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An extension of the technology acceptance model in the big data analytics system implementation environment

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ABSTRACT

Research on the adoption of systems for big data analytics has drawn enormous attention in Information Systems research. This study extends big data analytics adoption research by examining the effects of system characteristics on the attitude of managers towards the usage of big data analytics systems. A research model has been proposed in this study based on an extensive review of literature pertaining to the Technology Acceptance Model, with further validation by a survey of 150 big data analytics users. Results of this survey confirm that characteristics of the big data analytics system have significant direct and indirect effects on belief in the benefits of big data analytics systems and perceived usefulness, attitude and adoption. Moreover, there are mediation effects that exist among the system characteristics, benefits of big data analytics systems, perceived usefulness and the attitude towards using big data analytics system. This study expands the existing body of knowledge on the adoption of big data analytics systems, and benefits big data analytics providers and vendors while helping in the formulation of their business models.

1. Introduction

Given the popularity of digital devices such as personal digital assistants, mobile phones and laptops, and increasing usage of the Internet and social media, the volume of user-generated data has been increasing rapidly in emerging economies like India (Verma & Bhattacharyya, 2016). In India, 66% of the 180 million Internet users regularly access social media platforms, and their numbers are estimated to reach 283 million by 2018 (IAMAI, 2015). Analysing such user-generated data can help in identifying business opportunities for firms in emerging economies (Dubey, Gunasekaran, Childe, Wamba, & Papadopoulos, 2016). Big Data Analytics (BDA) comprises of techniques and technologies to capture, store, transfer, analyse and visualise enormous amount of structured and unstructured data (Erevelles, Fukawa, & Swayne, 2016). Due to fierce competition in the turbulent market environment of emerging economies, firms are adopting state-of-the-art information technologies for competitive advantage (Verma & Bhattacharyya, 2017), BDA being one of them. BDA enables firms to conduct their businesses in more efficient and effective ways by improving customer services, and empowering marketing and sales force (Chen & Zhang, 2014). One can, however, argue that not every firm in emerging economies intends to adopt the BDA technology despite possessing traditional business intelligence and analytics systems (Dubey et al., 2016). In a survey conducted by Qlik in 2015, out of 350 Indian firms surveyed, only 21% of the participating firms had implemented BDA systems, while 42% of the participating firms were potential adopters (Rigby & Bilodeau, 2015). Therefore, in this

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study, the authors attempt to understand the motivating factors among firms that prompt the business decision to adopt BDA systems.

The rapid growth in the usage of digital devices like smartphones, tablets, and Internet of things by consumers and suppliers has added to data complexity and led to the beginning of the BDA era (Bhimani & Willcocks, 2014). BDA can be conceptualised as a suite of data management and analytical techniques for handling very large (from terabytes and exabytes) and complex (from sensor to social media) data. Further, the BDA infrastructure requires advanced data storage, management, analysis and visualised technologies (Chen, Chiang, & Storey, 2012). Gandomi and Haider (2015) referred to BDA as a computation technique with five characteristics, namely, volume, velocity, variety, veracity and value. Because of these five BDA characteristics are posing challenges in delivering business-critical information to both big and small firms alike (White, 2012). Therefore, firms now need data analysts with skills to validate and interpret big data and manage a firm's search applications. Demirkan and Delen (2013) proposed three service models for BDA, namely, Data-as-a-Service, Information-as-a-Service and Analytics-as-a-Service. BDA has led to a paradigm shift towards data-intensive scientific discovery. However, this also comes with several challenges like difficulties in data capturing, data storage, data analysis and data visualisation (Nudurupati, Tebboune, & Hardman, 2016).

BDA is becoming an important asset for business managers due to its ability of creating information and knowledge value. The ability of BDA to identify problems and opportunities from internal and external unstructured data of customers and market could provide cumulative value and knowledge to managers (Chen & Zhang, 2014). As the amount of data continues to grow exponentially, firms from different sectors are becoming more interested in managing and analysing big data. Thus, firms are rushing to seize opportunities offered by BDA and gain benefits from these insights (Erevelles et al., 2016). Consequently, adopting BDA for better and real-time decision-making has the potency to unlock economic value. BDA could create value for a firm by revealing previously unseen patterns, sentiments, and customer intelligence, among other factors (Elgendy & Elragal, 2014). BDA could create value for a firm such as improved performance, customer intelligence, fraud detection, quality and risk management, and supply chain intelligence (Ji-fan Ren, Fosso Wamba, Akter, Dubey, & Childe, 2016). BDA enables firms to enhance existing products, create new services and products and invent entirely new business models. Industries where BDA can unlock new increased economic value include retail, healthcare, manufacturing, banking, telecom and government administration (Elgendy & Elragal, 2014). Using BDA firms can monitor customer sentiments towards brands, comprehend trends, perform direct marketing functions and identify influential individuals (Shen, Wei, Sundaresan, & Ma, 2012). BDA can enable firms to construct predictive models for customer behaviour and purchase patterns, enabling micro-segmentation of customers for targeted promotions and focused advertising. These will finally lead to enhanced profitability for firms (Gandomi & Haider, 2015).

Application of BDA helps analyse geospatial data and stock utilisation on deliveries, which provides insights to manufacturing and retail firms (Erevelles et al., 2016). These insights could enable firm managers to get demand forecast in real-time, automate replacement decisions and identify root causes of cost inefficiency (Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015). These measures could reduce lead times, costs, delays and process interruptions, thereby ultimately creating value. Furthermore, from the supplier side, the quality or price competitiveness can be improved by analysing the supplier's data to monitor performance (Ji-fan Ren et al., 2016). BDA can also minimise performance variability and prevent quality issues by reducing scrap rates and decreasing the time to market (Elgendy & Elragal, 2014). In healthcare, BDA can create value by improving quality and efficiency of services, and by integrating patient data across different departments and institutions (Gandomi & Haider, 2015). BDA can also provide diverse real-time information on aspects such as traffic and weather. BDA can create value for the banking sector by enabling quantification of various operational risks. BDA can even be used to identify networks of collaborating fraudsters, or discover evidence of fraudulent insurance or benefits claims. This may ultimately lead to the disclosures of hitherto unnoticed fraudulent activities (Elgendy & Elragal, 2014).

Given the benefits of BDA systems, it is important to look into the facts that drive BDA adoption in firms. Factors that have been identified for achieving implementation success of BDA systems include top management support (Gunasekaran et al., 2017), big data quality (Kwon, Lee, & Shin, 2014), and well-defined employee roles, including chief technology officers and functional managers (Constantiou & Kallinikos, 2015). BDA implementations require modifications in the existing business process because of the need to adapt organisational processes to match the capabilities of the system (Wang, Gunasekaran, Ngai, & Papadopoulos, 2016). BDA systems are inter-organisational systems and their implementation involves multiple stakeholders from different geographically dispersed locations. BDA systems require standardisation of big data and integration of the system with other information systems. Thus, there is a need to manage several vendors and service providers (Chen & Zhang, 2014). Traditional information systems project management challenges increase manifold in such environments, making BDA implementation more expensive, difficult and failure-prone (Nudurupati et al., 2016). Thus, the results obtained in other traditional technologies like data warehousing and business intelligence implementation environments have not been readily applied to complex BDA systems.

Several research studies have attempted to explain the use and adoption of new information system. However, none of the existing models, frameworks and theories fully explain the reasons for acceptance or rejection of a particular information system (Gangwar, Date, & Ramaswamy, 2015). In order to decrease the attrition of implementation of new information system, it is important to understand the benefits of BDA systems and factors that lead to either negative or positive attitudes towards information systems (Liao & Tsou, 2009). Resistance towards new information system tools like BDA might be attributed to discontented users of a firm that, in turn, might reduce overall organisational performance in the short run (Waller & Fawcett, 2013).

Presently, a vast amount of data related to business processes and customers is being exchanged between buyers, sellers, and competitors. Adoption of BDA systems could lead to changes in business procedures, managerial power and organisational structures (Chen, Preston, & Swink, 2015). Implementation of BDA systems might lead to a higher level of transparency, as BDA supports sharing of information and data across business processes and firm value chain (Gunasekaran et al., 2017). BDA could enable firms to gather, compile and distribute information and establish links amongst trading partners (Kwon et al., 2014). This makes system