is of two types: explicit knowledge and tacit knowledge. Explicit knowledge which is formal and coded form which can also be referred as digital, captured in database and archives which shares the comparable feature like big data whereas tacit is relatively difficult to be codified and it resides in the heads of people. The tacit knowledge of experienced employees of the organisation holds vital importance when making decisions using big data. Actionable knowledge and intelligence is engendered through blending tacit knowledge of employees with explicit knowledge obtained from big data (Sumbal et al., 2017).

Bigdata as digital data creates explicit form of knowledge, however, to generate knowledge from big data, data need to be managed, analysed and need to be connected to relevant context which is done by individuals, leaving tacit knowledge as a central part of bigdata management (Kudyba, 2014). Generation of predictive knowledge from bigdata can be seen as supporting the goal of KM decision making (Bassi, 1997; Sumbal et al., 2017). Creating new information and knowledge out of big data which is explicit knowledge, and use it to support decision-making in organizations in combination with tacit knowledge, would enhance the quality and increase trustworthiness of decision-making. We can derive better perception of when and how big data might be found suitable by concentrating on the essential aspects of storing and sharing knowledge. By studying variables such as the nature of knowledge (tacit or explicit), we can predict the types of knowledge is suitable in various industries. From this perspective, we can start to get an idea of when and where further contribution from big data may be helpful (Erickson & Rothberg, 2014). Using analytics, effective KM can be practiced resulting in improvement (Sumbal et al., 2017) and enhanced organisational performance. Thus, this provides a strong link of intersection of big data and KM. The potential value of big data analytics is unlocked and materialized only when leveraged to drive decision making. (Gandomi & Haider, 2015; Sasson et al., 2017). Both KM and bigdata are designed to produce insights that drive better decisions, increase productivity, higher revenue, competitive advantage (Elgendy & Elragal, 2014; Ohlhorst, 2012; Davenport 2017).

Bigdata analytics also plays a vital role in customer KM in assessing the behavioural patterns of consumer using technology platforms such as machine to machine platform and social media. The main aim is to secure structure and unstructured data through big data to transform it into actionable insights using customer knowledge management (CKM) platform helping in generation of knowledge, its dissemination and storage. Further the firms can utilize this knowledge to take data driven decisions to gain competitive edge. Bigdata can also be beneficial at individual level for personal KM and can help in time management, strengthen the efficiency of computer usage management which can indirectly affect the refinement of knowledge. Behaviour

management can be done by collecting big data from smartphones. Health awareness and browser, surfing management are the areas where big data can be applied (Zhao, 2013; Liu, Wang & Lin, 2017). From the organisational perspective, the experiential knowledge merged with explicit knowledge leads to creation of new knowledge. Knowledge residing in big data is indeed tacit and in most of the cases open to explicability. This new Knowledge once extracted can be transferred, used and can also be shared like any other explicit knowledge. This novel knowledge has all potential of creating economic value for an organization and resulting in high productivity, innovation and growth. Thus, it is also a major source of competitive advantage (Kabir & Carayannis, 2013).

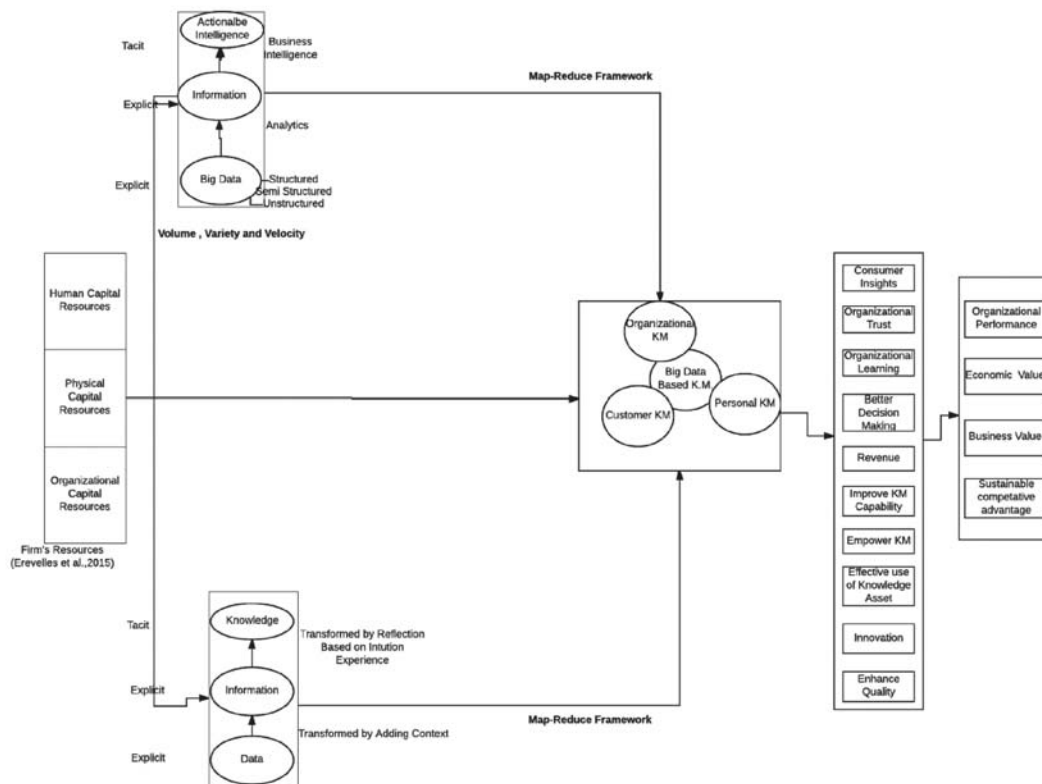


Figure 2: Big Data Knowledge Management Intersection - Conceptual Model (Source: Created by authors)

Conclusion

The 21st century economy is an epitome of knowledge economy in its finest form banking upon its intellectual capital. KM as a field of study has advanced a lot since its inception. Over the years, KM has evolved not only in theory but practice promoting organisational competitiveness. Technology in close association with KM and with the introduction of big data, organisations are benefiting from innovative solutions.

This paper provides a conceptual framework by identifying interrelation between the rapidly developing big data and well-established KM. On the basis of the literature reviewed, a profound

connection can be observed between big data and KM. This association of big data and KM sheds light on the fact that it is functional at a monumental level as organisational knowledge management (OKM), at individual level at personal knowledge management (PKM) and also at other levels like CKM.

The intersection of big data and KM alleviates the process of generating predictive knowledge which helps in enhancing KM capability and aids in effective decision making. This intersection is beneficial to all kinds of organisations; big or small. The effective KM processes should be implemented with big data and KM. The two concepts don't work in isolation. Along with this, there should be an intermingling framework of culture and strategies for big data feature as a contributor to KM and help to reap the benefits from the knowledge assets for an organisation.

There also exists an interdependent relationship between big data and KM because the structure of the both the domains are quite similar. Also, big data is incorporated in various levels of KM like analysing consumer behaviour pattern, capacity building, sales support, reporting, etc. Similarly, KM theory also serves utilitarian purpose, guiding the installation of big data systems. This congruence of big data and KM would lead to improvisation of decision making ability, increase in creating an environment of trust in an organisation, empowers the existing KM systems, creating an ambience of learning at both individual and organisational levels. This will lead to greater benefits from knowledge assets thereby enhancing the quality and eventually increasing the revenue of the organisation. As illustrated by the model, this intersection of big data and KM would result in creation of economic value, business value, improved organisational performance and accomplishing sustainable competitive advantage.

Limitation and Future scope

This study is conceptual in nature needing empirical testing. The literatures found in the discussion discussing the association between big data and KM have limited scope. There is a scope for testing this linkage empirically in other sectors to understand its effectiveness in other industries.

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