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Data quality management, data usage experience and acquisition intention of big data analytics

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ABSTRACT

Big data analytics associated with database searching, mining, and analysis can be seen as an innovative IT capability that can improve firm performance. Even though some leading companies are actively adopting big data analytics to strengthen market competition and to open up new business opportunities, many firms are still in the early stage of the adoption curve due to lack of understanding of and experience with big data. Hence, it is interesting and timely to understand issues relevant to big data adoption. In this study, a research model is proposed to explain the acquisition intention of big data analytics mainly from the theoretical perspectives of data quality management and data usage experience. Our empirical investigation reveals that a firm's intention for big data analytics can be positively affected by its competence in maintaining the quality of corporate data. Moreover, a firm's favorable experience (i.e., benefit perceptions) in utilizing external source data could encourage future acquisition of big data analytics. Surprisingly, a firm's favorable experience (i.e., benefit perceptions) in utilizing internal source data could hamper its adoption intention for big data analytics.

1. Introduction

Advanced IT devices, social media services, and corporate information systems are continuously churning out very large amounts of structured and unstructured data (dubbed big data) and businesses are increasingly facing challenges in managing and capitalizing them to their advantage. Characterized by volume, variety, velocity, and value (Chen, Chiang, & Storey, 2012), big data analytics is believed by industry practitioners to be the next 'blue ocean' in nurturing business opportunities. We define big data analytics as technologies (e.g., database and data mining tools) and techniques (e.g., analytical methods) that a company can employ to analyze large scale, complex data for various applications intended to augment firm performance in various dimensions. With that definition, high-tech data storage, management, analysis capability, and visual technologies are all part of big data analytics (Chen et al., 2012). Through big data analytics, a firm can do better in monitoring acceptance of products/services in the marketplace and in understanding its business environment, potentially fueling competitive advantages (Davenport, 2012). Already there is no shortage of evidence that big data analysis, if adequately done, can unleash major impacts on reducing business costs, kindling business insights, and unraveling strategic information, and subsequently boosting quality and effectiveness of corporate decision making.

Some firms have already jumped on the "big data" bandwagon. In fact, unlike technology firms (e.g., Google, IBM, and Apple) who are at the forefront of big data analytics and thus highly bullish about its business potentials, a large share of the industry and academia are divided over its strategic values. First of all, many companies are still un-decisive in adopting big data analytics. Although this may be due to a lack of relevant understanding and experience, the situation points to the need for more research to comprehend issues (e.g., key facilitators) pertaining to big data adoption. Second, some scholars take a position similar to Boyd and Crawford (2012) to whom big data is "a cultural, technological, and scholarly phenomenon that rests on the interplay of technology, analysis, and mythology that provokes extensive utopian and dystopian rhetoric". To them, big data may be a socio-technical phenomenon whose real benefits should be critically questioned and carefully examined.

Grounded on the theoretical lens of the resource based view (RBV) and isomorphism, this research intends to empirically investigate how firm attributes, mainly in terms of data quality management and data usage benefits, affect the adoption intention of big data analytics. RBV implies that the capability of big data analytics, data quality management, and data usage experience are all intangible firm resources. In this study, therefore, we take the position that big data analytics is an innovative IT capability and

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a strategic resource that can render competitive advantages to an adopting firm. Grounded in that position, this research examines the dynamics among firm level data quality management and its impact on data usage and adoption intention of big data analytics.

2. Theories

We draw on two theoretical perspectives to explain the adoption intension of big data analytics at a firm: resource based view (RBV) and isomorphism. RBV is useful in understanding innovation-related activities and performance through the theoretical perspectives of organizational resources and capabilities (Dosi, 1988). RBV portrays physical IT infrastructure as a tangible resource, whilst experience, technology competence, and knowledge, such as employees' skills and knowhow (Lieberman & Montgomery, 1998), are seen as intangible resources derived from combinations of internal investments and external appraisals. Strength in such tangible and intangible resource assets grows overall IT capability of a firm and this can lead to competitive advantages and ultimate performance superiority (Barney, 1986; Kim & Tsai, 2011). IT capability thus obtained plays an important role in affording a firm's competitive strength as an imperfectly imitable and non-substitutable resource that other competitors pay considerable costs in order to acquire the same capability (Lim, Stratopoulos, & Wirjanto, 2011).

The richer a company's resources, the more the company is able to adopt new resources in an agile manner (Lieberman & Montgomery, 1998). Adopting big data analytics as a firm-level innovation aims to achieve firm heterogeneity and hence affords higher value and awareness in securing sustainable advantages. Drawing on the RBV perspective, this study examines the theoretical relationship wherein capability of data quality management and data usage experience constitute intangible assets (or resources) that lead a firm to higher IT capability. There may be a causal relationship between the two dimensions in which better management practice of corporate databases in their quality furnish people with more confidence in data-driven decision making. In this light, heightened quality of corporate data could be a positive force in shaping an organizational culture that encourages usage of internal and external data for operational and strategic decision making. The expanded IT capability in data management and utilization is expected to become a virtuous force in furthering adoption of new data-related IT capability (i.e., big data analytics) and in sustaining the firm's competitiveness and growth (Argyris, 1996).

Besides RBV, isomorphism could also explicate a firm's intention to adopt an innovative IT such as big data analytics. According to neo-institutional isomorphism, the purpose of organizational innovations is not only to increase efficiency, but also to pursue similarities with benchmarked organizations. The classic view of neo-institutional isomorphism states that an organization's IT innovation tends to be affected by the fact that other, more recognized organizations have already adopted the technology regardless of its efficiency or rationality of doing so (Radaelli, 2000). Latecomer organizations usually seek legitimacy of such innovation adoption by describing it as a critical business trend or a socially desirable value. Thus, an organization's behaviors reflect rationalized norms and values shared within a society (Meyer & Rowan, 1977). As a form of social contagion, therefore, the spread of an IT innovation such as big data analytics among leading companies or competitors may motivate other firms to investigate and deploy the technology even if precise and exact measurement of its benefits is hard (Cavusoglu, Hu, Li, & Ma, 2010).

Akin to the 'external' isomorphism, 'internal' isomorphism may also be found where such a source of contagion (e.g., cognitive learning or benchmarking) is internal to an organization. That is, past internal success such as large scale management of internal data and resulting rewarding usage experience may facilitate adoption of in-kind innovations. Previous success performing similar tasks with innovative ITs could aid bold technology adoption despite its inherent uncertainties. In-depth case studies of a technology and relevant training can also be helpful. In addition, the neo-institutional view implies that uncertainties about core technologies make a firm depend more on such isomorphism. The less specific information that they have about the technology, the more a company can follow existing practices or draw on past experience. Consistent with the neo-institutional view, decision-making regarding big data analytics may be significantly affected by the success of past similar projects when subject knowledge is limited at a firm.

3. Research model

A research model is proposed to predict the intention to obtain big data analytics through the lens of RBV and 'internal' (rather than 'external') isomorphism (Fig. 1). In that model, a firm's control in maintaining corporate data quality is expected to significantly boost benefit perceptions from the usage of corporate data. Meanwhile, successful experience with data usage, as a form of important human capital (Kim & Tsai, 2011), should become a positive force in pursuing innovative big data analytics. The data usage experience as an intangible asset is divided into two types: that of internal data and that of external data. The term, internal data, refers to any data that are produced internally by a firm as a direct or indirect result of business operations. Those regarding employees, products and services, the production line, management decisions, customer profiles and transaction records, and corporate resources are representative types. External data are obtained from sources over which a firm has little or no control such as additional customer information, the market, competitors, macroeconomics, and those of the firm's natural environment. In the context of big data analytics, capitalizing such external information may turn out to be highly valuable for corporate decision making or accumulating business knowledge (Chen et al., 2012). Thus, processing external data for sense making becomes an integral part of big data analytics. A data source that particularly interests big data adopters is customer-generated information from social media or social networking services, stored in multiple locations across several geographies (Griffin, 2012). Besides the variables of data quality management and usage-driven benefits, it is anticipated that a firm's proactive culture in capitalizing on new IT capability is a key facilitating force of innovation adoption, and therefore included in the model as a control variable (i.e., resource facilitating condition).

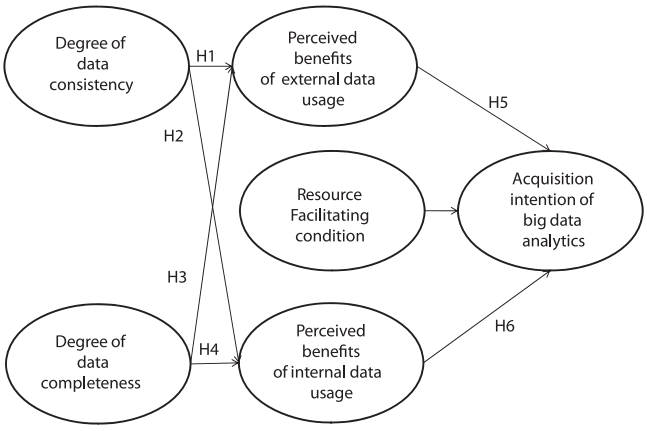

Fig. 1. Research model: the process of resource acquisition.