Journal of Business Research 93 (2018) 67–78

Contents lists available at ScienceDirect

Journal of Business Research

journal homepage: www.elsevier.com/locate/jbusres

Big data, big decisions: The impact of big data on board level decision-making

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ARTICLE INFO

Keywords:
Boards
Directors
Big data
Knowledge-based view
Capabilities
Decision making

ABSTRACT

Big Data (BD) has the potential to 'disrupt' the senior management of organisations, prompting directors to make decisions more rapidly and to shape their capabilities to address environmental changes. This paper explores whether, how and to what extent BD has disrupted the process of board level decision-making. Drawing upon both the knowledge-based view, and cognitive and dynamic capabilities, we undertook in-depth interviews with directors involved in high-level strategic decision-making. Our data reveal important findings in three areas. First, we find evidence of a shortfall in cognitive capabilities in relation to BD, and issues with cognitive biases and cognitive overload. Second, we reveal the challenges to board cohesion presented by BD. Finally, we show how BD impacts on responsibility/control within senior teams. This study points to areas for development at three levels of our analysis: individual directors, the board, and a broader view of the organisation with its external stakeholders.

1. Introduction

The potential of new technologies to 'disrupt' the management of organisations, including at the most senior levels, has recently been noted by many scholars (e.g. Abbasi, Sarker, & Chiang, 2016; Evans, 2017; Valentine & Stewart, 2013). One striking example of this disruptive effect is the challenging role played by 'Big Data' (BD) for directors and decision-makers (Janssen, van der Voort, & Wahyudi, 2017). The sudden rise of BD as a new knowledge source has prompted corporate decision-makers to make decisions more rapidly and to shape their capabilities to proactively address environmental changes (Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015).

Despite considerable research on making strategic (important, novel and resource hungry) decisions and the characteristics of these processes (Hickson, Butler, Cray, Mallory, & Wilson, 1986; Whittington, Cailluet, & Yakis-Douglas, 2011), there is little research on how BD has influenced the way decisions are made, on the impact of data proliferation on strategic responsibilities (Chari, Katsikeas, Balabanis, & Robson, 2012; Quinn, Dibb, Simkin, Canhoto, & Analogbei, 2016), or on how these data are handled at board level (Nutt & Wilson, 2010). A previous empirical study (Hickson, Miller, & Wilson, 2003) has identified the 'knowledge base' used by UK senior managers to inform their strategic decision-making as the single most important factor in the decision's success. However, while this was a large study with 55 UK cases, it mainly spanned a period where information for decisions was largely well-known (extant knowledge), available in hard copy as reports (explicit knowledge), or resided in managers' heads based on their experience or judgement (implicit or tacit knowledge).

The explosion of knowledge which has accompanied increasing access to BD arguably has a large impact on both how and what information senior managers use to inform their decision-making. A key research question is whether or not BD has changed the process of board level decision-making and, if so, how and to what extent? Our research addresses this question at three levels: first, we consider the implications of BD for *individual directors*; second, we explore BD's influence on the way that *the board* works; third, we review the impact of BD for *the wider organisation and its external stakeholders*. Knowledge Based View (KBV) is selected as a suitable theoretical framework because it helps us to understand why a "[l]ack of knowledge about BD sources influences decision-making quality" (Janssen et al., 2017, p. 339). For example, previous research (e.g. Raghunathan, 1999) confirms that the decision-making quality improves when directors have

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https://doi.org/10.1016/j.jbusres.2018.08.029
Received 16 November 2017; Received in revised form 22 August 2018; Accepted 24 August 2018

greater knowledge of the relationships among problem variables.

2. Theoretical approach

We situate our research approach to draw from KBV. In doing so, we explore the implications of BD for strategic decision-making undertaken by the board. For the purposes of our approach, we follow McAfee and Brynjolfsson (2012) by regarding BD datasets as being characterised by high levels of volume, velocity and variety. As such, BD is defined by dataset size (Erevelles, Fukawa, & Swayne, 2016; George, Osinga, Lavie, & Scott, 2016) and the challenges these data place on computing capacity (Fosso Wamba et al., 2017).

In viewing strategic decision-making as a process of making choices under varying conditions of uncertainty (Milliken, 1987; Petrakis, Kostis, & Kafka, 2016), the decision-making literature cites a lack of information as a key source of uncertainty (Nutt & Wilson, 2010). In the BD era, a lack of information is transformed into an abundance, with the potential to reshape data into usable information (Tihanyi, Graffin, & George, 2014). As such, these data offer the potential to reduce decision-making risk and improve strategic decision-making by allowing senior leadership teams to take a more holistic view (Filatotchev & Nakajima, 2010).

However, while there is little doubt that the BD explosion is being felt in wider society, in business relationships, and in crafting public policy; much less is known about its impact on the behaviours of senior managers taking decisions that matter. Since strategic decisions are typically defined as those that are without precedent in the organisation, they are costly in terms of financial and human resources; they are also inherently complex (Hendry, 2000; Hickson et al., 1986). There is rarely one best solution, rather a series of possible solutions, and each solution is a result of trade-offs and priorities in balancing risk and control (McNulty & Pettigrew, 1999). Although McAfee and Brynjolfsson (2012) suggest that profitability and productivity benefits ensue when BD is applied, these authors do not investigate the processes by which this occurs, nor how senior managers make data part of their decision-making routines. This gap highlights a key area for investigation.

The advent of BD has also spurred changes to board processes and structures with potential consequences for how strategic decisions are made. Chief Data Officers, Chief Information Officers or Chief Analytics Officer (Côrte-Real, Oliveira, & Ruivo, 2016; Fosso Wamba et al., 2015) are defined as a new breed of executive that some leading organisations are seeking to hire to improve their usage of BD in decision-making (Lee, Madnick, Wang, Wang, & Zhang, 2014). There is also evidence of boards moving away from top-down planning; instead processing large amounts of digital data, adopting techniques such as competency modelling (drawing on the resource-based view of the firm) and real-options analysis (drawing on financial strategy) (Camillus, 2008). The complexity of the decisions being made and of the data being used, which may induce feelings of certainty or bewilderment and prompt decision-makers to take highly risky decisions, is worthy of attention. As Camillus (2008, p. 17) notes, boards have problems because they 'can't develop models of the increasingly complex environment in which they operate'. This juxtaposition of 'big problems' and 'BD' provides a further area for investigation.

We adopt a knowledge-based view (KBV) to situate the research and guide the analysis (Felin & Hesterly, 2007; Nonaka, 1994; Spender & Grant, 1996). KBV scholars take an extensive view of data as a key resource in decision-making – a view theoretically articulated and empirically revealed in research taking a resource-based view of the firm (Barney, 2001; Priem & Butler, 2001; Wernerfelt, 1984). We argue that data can be viewed as a key resource which may be mobilised around decisions or incorporated into organisational intelligence as a more latent routine (with the potential for use in later decisions). For example, Collinson and Wilson (2006) empirically demonstrated the creation of latent routines via knowledge acquisition as a key feature of successful Japanese organisations.

The KBV is not, however, unproblematic. As Spender and Grant (1996, p. 48) observed, we need 'a clear statement of the epistemology which gives it (knowledge) meaning'. We also take the view that a single theory of knowledge is possibly untenable because of the many different types and definitions of knowledge. However, approaching the question of *how* knowledge is utilised (as in this paper) and not solely an examination of *what* knowledge is, avoids definitional plurality debates around knowledge (Spender & Grant, 1996). Nonaka and Takeuchi (1995) capture the plurality of knowledge as either explicit or tacit on the one hand, or on the other, how it is situated at various levels of analysis (from the individual, to group to organisational and inter-organisational levels).

To unpack the plurality of the KBV, this paper explores the key determinants of knowledge at three different levels: the director/individual level (managerial cognitive capabilities); the board level (behavioural factors); and the stakeholders' level (dynamic capabilities). These three perspectives – cognitive capabilities, a behavioural view and dynamic capabilities – all sit comfortably within a KBV-based approach, because they seek to explain the antecedents and consequences of knowledge. Capabilities refer to the ability to use knowledge (Ambrosini & Bowman, 2009; Amit & Schoemaker, 1993) that – as a key resource – affects the ways in which the board behaves. In particular, the extant literature accepts that in today's turbulent environment, companies need to continuously improve and re-shape their knowledge to respond promptly to external pressures (Lin & Wu, 2014; Wu, 2010). Knowledge as a unique and distinctive resource provides the 'basic foundations to renew or re-configure its resource base' (Côrte-Real et al., 2016, p. 380) and to build capabilities.

Managerial cognitive capabilities (at individual/director level), behavioural factors (at the board level) and dynamic capabilities (at the stakeholders' level) are interdependent concepts of the KBV framework. Grant (1996) considers organisations as entities where specialised knowledge of individuals (directors) is integrated to form organisational-level or group-level knowledge that can in turn lead to sustainable competitive advantage. Previous research (Helfat & Peteraf, 2015) documents that managerial cognitive capabilities, behavioural factors and dynamic capabilities affect the quality of decisions, as these capabilities facilitate the early recognition of environmental threats or opportunities that can impact on the quality of the decision-making process. Therefore, in the context of BD, a focus on managerial cognitive capabilities (at individual/director level), behavioural factors (at the board level) and dynamic capabilities (at the stakeholder level) allows the researcher to explore whether and how BD are part of the set of capabilities and knowledge that companies and decision-makers need to develop.

At the *individual level*, directors and managers need to develop the mental models and skills, or managerial cognitive capabilities (Helfat & Peteraf, 2015), to perceive, analyse and process changes in the environment. This cognitive process has been defined as 'cognitive complexity' (Schneier, 1979), and the literature notes it may lead to cognitive biases (Amit & Schoemaker, 1993), such as anchoring (i.e. old way of thinking), cognitive dissonance (i.e. holding conflicting beliefs or ideas) (Brennan & Conroy, 2013). The lack of cognitive capabilities can also cause boardroom or organisational inertia (Tripsas & Gavetti, 2000). The cognitive view (Chaston & Sadler-Smith, 2012) offers important insights into why directors may act conservatively, clinging on to more traditional processes which have been institutionalised since the pre-digital era. In particular, cognitive capabilities are especially enhanced in an uncertain and complex environment characterised by rapid changes (Carpenter & Fredrickson, 2001).

At the *board level*, a key concept in understanding boardroom behaviour concerns the notion of routines (Grant, 1996). Routines consist mainly of knowledge that is tacit and hard to codify (van Ees, Gabrielsson, & Huse, 2009); they refer to behaviour that is learned, repeated and rooted in tacit knowledge (Winter, 2003). Additionally,