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Big data and predictive analytics for supply chain and organizational performance<sup>☆</sup>

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## ABSTRACT

Scholars acknowledge the importance of big data and predictive analytics (BDPA) in achieving business value and firm performance. However, the impact of BDPA assimilation on supply chain (SCP) and organizational performance (OP) has not been thoroughly investigated. To address this gap, this paper draws on resource-based view. It conceptualizes assimilation as a three stage process (acceptance, routinization, and assimilation) and identifies the influence of resources (connectivity and information sharing) under the mediation effect of top management commitment on big data assimilation (capability), SCP and OP. The findings suggest that connectivity and information sharing under the mediation effect of top management commitment are positively related to BDPA acceptance, which is positively related to BDPA assimilation under the mediation effect of BDPA routinization, and positively related to SCP and OP. Limitations and future research directions are provided.

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## 1. Introduction

Big data and predictive analytics (BDPA) is an all-encompassing term for techniques destined to handle big data characterized in terms of high volume, velocity and variety (Duan & Xiong, 2015; Wang, Gunasekaran, Ngai, & Papadopoulos, 2016; Zhou, Chawla, Jin, & Williams, 2014). Big data can help address critical challenges of predictive analytics that refer to data capture, storage, transfer & sharing (i.e. system architecture), and search, analysis, and visualization (i.e. data analytics) (Chen, Chiang, & Storey, 2012; Duan & Xiong, 2015; Erevelles, Fukawa, & Swayne, 2016). BDPA can improve supply chain performance by improving visibility (Barratt & Oke, 2007), resilience and robustness (Brandon-Jones, Squire, Autry, & Petersen, 2014), and organizational performance (OP) (Schoenherr & Speier-Pero, 2015; Waller & Fawcett, 2013).

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Nevertheless, Hazen, Boone, Ezell, and Jones-Farmer (2014) claim that knowledge on how to assimilate BDPA and its influence on SCP and OP is scant. To address this gap, this research draws on resource based view (RBV) (Barney, 1991; Barney & Clark, 2007; Peteraf, 1993; Wernerfelt, 1984), management commitment (Jarvenpaa & Ives, 1991; Liang, Saraf, Hu, & Xue, 2007) and post-adoption diffusion of innovation (Hazen, Overstreet, & Cegielski, 2012; Saga & Zmud, 1994) to develop and test a model that explains the impact of BDPA in SCP and OP. Assimilation is the extent to which technology diffuses across organizational processes, and is part of three-stage post-diffusion process (i.e. acceptance, routinization, and assimilation) (Hazen et al., 2012; Saga & Zmud, 1994). Acceptance concerns how well an organization's stakeholders perceive the BDPA. Routinization concerns how well an organization's governance systems are adjusted to accommodate BDPA, and assimilation concerns how well BDPA has diffused across organizational process. This paper contributes to the BDPA literature (Ji-Fan Ren, Wamba, Akter, Dubey, & Childe, 2016; Whitten, Green, & Zelbst, 2012) by investigating to what extent resources (connectivity and information sharing) impact on BPDA acceptance and assimilation capabilities under the mediating effect of top management commitment, and the impact of BDPA assimilation on SCP and OP. This research, hence, extends those studies focusing on the role of information sharing and top management commitment on supply chain transformation and firm performance (Hitt, Xu, & Carnes, 2015;

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Prajogo & Olhager, 2012; Waller & Fawcett, 2013; Wu, Yenyurt, Kim, & Cavusgil, 2006) for the achievement of competitive advantage.

## 2. Theoretical background

### 2.1. Resource-based view

Resource based view argues that organizations achieve competitive advantage by creating bundles of strategic resources and/or capabilities (Barney, 1991; Barney, Wright, & Ketchen, 2001; Sirmon, Hitt, Ireland, & Gilbert, 2011). Superior firm performance relies on the extent a firm possesses simultaneously valuable (V), rare (R), imperfectly imitable (I) resources which are properly organized (O) (Amit & Schoemaker, 1993; Barney et al., 2001). Resources can be 'physical capital', 'human capital', 'technological capital', and 'reputational capital', either 'tangible' (e.g. infrastructure) or 'intangible' (e.g. information or knowledge sharing) (Größler & Grübner, 2006). When bundled, resources have significant value (Grant, 1991; Sirmon, Gove, & Hitt, 2008). Whereas resources refer to the tangible and intangible assets, capabilities are subsets of a firm's resources which are non-transferable and aim at enhancing the productivity of other resources (Makadok, 1999). Hence, capabilities are an absolute necessity for an organization (Hitt, Ireland, Sirmon, & Trahms, 2011) and depend on the environmental conditions in which an organization operates.

However, RBV recognizes that resources cannot provide competitive advantage by themselves. Sirmon, Hitt, and Ireland (2007) highlight the role of top managers in capability building, structuring the resource portfolio using the particular processes (acquiring, accumulating, and divesting); other studies investigate the importance of managerial decisions in resource acquisition and deployment (Grewal & Slotegraaf, 2007), and the role of managers in orchestrating resources (Chadwick, Super, & Kwon, 2015).

However, few studies investigate the effect of the combination of resources and capabilities on performance (Brandon-Jones et al., 2014; Ravichandran & Lertwongsatien, 2005; Rungtusanatham, Salvador, Forza, & Choi, 2003). For instance, Wu et al. (2006) argue that the utilization of capabilities may help organizations to achieve or sustain competitive advantage.

In this paper RBV is used to conceptualise BDPA assimilation as a capability that impacts on SCP and OP. Resources such as connectivity and information sharing under the mediation effect of top management

commitment (TMC) help BDPA assimilation (capability), which impacts on SCP and OP (Fig. 1).

### 2.2. Connectivity and information sharing

Following RBV, resources are bundled together to build capabilities (Grant, 1991). Connectivity (C) and information sharing (IS) are resources (Fig. 1) (Ji-Fan Ren et al., 2016; Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015). Premkumar and King (1994) define IS as organizational capital that focuses on the flow of information. Hazen et al. (2014) argue that the utilization of IS depends on quality. However, Ji-Fan Ren et al. (2016) postulate that quality, accessibility, accuracy, and relevance of IS rely on effective delivery, depends on IT infrastructure (Fawcett, Wallin, Allred, & Magnan, 2009; Sharif & Irani, 2006; Irani, 2010; Brandon-Jones et al., 2014). Therefore:

**H1.** Connectivity is positively related to information sharing.

### 2.3. Impact of connectivity and information sharing on BDPA acceptance under the mediation effect of top management commitment

Literature underlines the role of top management in knowledge and IS (Luo & Hassan, 2009). Chatterjee, Grewal, and Sambamurthy (2002) look into top management beliefs and their influence on opportunities and risks related to the assimilation of Web technologies, whereas Liang et al. (2007) investigate the mediating role of TMC in the successful assimilation of ERP. Following an RBV perspective, C and IS are resources that build 'BDPA acceptance' capability.

Scholars (Sirmon et al., 2007; Augier & Teece, 2009; Hitt et al., 2015) highlight the role of top managers in building capabilities and subsequently helping firms achieve competitive advantage. Management commitment orchestrates resources and creates capabilities (Chadwick et al., 2015; Prajogo & Olhager, 2012).

Notwithstanding the importance of TMC in the assimilation of technologies, literature is underdeveloped in the case of building BDPA acceptance capability. Scholars suggest that the acceptance of technology (i.e. BDPA) is the first stage of the assimilation process (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003), followed by routinization and assimilation (Hazen et al., 2012; Saga & Zmud, 1994). Hence, both C and IS impact positively on BDPA acceptance under the mediation effect of TMC. Therefore,

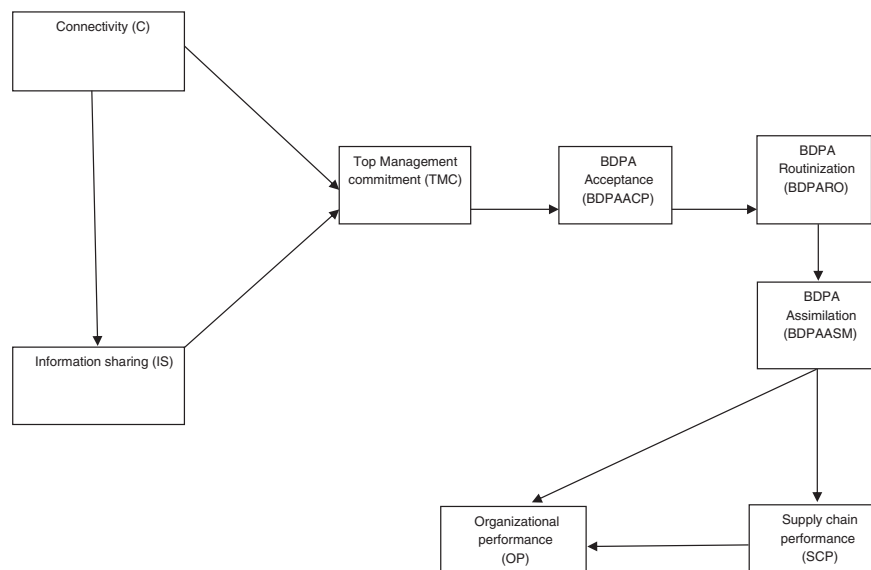


Fig. 1. Proposed model.

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