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Data analytics competency for improving firm decision making performance

Maryam Ghasemaghaei*, Sepideh Ebrahimi, Khaled Hassanein

DeGroote School of Business, McMaster University, Hamilton, Ontario, Canada

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ABSTRACT

This study develops and validates the concept of Data Analytics Competency as a five multi-dimensional formative index (i.e., data quality, bigness of data, analytical skills, domain knowledge, and tools sophistication) and empirically examines its impact on firm decision making performance (i.e., decision quality and decision efficiency). The findings based on an empirical analysis of survey data from 151 Information Technology managers and data analysts demonstrate a large, significant, positive relationship between data analytics competency and firm decision making performance. The results reveal that all dimensions of data analytics competency significantly improve decision quality. Furthermore, interestingly, all dimensions, except bigness of data, significantly increase decision efficiency. This is the first known empirical study to conceptualize, operationalize and validate the concept of data analytics competency and to study its impact on decision making performance. The validity of the data analytics competency construct as conceived and operationalized, suggests the potential for future research evaluating its relationships with possible antecedents and consequences. For practitioners, the results provide important guidelines for increasing firm decision making performance through the use of data analytics.

1. Introduction

The availability of data with enormous volume, velocity, and variety has resulted in a Big Data revolution that has the potential to lead to improved firms' decision making performance with associated competitive advantages (Chen et al., 2012). To that end, data analytics is being increasingly leveraged by many firms to deal with the massive amounts of data they collect and fulfill their growing needs for better and faster decisions (Fernández et al., 2014; Loebbecke and Picot, 2015). Data analytics is a combination of processes and tools, including those based on predictive analytics, statistics, data mining, artificial intelligence, and natural language processing (Russom, 2011), often applied to large and possibly disperse datasets for gaining invaluable insights to improve firm decision making (Ertemel, 2015). Over the past two decades, data analytics has become a critical organizational Information Technology (IT) competency due to the increased amounts, speed of change, and types of data in business (Kambatla et al., 2014). Firms need to improve their *data analytics competency* (i.e., firm's ability to effectively deploy data analytics-based resources in combination with other related resources and capabilities) to make better, more informed, and faster decisions.

There is some evidence that using data analytics tools can help organizations improve their decision making performance. However, recent studies found that many firms that invested in data analytics could not take full advantage of using these tools. For example, in a recent report, only 25% of firms reported that analytics has "significantly" improved their organization's outcomes

* Corresponding author.
E-mail addresses: ghasemm@mcmaster.ca (M. Ghasemaghaei), s.ebrahimi@mcmaster.ca (S. Ebrahimi), hassank@mcmaster.ca (K. Hassanein).

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(Deloite, 2013). Likewise, Colas et al. (2014) found that only 27% of firms that invested in data analytics reported their initiatives as successful. They argue that most firms could not take full advantage of using these tools due to a variety of reasons such as having low quality data, not using appropriate data analytics tools, and the lake of available analytical skills. Akter and Wamba (2016) also argue that while using data analytics has great potentials for improving firms' outcomes, organizations need to address various challenges in order to reap the benefits. Ghasemaghaei et al. (2017) argue that not all companies investing in data analytics can improve their decision making and different firm resources may play critical roles in successfully using these tools. In addition, Wu et al. (2016) argue that the high failure rate of successfully using data analytics could be due to the fact that often the necessary required conditions to generate insights from data analytics are neglected and most firms only focus on data aspects (e.g., data volume) to generate insight. Hence, it is critical to empirically explore the characteristics of more successful data analytics initiatives. Given the growth in the use of data analytics and the mixed outcomes it has obtained, this study focuses on conceptualizing, operationalizing and validating the concept of *data analytics competency* and strives to understand the impact of data analytics competency on firm decision making performance (i.e., decision quality, and decision efficiency). Defining and validating data analytics competency and its impact on firm decision making performance will offer new insights into the IT competency literature.

In recent years, firms are increasingly in possession of rich sets of data on their customers, businesses, markets and environments, which has been collectively called "Big data" (a concept indicating data that is high in volume, variety and velocity). Furthermore, the ultimate value and result of data analytics is greatly affected by the quality of the data used (Kwon et al., 2014). Without having high quality data (e.g., timely and relevant data) the improvement in firm decision making performance as a result of using data analytics could be impeded (Ghasemaghaei et al., 2016; Sukumar and Ferrell, 2013). Similarly, if users of data analytics do not have proper analytical skills and domain knowledge, decision making performance improvement within firms could be hampered (Waller and Fawcett, 2013). Likewise, if firms do not use sophisticated analytical tools that provide real-time insight, firm decision making performance could be impeded (Davenport, 2013). Hence, and consistent with Bharadwaj's (2000) framework which classified key IT-based resources as IT infrastructure, human IT resources, and IT-enabled intangibles, in the context of this study, data analytics competency is categorized as tools sophistication (IT infrastructure), employee analytical skills and domain knowledge (human IT resources), and data quality and bigness of data (IT-enabled intangibles). While it has been suggested that firms could improve their decision making performance through being competent in the use of data analytics, no studies have conceptualized, operationalized and validated the concept of data analytics competency.

In order to address the gaps identified above, we draw on Bharadwaj's (2000) key IT-based resources framework and Huber's (1990) theory of effects of advanced IT on decision making (Huber's theory) to pursue the following objectives: (i) define and validate the data analytics competency as a multidimensional formative index; and (ii) develop and validate a model to understand the impact of data analytics competency on firm decision making performance (i.e., decision quality, and decision efficiency). Both of the above endeavors are novel aspects not previously considered in the IS literature. Therefore, this study tries to address the following research questions: (1) what are the most critical firm resources that form data analytics competency? and (2) Whether and to what extent does data analytics competency impact firm decision making performance?

2. Deriving the theoretical framework

The Resource-Based View (RBV) of the firm posits that organizations compete on the basis of unique firm resources that are rare, difficult to imitate, and valuable (Barney, 1991). Grant (1991) classified firm resources into tangible, intangible, and personnel-based resources. Tangible resources encompass the physical assets of the firm, while intangible resources include assets such as product quality, and personnel-based resources include technical know-how and employee training. Firms create competitive advantage by assembling their resources to work together to generate organizational capabilities. Competency, thus, refers to a firm's ability to integrate, assemble, and deploy valued resources (Prahalad and Hamel, 2006).

Adopting the RBV of the firm, IS researchers have identified various IT related resources that serve as potential sources of competitive advantage (Seddon, 2014; Tallon, 2008; Wamba et al., 2017; Watjatrakul, 2005). Drawing on Grant's classification scheme for firm resources, Bharadwaj (2000) classified key IT-based resources as: (1) the tangible firm resource consisting the physical IT infrastructure components, (2) the human IT resources comprising the managerial and technical IT skills, and (3) the intangible IT-enabled resources such as knowledge assets.

The physical IT infrastructure, which comprises the computer and communication technologies, has been described as a critical firm resource in obtaining long-term competitive advantage (Bharadwaj, 2000). Viewed from the RBV perspective, the IT infrastructure is considered as a firm resource that makes feasible innovation within firms (Duncan, 1995; Venkatraman, 1991). Indeed, IT infrastructures that enable firms to obtain, process, and share information in real time, and detect opportunities and threats in a timely manner represent an invaluable firm resource (Reed and DeFillippi, 1990) that are central to the resource-based view.

Organizational human resources generally encompass the training, relationships, experience, and insights of its employees (Barney, 1991). Bharadwaj (2000) suggests that the critical dimensions of human IT resources include: (1) technical IT skills, such as systems analysis and design, programming, and competencies in emerging technologies, and (2) the managerial IT skills, which include abilities to effectively interact and coordinate with user community. Firms with strong human IT resources are able to work and communicate with business units more efficiently, integrate the business and IT planning processes more effectively, anticipate future business needs of the firm, and conceive of and develop cost effective and reliable applications that support the business needs of the firm faster than competitors (Bharadwaj, 2000). In addition, the successful use of IT systems and the managerial ability to coordinate the multifaceted activities have been found to be main distinguishing factors of successful firms (Sambamurthy and Zmud, 1992). Viewed from a resource-based perspective, human IT resources are difficult to obtain and complex to imitate; therefore, they