A Framework based Knowledge Management System (KMS) for Dynamic Decision-Making (DDM)

Mohammad Fazli Baharuddin, Tengku Adil Tengku Izhar, Ahmad Nadzri Mohamad
Faculty of Information Management, Universiti Teknologi MARA,
40150 Shah Alam, Malaysia

Wan Mohd Hafiz Wan Hasnol
Faculty of Information Management, Universiti Teknologi MARA Kedah,
08400 Merbok, Kedah, Malaysia

Abstract
The aim of this paper is to propose a methodology to improve the application of Knowledge Management System (KMS) that allow domain experts to retrieve and analyze data from different sources that can support dynamic decision-making. A framework will be developed and it can capture the concepts of complexity and use as a basis for data integration processes suitable for efficient dynamic decision-making. This framework aims to resolve the issue in identifying and evaluating relevant data for better decision-making that covers the characteristics of good quality relevant data.
Keywords: Knowledge Management System; Multiple Data Sources; Dynamic Decision-Making

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. Thus, having an ability to analyze data in a timely fashion can ensure businesses have a competitive edge to improve productivity in their decision-making (Zainab et al., 2011).

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 (Brehmer,1990). 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 (Bolloju et al, 2002). The aim of this paper is to propose a framework to improve the application of Knowledge Management System (KMS) that allow domain experts to retrieve and analyze data from different sources that can support dynamic decision-making. The framework can capture the above concepts of complexity and use as a basis for data integration processes suitable for efficient dynamic decision-making. This framework aims to resolve the issue in identifying and evaluating relevant data for better decision-making that covers the characteristics of good quality relevant data.

The originality of the framework lies in the creation of KMS integration that contains references to concepts and properties from every source that relevant to the organization. This framework will enable accurate integration of the datasets for decision making as it will serve as a meta-data for the connectivity of the integration process.This approach will enable the organization to have an overall view of data connectivity within and outside the organizations, and to enable the data scientists to harvest interconnected knowledge for analytics purpose.

The remainder of this paper is organized as follows. Section 2 is background. Section 3 is literature review. The proposed framework is discusses in Section 4. The final section contains some concluding remarks.

2. Background

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. However, data integration from different sources is rarely done by the organization. It supported by Bernhardt (2004), if two data sources provide a large number of common values and many of these values are rarely provided by other sources. Bleiholder & Naumann (2006) and Bernhardt (2004) also mentioned that integration of the data from different sources is rarely happened when the sources are fully independent.

In organizations, they refer to technologies to create, stores, retrieve and distributes knowledge in order to support their decision making. Technologies such as KMS allow organizations to gain vast amounts of business intelligence. KMS is a single, server-based repository that allows centralized analysis, security, and control over knowledge which designed for a strategic business unit or a department that it is a lower-cost version. KMS support reporting and query tools, store current and historical data, and consolidate data for management analysis and decision-making. Even though there are many recent studies have been done on KMS in managing organizational assets, there is still little debate these days about KMS in supporting dynamic decision-making compare to cloud computing, data warehouse and data mining. It is also limited studies on the role and importance of incorporating data from different sources for better decision-making. There is no universal acceptance method or approach in analyzing different sources of data for in-time decision-making. As mentioned by Slaper & Hall (2011), there is yet no consensus about how best to incorporate KMS in the organizations to improve business analytics and in-time decision-making. Furthermore, the synthesis of knowledge from data will require sophisticated data integration, data mining and image processing applications and there is no universal

technique from artificial intelligence to derive relationships between data from different sources Jacq (2007).

Other than that, organization lack of consistency in how to maintain data that can support the creation of knowledge within the organization. Therefore, it is very difficult for them to produced results in consistent manners that lead to their decision-making (Ulmer & Jan, (2010). Currently many organizations store data in multiple health information systems that are disparate meaning the data within each system stand alone and are not interoperable. The data may or may not be collected consistently Clark, (2011). Therefore, the aim of this research is to shift the focus to evaluate the efficiency of KMS in supporting decision-making process.

3. Literature Review

The development of information science makes the creation of a variety of data from various sources to be so easy. This added with the existence of information technology that helps an organization to function properly. Contemporary organizations significantly rely on a broad range of information technologies. Many organizations would be unable to function without the operational support provided by information technologies Turban & Volonino, (2011). Knowledge-intensive organizations designate information technologies among their core assets (Alvesson, 2004). Knowledge workers increasingly depend on information systems and services (Davenport, (2005). They often incorporate the essential business processes. Majority of former pen-and-paper business processes have been transferred into digital forms. Such transformation facilitates improved working efficiency, productivity, task automation, as well as accessibility of information, documents and resources (Wikoff, 2008). The aim of this literature review is to identify the gaps on the complexity in developing the proposed framework.

3.1 Internal and External Data Sources

Statistical data are a numerical statement of aggregates. Data, generally, are obtained through properly organized statistical inquiries conducted by the investigators. Data can either be from primary or secondary sources [14]. Meanwhile, Big Data is a collection of massive and complex data sets and data volume that include the huge quantities of data, data management capabilities, social media analytics and real-time data (Bernhardt, 2004; Buhl et al., 2013). Big data analytics is the process of examining large amounts of data. There exist large amounts of heterogeneous digital data. Big data is about data volume and large data set's measured in terms of terabytes or petabytes. This phenomenon is called Big Data. After examining of big data, the data has been launched as big data analytics.

However, it is important to first understand where sources of data come from; therefore the best way can be decided to pursue managing data. Traditionally, data sources are grouped into two different buckets; internal data and external data. Internal data is information that is procured and consolidated from different branches within our organization (Picciano, 2012). For instance, a factory publishes its annual report on total production, total profit and loss, total sales, loans, wages to employees, bonus and other facilities to employees and any other internal source who collects information about your customers. External data is data that was not collected by your organization. This data would be obtained from a source outside of the organization. Examples would be, purchasing a list from a list broker or gaining access to a proprietary database (Chen et al., 2012).

3.2 Integrating Data Sources / Structured and Unstructured Data

Furthermore, data science and business analytics works with both structured and unstructured data. Yet the future belongs to unstructured or semi-structured data from both internal and external sources. International Data Corporation (IDC) estimates the volume of digital data will grow 40% to 50% per year. By 2020, IDC predicts the number will have reached 40 Zettabytes (ZB). The world's information is doubling every two years. By 2020 the world will generate 50 times the amount of information and 75 times the number of information containers. The massive growth of unstructured or semi-structured data is amazing and has implications for data warehouse, business intelligence, data analytics architecture and database design. The way we capture, store, analyze, and distribute data is transforming. New technologies like reduplication, compression, and analysis tools are lowering costs (Bolloju et al., 2002). It supported by Brockman & Morgan (2003) that mentioned KMS can be a part of new technology in extract and analyzes the data from different sources.

Structured data gives names to each field in a database and defines the relationships between the fields. Unstructured data is usually not stored in a relational database (as traditionally defined) where the data model is relevant to the meaning of the data. The Internet of Things (equipping all objects in the world with identifying devices), blogs, videos, social media, emails, notes from call centers, and all forms of human and computer to computer communications will soon start to produce massive amounts of unstructured or semi-structured data.

The trick is to create value by extracting the right information from both internal and external data sources. That is what the science of data and art of business analytics needs to learn to extract from larger and larger sets of unstructured data. Therefore, in this research, how KMS can produce and extract the structured and unstructured data from different sources will be focuses.

3.3 Implementation of Knowledge Management System (KMS) in Organizations

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 [20]. 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 (Hussain, 2004; Han et al.,2007; Kiessling, 2009; Massa, & Testa, 2009). In Malaysia, KM agenda was inspired by the fourth Malaysian Prime Minister, Tun Dr. Mahathir Mohamad in 1991 (Salleh, et. al. (2003).. Despite these enthusiastic ideas, the concept and practices of KM started gradually and began to take off only in the late 1990s. KM evolved in Malaysia when a few multinational companies, namely Microsoft and Hewlett-Packard (HP) introduced their existing KM practices, processes and applications. The new national interest in this area embarked simultaneously(Nazatul et al.,2013). Implementation of knowledge management in an organization becomes more easily with existence of Knowledge Management System (KMS). KMS are tools and techniques that support KM practices in organizations. Thus, KMS are developed to boost the effectiveness of the organization's KM (Kamla et al., 2010).

KMS integrates an extensive range of tools. The goal of KMS is not to manage all the existing knowledge inside the organization, but it is to manage the right selected knowledge and make it readily available to help people create real-time decision making in the organization (Baharuddin et al. 2010). In this way, individual and organizational performance can be improved.

4. Proposed Framework for Dynamic Decision-Making

As mentioned before, with the phenomenon of big data and existence of multiple data from different sources, effectiveness of KMS will be focused on in order to extract and analyze the data and develop real time dynamic decision-making in an organization. Dynamic decision-making (DDM) skills should help decision makers process information, formulate flexible action plans, and balance multiple objectives in many real world problems from the data available (Brehmer,1992; Collins, 2001). In this part, the characteristic of dynamic decision-making will be discussed further.

Data from any sources should be depending on business and data understanding before analytic process been selected according requirements. According to Buhl, Raglinger, Moser & Heidemann (2013, business understanding includes determining business objectives, assessing the current situation, establishing data mining goals, and developing a project plan. Meanwhile, Data understanding once business objectives and the project plan are established, data understanding considers data requirements.

The step can include initial data collection, data description, data exploration, and the verification of data quality. Data exploration such as viewing summary statistics (which includes the visual display of categorical variables) can occur at the end of this phase. Models such as cluster analysis can also be applied during this phase, with the intent of identifying patterns in the data [15].

The proposed conceptual framework as shown in Figure 1 is being constructed based on previous studies in the literature review. Although there are many recent studies conducted on KMS in the context of evaluating the effectiveness of KMS in the organizations, there is still little debate these days on the role and importance of incorporating data from different sources for better decision-making (Zainab et al., (2011).
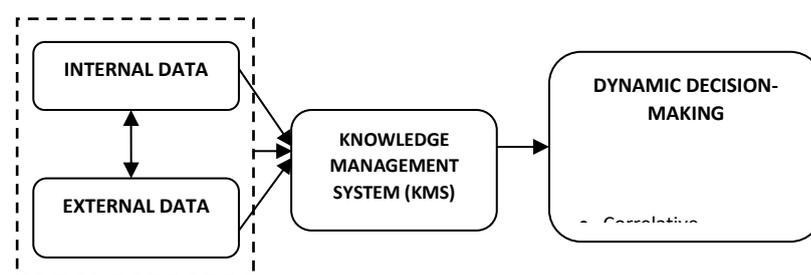

Figure 1: Proposed Conceptual Framework

There is yet no consensus on how best the process of incorporating these data can assist in decision-making. The focus of this thesis is the problem of evaluating the effectiveness of KMS by incorporating data from different sources. The proposed framework addresses the limitations of the previous studies on KMS to develop the dependency relationship for different sources of data. It is important to evaluate this dependency relationship to 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.

5. Conclusion

This conceptual paper is to propose a methodology to improve the application of Knowledge Management System (KMS) that allow domain experts to retrieve and analyze data from different sources that can support dynamic decision-making. The ability to draw correlation and extract knowledge from different sources of data will provide accurate situational awareness that supports effective decision-making. The outcome of this research will support KMS as a whole that consolidated decision-making process, data analysis and integration techniques and support real time decision-making. Besides the KMS, the framework also can be applied to the other areas which are highly impacted by things that are external to the organization in which decision-making is critical.

Acknowledgement

References

Zainab, A. M., Mai, A. & Akram, J. (2011). The significance of knowledge management system at
   financial decision making process. *International Journal of Business and Management*, 6(8), 130-
   142. Retrieved from http://www.ccsenet.org/ijbm
Brehmer, B. (1990). Strategies in real-time, dynamic decision making. In R. M. Hogarth (Ed.), *Insights in*
   Decision Making: University of Chicago Press.
Bolloju, N., Khalifa, M. & Turban, E. (2002) Integrating knowledge management into enterprise
   environments for the next generation decision support. *Decision Support Systems,* 33(2)**,** 163-176.
Bernhardt, V. (2004). *Data analysis (2nd Ed.)*. Eye on Education, Larchmont.
Bleiholder, J. & Naumann, F. (2006). Conflict handling strategies in an integrated information system.
Slaper, T. F. & Hall, T. J. (2011). *The triple bottom line: what is it and how does it work? Indiana*
   Business Review. Retrieved from
   http://www.ibrc.indiana.edu/ibr/2011/spring/article2.html
Jacq, N. (2007). *From Genes to Personalized Healthcare: Grid Solutions for the Life Sciences :*
   Proceedings of HealthGrid 2007. IOS Press.
Ulmer, S. E. & Jan C. F. (2010). Understanding the Meaningful Use Vocabulary Standards. *Journal of*
   AHIMA. 81(11), 48–49.
Clark, J. (2011). Tools for Data Analysis: New Toolkit Provides Resources for Health Data
   Analysts. *Journal of AHIMA.* 82(2).
Turban, E., Volonino, L. (2011). *Information Technology for Management: Improving Strategic and*
   Operational Performance (8th Ed.). Wiley, Indianapolis.

Alvesson, M. (2004). *Knowledge Work and Knowledge-Intensive Firms*. Oxford University Press, Oxford.

Davenport, T. H. (2005). *Thinking for a Living - How to Get Better Performance and Results from*
Knowledge Workers. Harvard Business School Press, Boston.

Wikoff, L. (2008). The Importance of Process in IT Organizations. *Journal of Computing in Civil Engineering*, 22(2), 71-73.

Butler, T & Murphy, C. (2007). Understanding the design of information technologies for knowledge
management in organizations: a pragmatic perspective. Information System Journal,
17(2), 143-163.

Buhl, H. U., Raglinger, M., Moser, F. & Heidemann, J. (2013). *Big data, business & information systems*
engineering, 5(2), 65-69.

Picciano, A. G. (2012). The evolution of big data and learning analytics in American Higher Education.
Journal of Asynchronous Learning Networks, 16(3), 9-20.

Chen, H., Chiang, R. H. L. & Storey, V. C. (2012). Business intelligence and analytics: from big data to
impact. *MIS Quarterly*, 36(4), 1165-1188
International Data Corporation. (2014). Weak High-End Demand Results in Worldwide External Disk Storage Systems Revenue Falling at Rates Not Seen Since 2009, According to IDC. *Press Release.* Retrieved from http://www.idc.com/getdoc.jsp?containerId=prUS24914414

Brockman, B. K. & Morgan, R. M. (2003). The role of existing knowledge in new product innovativeness
and performance. *Decision Sciences,* 34(2)**,** 385-419.

Hussain, F. (2004). Managing knowledge effectively. *Journal of Knowledge Management Practice*, 5.

Han, K. H., & Kang, J. G. (2007). A process-based performance measurement framework for continuous
process improvement. *International Journal of Industrial Engineering*, 14(3), 220-228.

Kiessling, T. S., et. al. (2009). Exploring knowledge management to organizational performance
outcomes in traditional economy. *Journal of World Business*, 44, 421-433.

Massa, S. & Testa, S. (2009). *A knowledge management approach to organizational competitive*
advantage: evidence from food sector.

Salleh, A., et. al. (2003). Knowledge management: a Malaysian study. *Malaysian Manage*, 38, 78-89.

Nazatul Aisha, M. R., et. al. (2013). Knowledge management implementation in a Government Research
Institute in Selangor, Malaysia. *Communication of the IBIMA*, 1-12.

Kamla Ali, A., et. al. (2010). Sharing knowledge to a knowledge management system: examining the
motivators and benefits in an Omani organization. *Journal of Organizational Knowledge Management*, 2010, 1-12.

Baharuddin, M. F., Masrek, M. N., & Shoid, M. S. M. (2015). Information Dissemination Strategies
among Migrant Workers: A Conceptual Framework. *International Journal for Infonomics (IJI)*, 8(3), 1052-1057. Retrieved from http://infonomics-society.ie/wp-content/uploads/iji/published-papers/volume-8-2015/Information-Dissemination-Strategies-among-Migrant-Workers-A-Conceptual-Framework.pdf

Brehmer, B. (1992). Dynamic Decision Making: Human Control of Complex Systems. *Acta Psychologica*
81: 211-241.

Collins. (2001). Good to Great. N.Y., Harper Business.