Big Data and Human Resource Management Nexus: A Review and Future Direction

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Abstract
Dramatic technological advancements, heavy reliance on data, the introduction of advanced information communication technologies, electronic business and high-end computing capacity necessitated the importance of big data application in organizations. Despite the increasing importance of big data, however, organizations have faced plenty of challenges. Thus, the reviewer aimed to identify the roles of big data for Human Resource Management (HRM), problems faced by HR professionals in using big data and provide solutions to the problems faced. In doing so, the reviewer collected research papers between 2014 and 2016 with the help of "Google scholar" search engine using search words "big data", "HR analytics" and "HRM" to come up with 28 relevant articles out of 35 journal articles. The review indicated that big data proved itself to be a very useful in recruitment, training, pay-performance fit, and career management among others. With regard to problems of big data use in HRM authors indicated several issues including but not limited to; characteristics of big data, difficulty in understanding the concept of big data, deciding over what data are generated and collected, issues of privacy, ethical considerations relevant to mining such data, high infrastructure costs, lack of the skills, knowledge and insight to ask the right questions of the HR data and functional silos in the organization whereby HR and organizational leaders fail to strengthen the capacity of experts in combining HR related data with other determinants of productivity and performance. The reviewer suggests that big data and its scope should be well defined; distinctive characteristics and types of big data should be understood with specific reference to HRM; and problems/challenges should properly be addressed through the establishment of joint team of HRM and big data experts. Finally, both the academia and practitioners should embrace the new research paradigm that focuses on the proper alignment of big data with HRM for better organizational success and researchers should produce studies that show techniques of data mining as well as big data analytics in relation to HRM practices.
Keywords: Big data, HRM, HR analytics

1. Introduction
1.1. Background
The world has seen dramatic technological advancements that changed the way we live and the way we work. Organizations are heavily relying on data more than ever and they have embraced the world of smart working, business analytics, and increasing volume of data, expressed not only in megabytes and gigabytes but also in terabytes, petabytes, and exabytes of storage capacity, to give better projection of activities with greater precision (George, et al., 2014).

The introduction of advanced information communication technologies, electronic business and high-end computing capacity invites practitioners and academicians to discover trends, behaviors, and actions in a different way than it was done previously. Besides, researchers nowadays make use of "big data" from a variety of data sources (George et al, 2016).

Scholars used both "data science" and "big data" interchangeably and they articulated the concept as an interdisciplinary field that deploys the combined benefit of statistics, data mining, machine learning, and analytics to get better understanding and explanation power as to how large volume of data generate analytical insights and prediction models for business decisions (Dhar, 2013). Over the past five years, scholars have been increasingly devoted to big data application in various academic disciplines including management, business, information systems, and social science research (Frizzo-Barker, et al, 2016; Constantiou & Kallinikos, 2014).

Over the past few years, the use of data science in general and data mining in specific for HRM processes has increasingly grown to achieve strategic benefits (Strohmeier & Piazza, 2009). Human resource management, being the management of the most valuable asset in the organization, is becoming the difficult attention seeking field of research.

Human resource management can make use of big data to understand the simple and complex cause effect relationship that exists among various variables. Such statistical calculation makes it easy to understand HRM variables through measurement rather than mere subjectivity. The presence of large collection in big data does not mean straightforward derivation from the original data records. It is important therefore to make clear that such data cannot often be used as a direct input to strategy making in either human resource management or other business subjects. However, the constant updatability of big data makes it possible for real-time responses that involve sophisticated algorithms dealing with dynamic data sets and requiring the developments of new indicators as well as new forms of graphical or visual representation that support sense making under conditions of rapid and

shifting environmental change (Oestreicher-Singer & Zalmanson, 2013).

The current organizational effort is also questioned despite the increasing popularity of HR analytics. In this regard, the significant variability in the measurement of organizations raised criticism. Supporting this, Fitzenz & Mattox (2014) reported that approximately 75% of HR departments do not have usable base metrics indicating that, for many organizations, there is a big leap from their current state to the appropriate use of analytics.

Thus, the presence of variability in measurement, the presence of large data in the business world now a days, and the increased importance of big data as a source for retrieving large HRM related data motivated the author to review the concept of big data and its importance for HRM.

1.2. Objectives and Research Questions

The objective for this review is to assess the use of big data in human resource management analytics and to provide future directions.

This review aimed to answer the following research questions;
1. What does the role of big data for HR looks like?
2. What are the problems faced by HR professionals in using big data?
3. What should be done to bring success in the organization with the help of big data?

2.   Methodology

The reviewer has selected big data and HR as a review area because it is a current concept in the technologically advanced world. Besides, the reviewer discussed the issue with experts during a departmental discussion and mapped the entire review activity. The reviewer collected research papers conducted in the topic of interest between 2004 and 2016. With regard to the search engine, Google scholar search engine was used using search words "big data", "HR analytics" and "HRM".

The reviewer also screened titles and abstracts of 35 journal articles and came up with 28 relevant articles. Besides this, the reviewer brought different findings related to the definition of big data, role of big data in HRM, and problems of big data in HRM. Finally, the reviewer set conclusions and forwarded future directions in the topic.

3.   Review of Literature and Empirical Results

Today's business environment has necessitated the generation of new knowledge and vision for business firms. One major source of new knowledge and innovative insight for business firms is big data (Jukić et al., 2015). Despite its importance, defining big data is not a simple task as it consists of a number of meanings (Frizzo-Barker, et. al., 2016). The next section reviews definitions for the concept.

3.1. Definition of Big Data

Small scale data collection, generation and use have become a traditional approach that is being replaced by a modern approach called big data. The modern approach goes beyond the singular data analysis and it looks in to a vast dataset to predict, connect and create relationship among different variables (Mayer-Schönberger & Cukier, 2013). The literature on the development trends of big data show a tendency of qualitative difference in the way issues are conceptualized. Additionally, there is huge variation in the data that is generated in the current digital environment (Constantiou & Kallinikos, 2014).

A multitude of sources, like internet clicks, mobile transactions, user-generated content, and social media as well as sales queries and purchase transactions, gave rise to the generation of big data (George, et al, 2014).

Scholars defined big data in different ways giving consideration to the bigness of data, the speed at which data is acquired, credibility of sources and variation of data. According to McAfee & Brynjolfsson (2012); Zikopoulos & Eaton (2011) big data can be defined in terms of the three elements; volume, velocity, and variety. The total size of the dataset represents volume and the speed at which data is acquired represents velocity. On the other hand, variety refers to the multitude of structured and unstructured data sources such as text, videos, networks, and graphics among others. In addition to the three elements Abbasi & Adjeroh (2014) described the fourth element called Veracity representing the varying credibility and reliability of different data sources.

From the above definitions we can understand that big data refers to not only big volume but also plurality of data sources, speedy access to large datasets, and the presence of varying reliability of data sources.

3.2. The Role of Big Data in Human Resource Management

Despite the failure of HR analysts in effectively utilizing HR analytics (Angrave et al., 2016), still big data can be useful in using complex data for complex decision problems. Intuitive decision making refers to the use of subjectivity for passing decisions and objective decision making refers to the use of objective data for making decision. With respect to the balanced use of intuition and data there is debate among HR scholars and practitioners. According to Schwarz & Murphy (2008), objective managerial decision making requires hard facts that can avoid

dependence on past experience or commonly accepted beliefs. However, Davenport (2006) argues that sole dependence on objective evidence is not always essential; rather decisions should be based on the combined use of analytics and instinct involving human capital.

The application of big data in an organization may be a one-time effort but it has a far reaching inspiring effect throughout the firm. These effort and associated results should be considered by HR leaders who initiate analytical methods as a support for organizational processes. According to Angrave et al. (2016), analytics involves both traditional relational database and sophisticated database structures. Besides, analytics must be rooted in an understanding of the data to be used and the context under which that data were collected if any meaningful insight is to be gained. This understanding will help determine the resources that are required and the form that the analysis will eventually take.

The HR related data is still often described as hard to define, difficult to measure and not critical when it comes to business strategy. Data collection in the past focused on work units and the HRM itself without consideration for its strategic effect on business (Lawler et al., 2004). Hence, the data driven HRM is considered as the best way to overcome the narrow scope (Lawler et al., 2004; Welbourne, 2015). Data-driven is often defined as something that is based on data and facts instead of intuition or personal experience (McAfee & Brynjolfsson, 2012; Rasmussen & Ulrich, 2015). In addition to the data-driven measuring and decision-making, HRM should focus on outside-in approach rather than inside only approach (Ulrich & Duhlebohn, 2015; Rasmussen & Ulrich, 2015).

Datasets, whose size is beyond the ability of commonly used software tools to capture, manage, and process data in a timely fashion can be tackled by big data. Currently, there is tough competition among enterprises in the area of recruitment, talent training, pay for performance, and career recruiting. Enterprises can facilitate HR activities like recruitment, selection, career management, etc. through the introduction of big data. Big Data provides a broader platform for enterprises' recruitment work, which is the Internet. According to Huang & Xiang (2013) China has more than two-thirds of enterprises use online recruitment. Companies combine recruitment into social net-working, and constantly gather resume and application information, which laid a solid foundation for the Big Data analysis of recruitment.

Employee training is an important aspect of HR activities that enables organizations to secure sustainable development of enterprises. Successful training can increase employees' level of knowledge, skill and enhance their work performance (Tian, 2014). The traditional employee training consists of hiring professional trainers, assigning material and financial resources through traditional form of classroom instruction that cannot meet the different needs of students effectively. However, in the context of Big Data, information access and sharing is very convenient that enables any individual to search the information they want to learn through the network at any time or anywhere easily. Additionally, companies are embracing the world of online training where they can buy online courses for their employees. Similarly, many organizations began to develop professional network training courses. In addition, employees' can get access to online test and feedback at any time, which can enhance learning interest effectively and ensure the learning effect (He, 2013).

Employees are attracted to high paying organizations given that high payment relates to high performance. The pay level of a company is always the most important indicator that attracts employees, and for enterprise managers, pay and performance are effective means by which to motivate employees to work harder and harder (Wu, 2012). Traditional performance systems often focus on more qualitative and less quantitative terms and the salary can't reflect differences between high performance employees and low performance employees. However, following Big Data approach companies can record the daily workload, specific content of the work and the task achievement of each employee, then use cloud computing processing to analysis these data (Wei, 2012).

Career management deals with the progression of individuals within an organization in accordance with assessments of organizational needs, defined employee success profiles and the performance, potential and preferences of individual members of the enterprise. Besides, it aims to ensure that the organization has the managers it requires to meet future business needs (Armstrong, 2006). To deal with career management in the organization, Big Data is helpful in quantitatively analyzing all the information that we can get of employees, including their interest on job, promotion will, professional experience and performance, career planning books and other data. It is therefore, important for enterprises to combine the traditional career management with automated career management so that they can provide personalized career guidance for employees and reduce the employee turnover (Zang & Ye, 2015).

3.3. Problems in making use of Big Data for HRM

Though there is no single category to describe problems of big data use in HRM, Akerkar (2014) and Zicari (2014) explained that the broad challenges of big data can be grouped into three main categories as data related, process related and management challenges. On the other hand, Jin, et al. (2015) stated that some of the challenges are a function of the characteristics of big data, its existing analysis methods and models, and the limitations of current data processing system. Other studies also identified problems like difficulty in understanding the concept of big

data (Hargittai, 2015), decision-making of what data are generated and collected (Crawford, 2013), issues of privacy (Lazer et al., 2009), ethical considerations relevant to mining such data (Boyd & Crawford, 2012) and high infrastructure costs (Wang & Wiebe, 2014).

Many professionals assume that the people aspect is more of subjective and they question whether people can be reduced to metrics. Besides, there is a problem as to whether big data theory can be applied to HR practices in organizations. Supporting this, the Chartered Institute for Personnel and Development (CIPD) states that the HR function lacks the skills, knowledge and insight to ask the right questions of the HR data they have at their disposal (CIPD, 2013). Additionally, Deloitte (2015) mentioned that the area of HR analytics has not developed yet and provided the survey of Chinese companies as an evidence for this case. Similar to the previous problem, HR professionals may produce brilliant ideas in relation to the development of HR analytics but the mental block, inability to change new analytics idea in to practice for better analysis of HR data, may hamper the practicality of the idea. Such mentality can be the result of functional silos in the organization whereby HR and organizational leaders fail to strengthen the capacity of experts in combining HR related data with other determinants of productivity and performance (Smeyers, 2015).

4. Conclusion and Future Directions

Today's business environment has become complex in the way business processes are conducted. Additionally, the presence of large volume of data coupled with huge variation in the data that is generated in the current digital environment makes competition even harder. Such dynamic scenarios paved way to the birth of data science and big data analytics whereby organizations heavily rely on such tools to face challenges posed by the information revolution. Big data analytics refers to a holistic process which deals with data, sources, skills, and systems in order to create a competitive advantage. This review addressed the role of big data for HRM practice and revealed problems of big data use in HRM practice. Accordingly, big data proved itself to be a very useful in recruitment, training, pay-performance fit, and career management among others.

With regard to problems of big data use in HRM authors indicated several issues including but not limited to; characteristics of big data, difficulty in understanding the concept of big data, deciding over what data are generated and collected, issues of privacy, ethical considerations relevant to mining such data, high infrastructure costs, lack of the skills, knowledge and insight to ask the right questions of the HR data and functional silos in the organization whereby HR and organizational leaders fail to strengthen the capacity of experts in combining HR related data with other determinants of productivity and performance.

In order to get the most out of big data for HRM success, the reviewer suggests that big data and its scope should be well defined; distinctive characteristics and types of big data should be understood with specific reference to HRM; and problems/challenges should properly be addressed through the establishment of joint team of HRM and big data experts.

Finally, both the academia and practitioners should embrace the new research paradigm that focuses on the proper alignment of big data with HRM for better organizational success and researchers should produce studies that show techniques of data mining as well as big data analytics in relation to HRM practices.

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