The Impact of Big Data on Innovation Performance: The Mediating Role of Market- driven Capability

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Research-in-Progress

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Abstract

Big data has received significant attention in recent years. However, little is known concerning the impact of big data characteristics on innovation performance. This research-in-progress study draws on the organizational learning theory to investigate the influence of big data characteristics on innovation performance mediated by market-driven capability. A survey-based research is outlined to test the proposed research model using structural equation modeling techniques. Prospective contributions to theory and practice are also explained.

Keywords

Big data, market-driven capability, innovation performance.

Introduction

Big data, as an advanced type of information technology (IT) artifact, has been considered as the next pioneer (Manyika et al. 2011) which could enhance firms' outcomes (Calantone et al. 2002). In particular, to increase innovation performance by developing new products and technologies, organizations may leverage big data to understand new trends in the market, gain insights about customers, and refine firm processes (Hazen et al. 2014). Accordingly, it is argued that market-driven organizations can develop innovative features (Day 1994; Han et al. 1998; Hurley and Hult 1998; Slater and Narver 1995); however, the organizational mechanisms associated with big data to increase innovation performance are not yet fully understood. For instance, although previous studies have shown the positive relationship between big data and firms' performance (Ghasemaghaei 2018; Ghasemaghaei and Calic 2019; Wamba et al. 2017; Wang et al. 2019), the impact of big data characteristics on a distinctive organizational capability has not been investigated so far. Hence, in this research, the influence of big data on innovation performance mediated by market-driven capability will be studied.

As a growing number of firms utilizing big data to understand their market and customers' behavior (Xu et al. 2016), it is increasingly crucial to investigate the impact of big data on firms capabilities and performance. Big data characterized by volume, variety, and velocity (Chen et al. 2012) could enhance organizational capabilities and marketing activities (Erevelles et al. 2016). Mainly, market-driven capability including inside-out, outside-in, and spanning processes (Day 1994) may be influenced by utilizing big data which has the ability to develop innovative features such as new products and technologies. For example, big data has been fostered with the advancement in technology which exposes organizations to information in an environment (Chen et al. 2012). However, exposing to external information does not necessarily mean that organizations are able to learn and successfully obtain market related insights and consequently increase their market-driven capabilities (Pennings and Harianto 1992). Therefore, the main objective of this research is to investigate whether more and rich data impacts market-driven capability which eventually enhances innovation performance. This objective leads the study to the following research question:

RQ: Do big data characteristics affect innovation performance mediated by market-driven capability?

To address the above research question, organizational learning theory is used to understand the effects of a firm's related resources and capabilities on innovation performance.

This study serves as a basis for developing guidelines that can help researchers and managers to better understand the impact of big data initiatives on innovation performance. The rest of this manuscript is organized as follows. First, the theoretical background is presented. Next, the research methodology is outlined and finally, potential contribution to theory and practice is noted.

Theoretical background

This section describes theoretical perspectives and definitions that have been applied to comprehend the influence of big data characteristics on innovation performance.

Big Data Characteristics

Big data characteristics refer to volume, variety, and velocity (Chen et al. 2012; Ghasemaghaei and Calic 2019) which means integrating and analysis large amounts of different types of data with speed (Ghasemaghaei 2018). Big data has the ability to increase organizational outcomes by helping organizations to better understand their market (Brynjolfsson et al. 2011; Ghasemaghaei et al. 2017). Consequently, big data enables managers to align organization's strategies and decisions based on their learning from market changes and customer interactions (Pisano et al. 2015). Also, big data provides opportunities for innovation (Gobble 2013) that is emphasized in the McKinsey report (Manyika et al. 2011) by noting that big data is the next frontier for innovation. Big data can support organizations to develop new products (Johnson et al. 2017) and has the impact on new product performance (Citrin et al. 2007).

Market-driven Capability

Capability is comprised of a set of skills and aggregate knowledge through which organizations can coordinate activities and utilize their assets (Dierickx and Cool 1989). Some capabilities such as market-driven are easily distinguishable in organizations since the associated activities are available in the organization and also could be identified in all businesses (Day 1994). Based on Day (1994) research, market-driven capabilities are considered as outside-in, inside-out, and spanning. Outside-in capabilities enable organizations to establish external connections and gather valuable information from outside environment (Roberts et al. 2012). However, inside-out and spanning capabilities are inward-facing and internally oriented (Day 1994). Inside-out capability empowers organizations to facilitate their internal operations (Banker et al. 2006). It is a response to market opportunities and competition. Spanning capability integrates both outside-in and inside-out capabilities of the organizations (Fahy and Hooley 2002). This capability involves spreading information and knowledge through the organization, integrating relevant external knowledge into internal operations, and breeding new insight of market (Ripollés and Blesa 2012). The present study argues that big data has the ability to augment market-driven capabilities and thus increase innovation performance.

Innovation performance

Innovation enables organizations to generate value and competitive advantage in the increasing changing business environments (Madhavan and Grover 1998). Innovative organizations can respond to the environment changes and develop capabilities that help them to reach better performance (Lloréns Montes et al. 2004). Innovation in organizations includes developing new products or services and new administrative systems which play a significant role in enhancing competitive advantage (Damanpour 1991; Hurley and Hult 1998). Furthermore, in the present research, we adopt innovation performance with two factors, administrative innovation performance such as the extent of responsiveness to environmental changes and the degree of innovative administration and technical innovation performance such as developing new technologies or incorporating technologies into new products (Chen et al. 2009).

Organizational learning theory

Organizational learning theory is grounded in the resource-based view (RBV) (Barney 1991), which states that a firm's learning ability is a capability that cannot be easily imitated by competitors (Day 1994). This

theory is related to the development of various insights, knowledge and relationships between different actions (Huber 1991). Specifically, organizational learning refers to the process of improving actions by applying better knowledge and understanding (Fiol and Lyles 1985). Hence, implementing creative ideas in a successful manner, which comprises innovation (Amabile et al. 1996), is closely associated with organizational learning. Accordingly, innovation is considered a learning process that tries to find new ways to solve problems (Alegre and Chiva 2008). Big data can promote organizational learning through the capabilities of data sensemaking routines that try to find trends and patterns and connect them to candidate improving actions (Calvard 2016). Hence, innovation depends on the organization's capability of learning through exploring new and diverse knowledge which can be derived from big data.

As such, the present study focuses on the role of big data in innovation performance through its effect on organizational capabilities including market-driven capability.

Methodology

This study will use a cross-sectional survey of middle managers. This sample frame choice is because the respondents who may be in charge of IT, marketing, and R&D management can better perceive the impacts of big data characteristics on organizational capabilities and innovation performance, and reasonably answer the questions in this regard (Abbasi et al. 2016; Ghasemaghaei et al. 2017). We also performed an applicability check asking ten managers to assess the results to further validate the findings of this study.

The survey instrument will be provided by incorporating all appropriate measurement scales from the literature. For instance, big data characteristics will be measured as a second order formative construct of volume, variety, and velocity each using a 4-item reflective scale adapted from (Johnson et al. 2017). To measure market-driven capabilities, a second order formative construct of outside-in, inside-out, and spanning capabilities using 4, 4, 3-item reflective scale adapted from Ripollés and Blesa (2012) and Wu and Hu (2012) will be applied.

For all constructs, this paper will assess convergent validity by the reliability of the items, and discriminant validity by using Average Variance Extracted (AVE) (Fornell 1994). This paper will conduct a two-step data analysis to examine the measurement model and to test the proposed hypotheses. The research questions will be addressed by validating the model shown in Figure 1 using structural equation modeling techniques. In particular, Partial Least Squares (PLS) (Liang et al. 2007) will be employed. In order to have an acceptable statistical power of 0.8 to obtain a medium effect size (f = .25), at least 84 samples are required for this study (Roldán and Sánchez-Franco 2012). As there might be some potential outliers and to take care of spoiled or incomplete surveys, 150 samples will be collected for this research. Moreover, to better understand the impact of big data characteristics on market-driven capability we will explore the impact of volume, variety, and velocity on each individual capability.

Conclusion

This study makes both theoretical and practical contributions to the nascent body of knowledge about big data. The findings of this study can be applied to conduct further research and develop theories for better understanding how big data characteristics impact firm innovation performance mediated by market-driven capability. Moreover, this research extends literature in organizational learning to the context of big data. The findings of this study will also provide practical implications since utilizing big data within an organization may lead to developing new products and services. Data analysts need to pay particular attention to considering the impacts of volume, variety, and velocity on organizational capability if they are planning to enhance the innovation performance through the novelty of new products and services and more efficient processes and activities. The findings of this research also help firms to distinguish the most critical aspects of big data characteristics that affect market-driven capability.

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