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Technological and Human Factors for Supporting Big Data Analytics in Saudi Arabian Higher Education

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Abstract

Big data analytics is an emerging technology that is widely utilized across industries and is increasingly discussed among researchers. This study investigates the effects of Technological and Human Factors for Big Data Analytics (THFFBDA) on technological improvements of big data analytics (BDA) towards improved decision making by top management in Saudis' Higher Education. This paper seeks to enhance our understanding of how these components impact on the implementation of big data analytics to improve decision making by top management in Saudi Arabian Higher Institutions. This study draws on the Sociotechnical theory to define and investigate THFFBDA, and the Delone & McLean Information System success model to highlight the technological improvements in BDA. This research paper concludes with propositions on the potential effects of THFFBDA on decision making among universities' top management and proposes a mixed-methods approach to study the above phenomenon.

Keywords

Technological and Human Factors, Big Data Analytics, Higher Education, Saudi Arabian Universities, Decision Making, Top management.

Introduction

Developing nations recognize the advantages of new innovated technologies for gaining business values. Saudi Arabia is one of these developing countries that is investing in creative technologies such as internet of things, agile innovation, and big data analytics to achieve the nations' vision 2030, Communication and Information Technology Commission (CITC 2016). Big Data Analytics (BDA) is considered as one of emerging technologies in Saudi Arabia especially in educational sectors. Thus, this technology could increase value realization for organizations (Günther et al. 2017). Earlier investigations have shown how big data analytics can convert business and deliver business value in public and private sectors (Gupta and George 2016). Although big data analytics (BDA) Studies demonstrate the beneficial impact of big data analytics in various fields, few researches focus on the significance of BDA for supporting decision making in Saudi Arabian Higher Education Sectors (Mukthar and Sultan 2017). Likewise, a study on BDA in Higher Education indicates that BDA assists top management to monitored students' violence-related behavior (Baig and Jabeen 2016). However, others indicate that there are challenges of implementing BDA in Higher Education Institutions, which include Information Technology infrastructure, technical issues, analytical skills, and big data security and privacy (Ahmed 2016).

Like other IT and Information System instances, BDA is a socio-technical system, which might be shaped by social and technical forces (Günther et al. 2017). To overcome the challenges associated with BDA, we could therefore consider technological and human factors in the implementation and use of BDA. The technological factors revolve around the big data analytics tasks (BDATs) such as storing, analyzing, and visualizing, which are

inevitably essential for gaining the value of big data analytics and improving decisions process in Higher Education Firms (Al Ghamdi and Thomson 2018). These tasks have been broadly addressed in previous researches without investigating on how they, together with system quality as a technological enabler support, Higher Education Sectors to improve decision making based on analyzed data. To achieve the BDA tasks above, we need to consider the human aspect, conceptualized in this study as big data analytics performers (BDAPs). BDAPs in the proposed research model include IT academic and non-academic staff who should be responsible for controlling the security of BD i.e. who has access to these data for making an effective decision. Besides, IT staffs are crucial factors for ensuring the privacy of BD is taking place by generating policy standards for BD. Thus, these human factors lead to improve the decisions making by top management since it allows top management to create their decision derived from secured and private BD.

Considering the issues stated above, this research presents a model on the effects of Technological and Human Factors in Big Data Analytics (THFFBDA) for improving executive decision making basing on perspectives from the Saudi Higher Education Sectors. The following section discusses the theoretical perspectives on technological and human factors in IT supported environments and the improvement and success of such developments.

Theoretical Background

While there are rapidly expanding literature on big data analytics focusing on technical aspect, there is limited researches empirically grounded on IS theories that merge social and technological factors to gain more insights on the influence of these components (Gupta and George 2016). Besides, reviewed literature and the phenomena of this study suggests the researchers to consider these important theories, regardless of other alternative theories. Thus, this study draws from two essential theories. The first theory is the socio-technical. The second theory is Delone & Maclean Information System success model (1992). Subsequently, we will begin with the socio-technical theory which we named in this study as big data analytics tasks (BDATs).

Socio-technical Theory

This research paper is mainly built on socio-technical theory. This theory is closely connected and supportive of the arguments of this study. Socio-technical theory (STT) was founded by Cherns (1976) and his theory pointed out how the implementation of a new information system can be merged with human factors such as tasks, rules, and culture to attain organization objectives (Wyatt 1981). Therefore, in this study, we select components from STT that merged technological and human factors which we conceptualized as big data analytics tasks (BDATs). In fact, big data analytics has attracted researchers to establish further investigation on the benefits of applying STT in big data analytics. One of those studies was reinforced on a suggestive case study; the researcher investigates the actualization of four BDA affordances at an automotive manufacturing company to explain how organizational actions are conducive to actualizing BDA affordances. The study concludes that STT perspective, which frames actualization as the process of recursively shaped on social and technical entities and enabling the investigators to validate incremental and fundamental learning on both the organizational and individual levels (Dremel et al. 2018).

Delone & Mclean IS Success Model

Delone and Mclean IS success model is the second theory underpinning this research paper. This model was developed in 1992 as a multidimensional model with interdependencies between the different success categories (Grover et al. 1992). In this research paper, we select those factors which consists of system quality which includes big data security and privacy, as mediating components. We then shaped these factors as big data analytics technological improvements (BDATI). Thus, these components can assist successful implementation of big data analytics in Higher Education system in Saudi Arabia. Additionally, one of the previous studies that used Delone and Mclean in BDA discussed how the quality dynamic in big data environment is linked with enhancing business value and firm performance (FPER). The study indicates that system quality and information quality are important factors for improving performance aspects (Ji-fan Ren et al. 2017). Therefore, this study aims to investigate on big data technological and human factors for big data analytics in education sectors. Eventually,

THFFBDA conceptualized framework of the current study will be discussed in the next section followed by research model and research propositions.

Research Conceptual Model on THFFBDA

Based on review of the literature, this model is developed based on socio- technical and Delone & McLean IS success model. The proposed model for this study contains four categories. Big data analytic tasks (BDATs), big data analytics performers (BDAPs), big data analytics technological improvements (BDATI) for successful implementation of big data analytics in Saudi higher education (mediator), and the outcomes of applying these factors which is improving decision making by top management in Saudi Arabian universities.

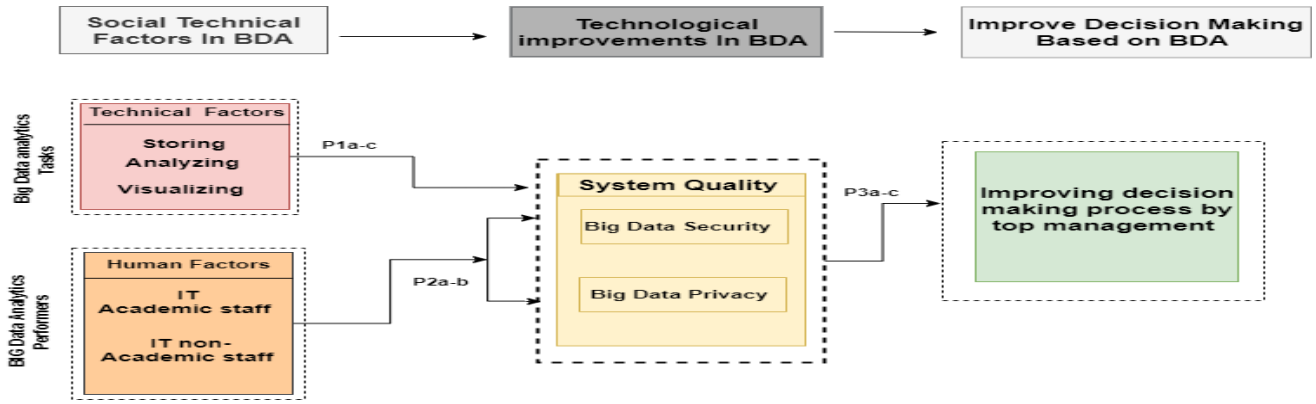

Figure 1. Proposed Research Model

Propositions for Emerging Research

The Propositions presented in this paper are aimed at technological and human factors along with technological improvements for BDA to improve decision making by top management in Saudi Arabian Higher Education. More importantly, in this study, top management's staff are making effective decisions basing on secured and private BD. consequently, the security and privacy are vital and were selected as the main components for improving decisions in Saudis' Higher Educations.

Technological Factors (Big Data Analytics Tasks - BDATs)

Storing Big Data

Big data is characterized by high volume, high velocity, and high variety which posits serious implications on the firm's ability to create sufficient storage that can support quick access to different forms of data (Watson 2014). Ability to store big data from various sources could support decision making by top management teams (Alghamdi 2016).

Analysing Big Data

Storing big data and analyzing it often go hand –in- hand. Firms not only store big data, but they are increasingly doubling their big data management tools to support data integration and analysis for better information outcomes (Magdanz 2014). For instance, universities in Saudi Arabia are considering the possibilities for analysing stored data for supporting decision making.

Visualizing Big Data

Data visualization is the next big step in big data analytics tasks as firms increasingly adopt different business Intelligence and data visualization tools to enhance the management and use of big data. Visualization "has proven effective for not only presenting essential information in vast amounts of data but also driving complex analyses" (Keim et al. 2013, p. 20). Unlike BD storage and analysis, BD visualization is the ultimate step towards enhanced decision making because it creates an attractive and interactive way to guide decision making. **Proposition 1a-c**: BDATs (i.e., storage, analysis and visualisation) will be positively related to system quality.

Human Factors (Big Data Analytics Performers – BDAPs)

Academic and non-Academic Information Technology Staff

Other studies argue that the security of an information system is affected by IT staff (Betz 2016). Besides, BD systems like other IT systems are prone to the effects of the IT staff that use and maintain these systems (Russom 2011). In this research academic and non-academic staffs are crucial human factor for securing g big data within universities in Saudi Arabia as well as ensuring that the privacy of BD is taking place. The security and the privacy of BD performed by the system quality. **Proposition 2a-b:** BDAPs will have a positive effect on system quality.

Technological Improvements in Big Data and Improved Decision Making

System Quality

In this study, system quality is the main theme for BDATI. Besides, system quality is measures as system reliability, accessibility, adaptability, integration, response time and privacy (Ji-fan Ren et al. 2017). However, in this study, system quality is measured by allowing big data tasks such as storing, analyzing, and visualizing as well as BD security and privacy, which will ultimately improve decision making.(Siddiqa et al. 2016; Cavallo et al. 2019).

Security of BD

Information security is a crucial factor not only in IS field, but also important for securing BD (Jung 2017). Data integrity improves decision making, leads to effective decisions and ultimately supports organisation planning and control process (Cavallo et al. 2019). Similarly, data being easily available creates efficiency in the organization's decision making process.

Privacy of BD

The role of BD privacy cannot be underestimated. Recently, various researches have discussed the value of BD privacy which allow organizations to gain business values and competitive advantages (Oussous et al. 2018). Therefore, **Proposition 3a-b**: system quality (i.e., System security, privacy) will positively have an impact on improving decision making by top management.

Improving Decision Making by Top Management

The outcomes of the current proposed model is aimed at improving the decisions making by top management. Nowadays the quality of decision made by top management allow them to improve firm's performance. Therefore, the decision made using analyzed data should allow Saudi universities to gain business values (Elgendy and Elragal 2016).

Research Methods

For the current study, both quantitative and qualitative methods of research are used to examine the hypotheses and demonstrate central theme of the proposed research model. The first method is quantitative method where data would be collected from IT staff in Saudi Universities which include academic and non-academic through

closed-ended surveys (Creswell et al. 2003). The second method in this research is qualitative with the purpose to validate/endorse quantitative results. Additionally, qualitative method would be gathered through semi-structured interviews with the top managements and IT managers in Saudi Arabian universities.

Conclusion

This in progress research investigates on the Effect of technological and human factors that enables the creation, facilitate the process of big data analytics for improving decision making executives in Saudi Arabian Higher Education through big data analytics tasks BDATs and human factors. A conceptual framework is created via extensive research literature that allows the creation of technological and human components that support the implementation of BDA. To conclude, technological and human factors through technological improvements are crucial aspects for improving decision making in Saudi Universities, to achieve it successfully within the organization, human factors which we named it as big data analytics performers must include skill full IT staff to gain the business values of these mentioned factors.

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