Impacts of Big Data Analytics on Organizations: A Resource Fit Perspective

Emergent Research Forum Papers

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Abstract

Using big data analytics is generally considered to improve organizational performance. However, we argue here that the role of fit between different organizational resources associated with big data use needs to be better understood in order to explore how organizations can create value, increase agility, and ultimately improve overall performance from the use of big data analytics. This research-in-progress study draws on the theory of resource-based view (RBV) and the person-environment (P-E) fit perspective to develop a theoretical model explaining the impacts of fit between various elements including (i.e., tools, data, tasks, employees) on organizational performance. A survey-based methodology is outlined to empirically validate the proposed research model using structural equation modeling techniques. Potential contributions from this research to theory and practice are also outlined.

Keywords

Big data analytics, resource fit, organization performance, agility, value.

Introduction

Big data analytics, defined as tools and processes often applied to large and disperse datasets for obtaining meaningful insights, has received much attention in IS research given its capacity to improve organizational performance (Mithas et al. 2013). Such technologies help organizations to better understand their markets and leverage opportunities by accessing abundant data (Chen et al. 2012). Hence, top-performing organizations frequently use such tools (LaValle et al. 2013). While there is some evidence that using such tools can create value for organizations, the mechanisms that drive this association and the boundaries of this association require further research.

To this end, we integrate the resource-based view (RBV) of the firm (Barney 1991) with the person-environment (P-E) fit perspective (Kristof-Brown et al. 2005). The RBV explains how IT resources, such as big data analytics, can improve firm performance; and the P-E fit perspective explains under what conditions this will happen. Specifically, it explains why the fit between resources and needs is important (Greguras & Diefendorff 2009). We adopt this perspective arguing that P-E fit might influence the value that big data analytics can add to a firm. In essence, we make the case that not all big data analytics initiatives have the same chance of success. The benefits they provide, we argue, will depend on the fit of various relevant firm resources.

To examine these issues, we pose the following research questions:

RQ1: How can big data analytics influence organizational performance?

RQ2: How does the fit between data, data analytic tools, employees capability and tasks influence firm performance antecedents?

Theoretical background

Resource-Based View

The resource-based view (RBV) posits that firm resources drive competitive advantage (Melville et al. 2004). There are four conditions necessary for a resource to create a sustainable competitive advantage including: value, inimitability, rareness, and non-substitutability (Barney 1991). Other important attributes of resources are transparency, durability, replicability, transferability (Grant 1991) appropriability, and competitive superiority (Collis and Montgomery 1995). Resources that are firm specific, difficult to imitate, and valuable enable firms to enhance efficiency, create value, and improve performance (Teece et al. 1997).

The RBV has been used to assess the competitive advantage implications of specific firm resources. In an IT context, it provides a framework for analyzing whether and how IT, as a resource, could be associated with providing value and improving firm performance (Melville et al. 2004). In this study, we argue that the value big data analytics could create depends on the level of fit between these IT tools and other resources in the firm. Along these lines, Resource-based theory can help us understand how the linkage between a firm's "Big Data" related elements including data, analytic tools, and employees, as well as employees' tasks create value, increase agility, and ultimately improve a firm's performance.

Person-Environment Fit Perspective

The Person-Environment (P-E) fit perspective is based on the premise that there should be a fit between elements of the environment to improve organizational performance. This perspective emphasizes how the individuals perceive the situation in the organization (Ayyagari et al. 2011). Particularly, the lack of fit between the elements of the environment could lead to unmet job demands and individual needs (Cooper et al. 2001). In this study, it is believed that the fit between different organizational resources associated with big data use plays a critical role in improving overall organizational performance.

Research Model and Hypotheses

To answer the research questions identified for this study, we propose the research model shown in Figure 1 below which is based on RBV and P-E fit.

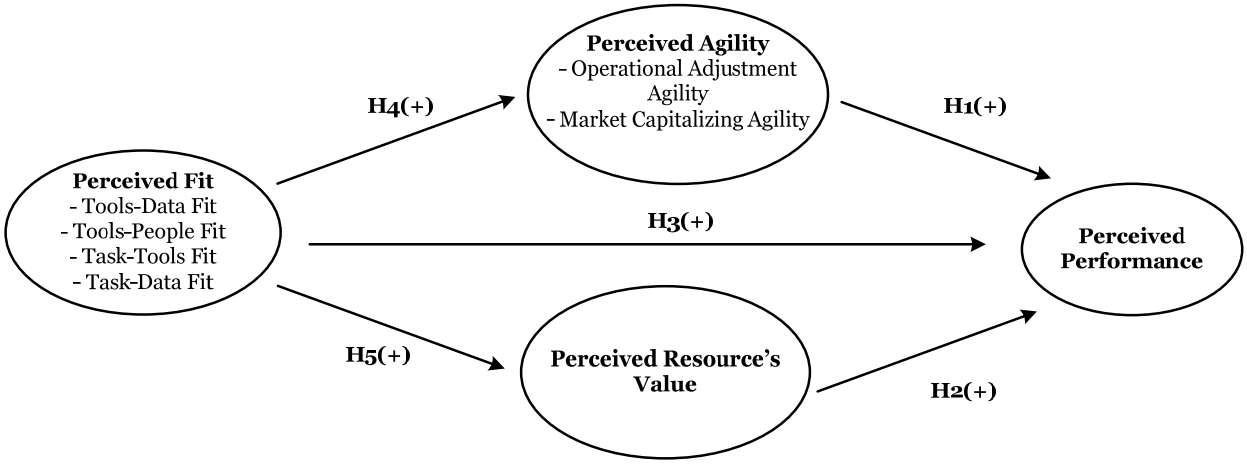

Figure 1. Research Model

Performance refers to overall firm performance, including profitability, productivity, market value, efficiency, competitive advantage, etc. Resource-based theory helps to understand of the linkage between a firm's resources and their impacts on organizational performance (Melville et al. 2004).

Agility: In this study, we consider two types of organizational agility: operational adjustment agility, and market capitalizing agility. *Operational adjustment agility* refers to "the ability of firms' business processes to accomplish speed, accuracy and cost economies in the exploitation of opportunities for

innovation and competitive action" (Sambamurthy et al. 2003, p. 245). Operational agility is considered as a key determinant of an organization's success in today's rapidly changing environments (Huang et al. 2014). *Market capitalizing agility* refers to a "firm's ability to quickly respond to and capitalize on changes through continuously monitoring and quickly improving product/service to address customers' needs" (Lu & Ramamurthy 2011, p. 933). This type of agility emphasizes a dynamic and growth-oriented entrepreneurial mind set about decision making, strategic direction, and judgment in uncertain conditions (Sambamurthy et al. 2003). Both types of agility entail a continual readiness to change, with the former emphasizing speedy implementation and the latter focusing on entrepreneurial mind set (Lu & Ramamurthy 2011).

A high level of firm agility reflects the quickness with which a firm can adapt to changes in the business environment. According to RBV theory, firm agility represents a valuable capability (Swafford et al. 2008) which contributes to a firm's superior performance (Chen et al. 2014). Thus, we hypothesize that:

H1: Higher *firm agility will have a positive impact on organizational performance.*

Resources' Value: Value has the potential to produce competitive advantage. According to RBV theory, value refers to the inimitability, uniqueness, rareness, and nonsubstitutability of resources in organizations. Carmeli & Schaubroeck (2005) argue that high value of the resources improves organizational performance as it leads to differentiation relative to competitors. Likewise, Fahy (2000) suggests that the essential elements of the RBV of the firm are the firm's key resources role to create value which lead to superior performance in the marketplace. Thus, we hypothesize that:

H2: Higher resources *value will have a positive impact on organizational performance.*

Fit: Radhakrishnan et al. (2008) argue that the business value of IT capability lies in leveraging the value of other resources within a firm. It is widely believed that IT does not create business value by itself and should integrate and interact with other organizational resources to influence performance (Nevo & Wade 2010; Chen et al. 2014). According to RBV and P-E fit perspective, in this study, it is believed that to create business value, increase agility and improve organizational performance from big data and data analytics tools, there should be a fit between them with other key firm elements including employees and their job tasks as explained below:

*Data-Tool Fit***:** Modern technologies make available to analysts a vast amount of unstructured and structured data from a variety of sources (Sharma et al. 2010). Thus, analysts need to use sophisticated data analytic tools to analyze the data (Davenport et al. 2010). In recent years, the tools available to handle the velocity, volume, and variety of big data have improved greatly (McAfee & Brynjolfsson 2012). There is a complex relationship between data and analytical tools (Sharma et al. 2014). In order to provide value, there should be a fit between analytical tools and the data that firms have access to. In other words, data analytic tools should be able to fulfil the data analysis needs and analyze the data properly.

Fahy (2000) argues that the essential elements of the resource-based view are value creation and superior firm performance. Chen et al. (2014) also suggest that the match between firm resources increases business opportunities and decrease threats from the exogenous environment. In addition, Huang et al. (2014) found that the use of data analytics improves firm agility. Thus, we expect that a fit between analytical tools and data could create value, enhance agility, and improve firm performance.

Tool-People Fit: Lycett (2013) suggests that although data analytics tools make it easy to discover patterns, relationships, and trends, it is important to understand the causes behind those patterns in order to take actions that generate value. Analysts use the data and analysis as a means to understand the phenomena that the data represent (Sharma et al. 2014).

According to Person-Job fit perspective, there should be a fit between individuals' skills and abilities and the requirements of their job (Edwards 1991). When employees have the skills needed to fulfill job demands, they are more likely to perform at a higher level and are more highly committed to the organization (Ayyagari et al. 2011). Therefore, there should be a good fit between what analytical tools can do and employees' capabilities in order to create value and improve organizational performance.

*Tool- Task Fit***:** There is a need to gain a better understanding of how organizational routines, structures, and decision-making processes impact on the use of data analytic tools (Sharma et al. 2014). Mintzberg

(1979) argues that there should be a fit between organizational task requirements and the mechanisms to perform those tasks. Thus, it is important to have a good fit between the capabilities of the analytical tools and the organizational tasks' requirements. It is therefore expected that a good fit between analytical tools and organizational tasks could create value, increase agility, and improve organizational performance.

*Task- Data Fit***:** Like many new information technologies, big data can reduce organizational costs, decrease time for producing new products and services, and support firm decision making (Davenport & Dyché 2013). However, it is important to note that to gain these advantages, there should be a good fit between the tasks organizations are charged with and the data they have access to. In other words, the tasks business units are responsible for should be well supported by the data available to them. It is therefore expected that a good fit between the data organizations have access to and organizational tasks' requirements could create value, increase agility, and improve organizational performance.

Thus, we hypothesize that:

H3: A higher *perceived fit between task, tools, employees, and data will have a positive impact on organizational performance.*

H4: A higher *perceived fit between task, tools, employees, and data will have a positive impact on organizational agility*.

H5: A higher *perceived fit between task, tools, employees, and data will have a positive impact on perceived value.*

Methodology

Research Methodology

The proposed study will involve a cross-sectional survey of middle level managers who will be recruited through a market research firm. Participants will be directed to complete the survey instrument. Open ended questions will be used to gather details about the employees' organizations and business units regarding the use of data analytics. Moreover, organizations' size, industry type, and revenue will be controlled for in the model. Participation will be voluntary, and each participant will be given monetary compensation for his/her participation. Ethics approval will be secured prior to any data collection.

Measurement Instrument

To ensure content validity, measurement scales for most constructs in the model were selected from the extant literature. Perceived performance will be measured using a 5-item scale adapted from Wu et al. (2014). Perceived agility design will be measured as a second order construct considering both operational adjustment agility and market capitalizing agility using 3-item scales for each from Lu & Ramamurthy (2011). Perceived value will be measured using a 3-item scale from Carmeli & Schaubroeck (2005). Perceived fit will be measured as second order construct considering tools-data fit, tools-people fit, task-tools fit, and task-data fit using 3-item scales for each from Vogel & Feldman (2009).

Instrument Validation

All the constructs in the research model are reflective. For reflective constructs, construct validity (i.e., convergent and discriminant validity) and construct reliability will be calculated. Construct reliability will be assessed using Composite Reliability and Cronbach's alpha (Werts et al. 1974). Discriminant validity will be evaluated using the Average Variance Extracted (AVE) for each construct (Fornell & Cha 1994). Convergent validity will be examined through the AVE for each construct, making sure it exceeds the variance due to measurement error for that construct (i.e. AVE is above 0.5) (Au et al. 2008). Considering that all measures will be collected at one point in time, we will assess the common method bias. Two techniques will be used in this regard: (i) a statistical approach used by Liang et al. (2007); and (ii) Harman's single-factor test, as per Podsakoff et al. (2003).

Data Analysis

The research main questions (RQ1 and RQ2) will be answered through validating the model of Figure 1 through structural equation modeling techniques using Partial Least Squares (PLS) as it is more suited for exploratory research (as the proposed study) (Gefen et al. 2000). The goodness of model fit indices will be also calculated to assess the PLS model in terms of overall (both measurement and structural levels) prediction performance of the model (Vinzi et al. 2010).

Post hoc Analyses and Qualitative Analysis

A post-hoc analysis will be conducted to understand if there are any possible significant relationships which are not hypothesized in the model through a saturated model analysis (Chin et al. 2003). A qualitative analysis will also be conducted in this study with the information acquired from the subjects' responses to open-ended questions. Content analysis techniques will be used to analyze the responses (Bachiochi & Weiner 2002). The results of this analysis will be used to strengthen the quantitative findings through triangulation (Benbasat et al. 1987).

Sample Size

The minimum sample size for validating a model in PLS is ten times the number of items for the most complex construct (Gefen et al. 2000). The most complex scale in the research model has 5 items, resulting in a minimum sample size of 50. Following Roldán & Sánchez-Franco (2012), the minimum sample size required to detect a medium effect size at a power of .80 and alpha of .05 would be 76 cases. To account for potential outliers, 150 participants will be recruited in total.

Conclusion

This research promises to make significant contributions to both theory and practice. It will leverage and integrate the P-E fit and RBV views to examine how the fit between various elements including tools, data, tasks, employees can influence organizational performance. Thus, using this unique integrative view, our research addresses a gap in the literature and advances our understanding of the value of big data analytics. This knowledge can be used for further research in the value of big data analytics tools, and for developing theories for better understanding the circumstances under which IT resources can translate into performance improvements.

The results of this study will also have important implications for managers engaged in using big data analytics to improve firm performance. The potential value that could be created through the use of data analytics is one of the key motivations for why firms are making significant investments in those technologies. Managers need to pay particular attention to considering the fit between organizational resources associated with use of big data if they are to capture the full value it promises.

Notwithstanding the contributions of this study, it has a number of limitations. The study will be conducted among Canadian and U.S. mid-level managers. Therefore, further research is needed to determine the extent to which the findings of this study could be generalized to other geographic regions and to more senior management groups who presumably have a higher-level view of the their firms.

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