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Resource management in big data initiatives: Processes and dynamic capabilities☆,☆☆

Ashley Braganza [a,*], Laurence Brooks [b], Daniel Nepelski [c], Maged Ali [d], Russ Moro [a]

[a] Brunel University London, College of Business, Arts and Social Sciences, Brunel Business School, UB8 3PH, UK
[b] De Montfort University, Centre for Computing and Social Responsibility (CCSR), The Gateway, Leicester LE1 9BH, UK
[c] European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Calle del Inca Garcilaso 3, Seville 41092, Spain
[d] Essex University, Essex Business School, Wivenhoe Park, Colchester, CO4 3SQ, UK

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ABSTRACT

Effective management of organizational resources in big data initiatives is of growing importance. Although academic and popular literatures contain many examples of big data initiatives, very few are repeated in the same organization. This suggests either big data delivers benefits once only per organization or senior managers are reluctant to commit resources to big data on a sustained basis. This paper makes three contributions to the Special Issue's theme of enhancing organizational resource management. One is to establish an archetype business process for big data initiatives. The second contribution directs attention to creating a dynamic capability with big data initiatives. The third identifies drawbacks of resource based theory (RBT) and it's underpinning assumptions in the context of big data. The paper discusses lessons learnt and draws out implications for practice and business research. The paper's intellectual and practical contributions are based on an in-depth case study of the European ICT Poles of Excellence (EIPE) big data initiative and evidence from the extant literature.

1. Introduction

This paper develops an archetype business process for big data initiatives and the roles required for effective big data resource management. The literature assumes processes for big data initiatives exist and that resources are managed accordingly. This assumption appears baseless as the literature lacks coherent processes for big data initiatives within which to manage resources. This concern is compounded by vast amounts of resources businesses (public, private and third sector) put into big data. The analysis identifies limitations in resource based theory in the context of big data initiatives.

This paper has three objectives; the first objective is to set out an archetypical business process for big data initiatives. The literature has several reported examples of big data successes, see for example Davenport (2013) yet, very few examples are of repeated success by the same organization. Big data appears to be a 'one off' incident in most organizations. This paper argues that for big data to be truly strategic, senior leaders need a process they can implement to ensure benefits are delivered from investments made in organizational resources for big data. Previous scholarly studies show little or no attention is given to proposing a coherent and sustainable process for implementing big data initiatives. The tradition of developing archetypes is established in the management literature (Greenwood & Hinings, 1993). More contemporary examples include studies of buyer and supplier archetypes (Kim & Choi, 2015).

The second objective is to examine roles in big data initiatives. The concern is that lack of clarity in various roles necessary for big data initiatives hampers organizations from using resources strategically. Conventional approaches to strategy suggest mission critical roles are carried out by organizations or their close partners. This paper argues that in big data programs many roles are outside organizations and the nature of relationships are more transitory than previous partner relationships formed through alliances, joint ventures or outsourcing agreements.

The third objective is to challenge mindsets related to big data resources. The concern is big data is implemented using resource based theory (RBT) thinking about organizational resource management. The paper argues big data overturns many of RBT's assumptions

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* Corresponding author.
E-mail addresses: ashley.braganza@brunel.ac.uk (A. Braganza), laurence.brooks@dmu.ac.uk (L. Brooks), daniel.nepelski@ec.europa.eu (D. Nepelski), maaali@essex.ac.uk (M. Ali), russ.moro@brunel.ac.uk (R. Moro).

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about resources to achieve competitive advantage. Yet, scholars face difficulties overcoming vested interests in research steeped in theories found wanting by big data. Agarwal and Dhar (2014) observe that while big data is premised on open access to data so that prior knowledge can be tested and falsified (Popper, 1963), academics base their work on data that they do not release for others to challenge or confirm those findings. RBT needs questioning in the context of big data.

This paper makes three contributions to big data. First is an archetype process for big data initiatives. Second is to direct attention towards big data as dynamic capability in organizations. Third is to explore limitations of RBT when applied to big data initiatives. The paper sets out implications for practice and business research.

Big data is a global phenomenon (Brumfiel, 2011). Big data has potential to increase economic returns by gaining deeper insights from oceans of data available. Various estimates of sources and volumes of data being produced include CISCO's estimate "by 2020, the gigabyte (GB) equivalent of all movies ever made will cross the global Internet every 2 minutes" (Cisco Visual Networking Index, 2016, p.4). Amazon, Google, Facebook, Twitter and other social media as well as telecommunications companies produce massive quantities of data. Data sources include smart phone applications, the internet of things, machines, meters and sensors that ubiquitously collect data. Big data has led to the creation of new technologies, methods, data capture applications, visualization techniques, and data aggregation capabilities. Drawing on established business intelligence, data mining and analytics practices, big data methodologies spawn new generations of algorithms and renew interest in mathematics, statistics and quantitative analysis.

Much of the extant research focuses upon defining big data in terms of Vs (exactly how many is outside this paper's scope): Volume, Variety, Velocity, Validity, Veracity, Value and Visibility (Erevelles, Fukawa, & Swayne, 2016; Power, 2014). Another significant area of study is big data infrastructure, namely technologies, analytics and methods organizations use to enable big data (Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015). Scholars recognize big data is more than a technological issue and, to be fully effective, big data needs to become part of the fabric of organizations (Davenport, Barth, & Bean, 2012). Big data should be incorporated into strategic activities such as marketing and new product development (Xu, Frankwick, & Ramirez, 2016). Others recognize big data affects organizational culture, as decision making becomes more evidence-based (Erevelles et al., 2016; Irani, 2010). The literature assumes big data is beneficial for all organizations and this may not be the case.

An assumption underpinning big data is that data is an asset. As with other assets, data can be used to improve competitiveness, innovation and efficiencies in organizations. These arguments by proponents of big data are not new. Organizations have been collecting, storing and analyzing data contained in customer relationship management, enterprise resource planning or human resource management systems. Organizations spent millions of dollars on implementing information management and data warehousing systems to own and control data. Data samples were used to predict future patterns simply because there was insufficient computing power to analyze large volumes and varieties of data. These conventional practices are termed small data (Mayer-Schönberger & Cukier, 2013).

This paper is structured as follows: first the literature is reviewed. Then, an empirical exemplar case of the European ICT Poles of Excellence (EIPE) big data initiative is presented. Next, the empirical example and literature is discussed to develop the process for big data, examine big data and dynamic capabilities and consider RBT's shortcomings. Finally, following implications for practitioners, the paper identifies limitations and presents brief conclusions.

2. Theoretical foundations

Three theoretical frames of reference are relevant to develop thinking about big data. These are knowledge based views of organizations, resource based theory and dynamic capabilities. These three approaches are chosen because individually they offer selective insights into the phenomenon of big data; collectively, they provide a frame to examine big data processes, relationships and resources. Prior research in knowledge management suggests big data may yield deeper understanding for strategic action. One of several critical resources in big data is data itself and RBT provides the Value, Rarity, Imperfect Imitability and Non-substitutability (VRIN) framework to consider strategic resources. RBT addresses issues of resource ownership, attributes of resources and, most importantly, enables discussions about big data's contribution to strategic advantage. Dynamic capabilities refer to ways in which organizations configure and continually reconfigure processes to achieve beneficial outcomes. Many big data examples in the extant literature refer to 'one-off' big data deployments. Dynamic capabilities suggest ways in which organizations, that want to exploit big data, reconfigure resources to make big data initiatives repeatable and sustainable rather than isolated events.

2.1. Knowledge-based view (KBV) of organizations

Knowledge management (KM) is firmly established in scholarly literature since the 1990s. Early works focused upon the nature of knowledge (Nonaka & Takeuchi, 1995), its contextual sensitivity (Lam, 2000) and knowledge based systems (Davenport & Prusak, 1998). KM is examined from multiple perspectives: strategy (Barney, 2001), organization (Choo, 1996) and capabilities (Kogut & Zander, 1992). Contemporary researchers use KM as a theoretical foundation to study effects of external turbulence on organizational structures (Liao et al., 2011). The ability of organizations to incorporate external information into innovations has received much research attention since Cohen and Levinthal's (1990) treatise on absorptive capacity. Camisón and Forés (2010) argue absorptive capacity is measured using various proxy measures such as patents filed (Zhang, Baden-Fuller, & Mangematin, 2007), number of publications (Mangematin & Nesta, 1999) and employees' educational qualifications (Caloghirou, Kastelli, & Tsakanikas, 2004). Camison and Fores use Zahra and George's (2002) constructs of absorptive capacity to develop four dimensions of knowledge capabilities: Acquisition, Assimilation, Transformation and Application. According to Filippini, Güttel, and Nosella (2012), knowledge management initiatives are "characterized by a set of methods (formal descriptions of objectives and tasks), roles (social structures and responsibilities), resources (human resources, time, and infrastructure), and organizational routines that enable either exploratory or exploitative learning" (p.318). More recently, Donate and de Pablo (2015) studied leadership effects on organizations' abilities to explore and exploit knowledge. They draw upon leadership literature, arguing that knowledge-oriented leadership is important to KM initiatives. Many KM initiatives focus on acquiring, analyzing and exploiting customer information. The growth of internal databases to capture customer information and access to external data from web based sources provides organizations with unprecedented opportunities to develop innovative and tailored offerings to customers and other stakeholders. Yet, turning data into meaningful information is proving highly challenging to organizations. Rollins, Bellenger, and Johnston (2012) conclude organizations are muddling through with managers dealing with decisions in front of them "rather than taking a longer-term planned approach" (p.763).

2.2. Resource-based theory (RBT)

Wernerfelt (1984) argues organizations overlook the effects internal resources have on competitive advantage, in favor of industry, market and product related factors. Barney (1986b) suggests internal resources are greater determinants of strategic advantage than external factors. Dierickx and Cool (1989) recognize the importance of internal resources; they posit resources deployed to achieve competitive advantage must be developed and accumulated within organizations and

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