

THE EFFECTS OF BIG DATA ANALYTICS AND INNOVATION CULTURE ON ABSORPTIVE CAPACITY AND INNOVATION

(Research-in-Progress)

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ABSTRACT

The 21st century is the big data era. Conducting innovation based on big data analytics is the future trend of innovation. Studies connect big data analytics to develop data driven innovation, which helps a firm to develop products tailored to customer needs and thus makes such innovation more successful. However, no existing research opens the black box to investigate how big data analytics can support innovation through theoretical foundations. Drawing on absorptive capacity theory, our paper intends to address this void. Specifically, we develop a research model to examine the impacts of big data analytics, absorptive capacity, and innovation culture, three important constructs in the data driven innovation model on innovation. We define big data analytics as a set of analytic technologies based on big data bases. We also introduce the impact of innovation culture on absorptive capacity formation and innovation outcome. We plan to collect data from 1000 local companies. The research results can shed important insight on the mediating role of absorptive capacity and the moderating role of innovation culture in data driven innovation.

Keywords: *Big Data Analytics; Absorptive Capacity; Innovation; Innovation Culture*

Introduction

The 21st century is a data deluge century, which builds computing on data centric (Williams et al. 2008). Huge size of data - big data were generated in business activities. Compared with traditional data, big data has three unique characteristics, which are volume, velocity, and variety. According to McAfee and Brynjolfsson (2012), there are about 2.5 exabytes of data generated every day. Velocity refers to the speed of data creation in real-time, or nearly real-time or streams, which makes it possible for a company to be much more agile than its competitors. Variety indicates that big data takes the form of structured to semi-structured and/or unstructured data, such as messages, updates, and images posted to social networks (McAfee and Brynjolfsson 2012; Russom 2011). Previous studies indicate that big data may enhance firms' innovation (Hemerly 2013), but few studies examine how big data can affects firms' innovation. Thus, we will address this issue and explain how big data analytics can affect firms' innovation.

Theoretical Background

The innovation process is a knowledge exploitation and exploration process. Studies indicates that prior knowledge affects innovation through enhancing the firm's absorptive capacity, which is viewed as an antecedent of organizational innovation. Big data analytics is a business intelligence technology that operates on big data sets, and extends organizational knowledge exploitation and

exploration capabilities. Based on this perspective, we adopt absorptive capacity theory to examine the relationship between big data analytics and organizational innovation.

Absorptive Capacity (ACPC)

Absorptive capacity is the ability of a firm to identify, assimilate, and exploit knowledge from the environment, and it is associated with organization R&D, which is a process of generating new information and developing the firm's ability to assimilate and exploit existing information. (Cohen and Levinthal 1989; 1990). A firm's absorptive capacity is a function of the firm's level of prior related knowledge and is critical to a firm's innovative capability (Cohen and Levinthal 1990). A firm's absorptive capacity is an ability to evaluate, acquire, integrate, and commercially utilize external knowledge (Van den Bosch et al. 1999). Thus, a firm's absorptive capacity has four dimensions, which are knowledge acquisition, knowledge assimilation, knowledge transformation, and knowledge exploitation (Zahra and George 2002).

Big Data Analytics (BDA)

Grounded in data mining and statistical analysis (Chen et al. 2012), big data analytics is one type of business intelligence technology that uses advanced analytic techniques, such as predictive analytics, data mining, statistical analysis, complex SQL, data visualization, artificial intelligence, natural language processing, and database capabilities that support analytics (Russom 2011). Big data analytics is "an advanced analytic techniques operates on big data sets", which can help firms to explore new business opportunities and develop new business processes (Russom 2011).

Innovation (I)

Innovation refers to the design, invention, development and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm (Joshi et al. 2010). Effective innovation requires the creation, capture, harvest, sharing and application of knowledge (Lemon and Sahota 2004). By accessing a large number of knowledge sources, firms can enhance their innovation capabilities (Leiponen and Helfat 2010). In conclusion, innovation is an organizational knowledge production from exploitation and exploration process (Kleis et al. 2012).

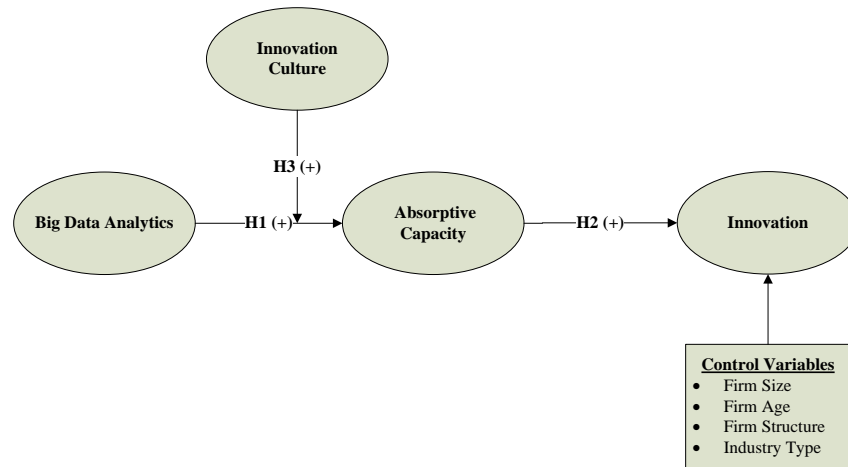
Innovation Culture (IC)

Organizational culture is shared values, beliefs, and behavior expected of members of an organization (Lemon and Sahota 2004). It builds on a set of well-worked assumptions in the past that are accepted as valid within the firm, and forms an integral part of the general functioning of an organization (Martins and Terblanche 2003), which creates a guideline or pattern of regular and predictable activity (Nelson and Winter 2009). Innovation culture is one type of organizational culture. AECA define innovation culture as "a way of thinking and behaving that creates, develops, and establishes values and attitudes within a firm, which may in turn raise, accept and support ideas and changes involving an improvement in the functioning and efficiency of the firm."

Research Model and Hypotheses Development

In this section, we propose a theoretical model that explains the relationship between big data analytics and innovation. Figure 1 depicts such model.

Figure 1. Conceptual Model



Big Data Analytics and Absorptive Capacity

Absorptive capacity has four dimensions: knowledge acquisition, knowledge assimilation, knowledge transformation, and knowledge exploitation (Zahra and George 2002).

Big data analytics can help organizations extract value from very large volumes of a wide variety of data by enabling high-velocity capture, discovery, and/or analysis (Villars et al. 2011). Big data analytics also provides various analytical mechanisms, such as MapReduce, Dryad, and All-Pairs, to improve the analytical capabilities of firms and help firms identify the useful information from organizational memory, thus increasing the organizational memory quality. Big data analytics supports knowledge transformation and exploitation by providing a set of sophisticated analytic tools to help firms exploit existing knowledge to create new knowledge. Big data analytics can enhance exploitation capability by facilitating the use of existing data to conduct organizational decision process (McAfee and Brynjolfsson 2012). Based on those, we develop the first conclusion, which is

H1: Big data analytics is positively related to organizations' absorptive capacity.

Absorptive Capacity and Innovation

Innovation process is a new knowledge creation process. Firms that continually invent new knowledge are likely to have a greater number of inventions that can be converted to a greater number of new products and services (Joshi et al. 2010). As a capability of knowledge absorption (Van den Bosch et al. 1999), ACAP is a critical antecedent of organizational innovation (Cohen and Levinthal 1990). ACAP promotes the speed, frequency, and magnitude of innovation (Zahra and George 2002). ACAP will affect an organization's ability to search for new knowledge and build new connections with other companies (Zahra and George 2002). Network affects a firm's capabilities to access external resources (Uzzi 1997), which affects organizational innovation. ACAP also affects a firm's ability to understand knowledge and organizational learning capability (Zahra and George 2002), thus influencing organizational innovation. Based on these arguments, we conclude that

H2: A firm's absorptive capacity is positively related to the firm's innovation.

Moderating Effect of Organizational Culture

Absorptive capacity is an accumulated capacity of individuals (Cohen and Levinthal 1990). Therefore, without support from all employees, firms cannot increase their absorptive capacity. Innovation culture encourages knowledge sharing among employees (Claver et al. 1998). Sharing knowledge enhances the ability of individuals to understand the effect of big data analytics, and thus strengthen the relationship between big data analytics and absorptive capacity. We conclude that

H3: Innovation culture positively moderates the relationship between big data analytics and absorptive capacity.

Method

CEO's of small to medium size firms in the technology industry will be surveyed. We propose to measure our constructs by adopting measures from previous literature. Innovation scales were adapted from Keskin (2006). Absorptive capacity scales were adapted from Armstrong et al. (2015). Innovation culture scales were adapted measure from Dobni (2008). Big data analytics was measured by new scales, which are used to measure the degree to which the firm uses big data techniques and technologies. Firm size, age, structure, and industry have been shown in prior studies to affect firms' innovation. Thus, we control for those four factors in our model.

Contributions and Limitations

Our research has two contributions. First, this is the first study that explains the forming mechanism of data driven innovation. Second, we also explain the effect of innovation culture, which highlights the role of organizational culture. We also have several limitations. The first limitation is that our data is mainly from technology companies. Future research can gather more data from different industries. Second, we did not consider environmental effects. Future research should consider environmental effects, which may provide a more comprehensive picture of data driven innovation. Third, our survey collected data in the US. Future research could collect data cross culturally or from other countries.

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