Towards a Service-Oriented Architecture for Knowledge Management in Big Data Era

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ABSTRACT

Nowadays, big data is a revolution that transforms conventional enterprises into data-driven organizations in which knowledge discovered from big data will be integrated into traditional knowledge to improve decision-making and to facilitate organizational learning. Consequently, a major concern is how to evolve current knowledge management systems, which are confronted with a various and unprecedented amount of data, resulting from different data sources. Therefore, a new generation of knowledge management systems is required for exploring and exploiting big data as well as for facilitating the knowledge co-creation between the society and its business environment to foster innovation. This article proposes a service-oriented architecture for elaborating a new generation of big data-driven knowledge management systems to help enterprises to promote knowledge co-creation and to obtain more business value from big data. The proposed architecture is presented based on the principles of design science research and its evaluation uses the analytical evaluation method.

KEYWORDS

Big Data Analytics, Big Data, Knowledge Management System, Service-Oriented

INTRODUCTION

The development and use of Knowledge Management Systems (KMSs) are currently having a direct and dramatic impact on business decisions and processes in modern and networked organizations that are required to be more competitive to grasp more business opportunities (Alavi & Leidner, 2001). However, these KMSs are currently confronted with a various and unprecedented amount of data, resulting from different business and IT-based services, called “big data” (Chen, Chiang, & Storey, 2012).

Big data provides high-volume, high-velocity and high-variety information assets that lead to a revolution of transforming traditional organizations into knowledge-intensive ones, called data-driven organizations (DDOs). Consequently, knowledge discovered in DDOs needs to be translated from big data into organizational knowledge to aid managers in making decision and in improving performance (Chen et al., 2012). Despite the fact that big data research has recently gained rapid growth, there is a

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lack of frameworks and architectures that enable DDOs to capture the value of big data in a systematic manner, especially for promoting organizational learning (Olivo, García Guzmán, Colomo-Palacios, & Stantchev, 2016; X. Wang, White, & Chen, 2015). Indeed, one of the most important challenges for KMSs today is to be able to deal with big datasets that are required to be updated frequently or continuously. Therefore, a new generation of KMSs to handle effectively big data sources becomes an essential tool for organizations, notably DDOs.

In fact, most of the recent studies, which are related to the integration of big data and KMSs, have separately concentrated on specific aspects of knowledge management such as business intelligence and business analytics (Chen et al., 2012), data mining and knowledge discovery (Wu, Zhu, Wu, & Ding, 2014) as well as the construction of the total process of collaborative knowledge management and set up the overall framework of a collaborative management system for IT start-up companies based on knowledge flows (Lu, 2016). These studies have strongly focused on knowledge exploration but have not been fully supported knowledge exploitation yet. There were little attempts to take into account the impact of big data on the whole process of organizational knowledge management and the trend of service orientation (Kakabadse, Kakabadse, & Kouzmin, 2003).

Besides, the service science perspective always considers customers as value co-creators. Co-creation is carried out by individuals and the organizations within a unified network that bring the benefits to all stakeholders (Vargo & Lusch, 2008).

As a result, this research aims at proposing a novel service-oriented architecture for big data-driven knowledge management systems, hereafter called BDD-KMS architecture. This paper discusses the architecture for a new generation of BDD-KMS to help enterprises, especially SMEs (small and medium-sized enterprises) to promote knowledge co-creation and obtain more business value from big data.

The rest of the paper is structured as follows. Section 2 provides a summary of theoretical background. Section 3 describes the essentials of the research design and positions our paper with respect to the related work. Section 4 introduces the proposed architecture according to the design science research, including a set of constructs, a model and a method. Section 5 demonstrates a use case of the architecture. Section 6 outline conclusions and some ideas for further research.

THEORETICAL BACKGROUND

In this research context, data consists of traditional data and big data. Knowledge is constituted from knowledge objects, which are classified on the basis of their level of development, that is, as data, information, knowledge or wisdom (Bierly, Kessler, & Christensen, 2000). Knowledge management (KM) is defined as organizational activities related to knowledge artefacts in which a learning process has occurred, and intellectual capital is accumulated and developed. Knowledge management systems (KMS) represent a specific type of information systems applied to handle organizational knowledge (Alavi & Leidner, 2001), that includes activities such as knowledge capture, knowledge organization, knowledge transfer and knowledge application (Le Dinh, Rickenberg, Fill, & Breitner, 2015). The backbone of KMSs is the knowledge architecture, which is the application of information architecture to knowledge management that supports and enhances the KM activities.

Big data brings a great opportunity but also a big challenge to implement KMSs in DDOs. The importance of big data does not revolve around how much data organizations have today, but what business value they can distill from this data in the best manner and within the shortest response time. In the global competitive environment, organizations, which are able to effectively leverage big data through KMSs, can differentiate themselves from their rivals. However, there is a great challenge for DDOs in handling the immense volumes of data, which are being continuously generated on an hourly basis. Hence, a huge computing power for analytics, which is required to process the unprecedented input, creates significant barriers for organizations, especially SMEs, to harness effectively the business value of big data.
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