



CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies, CENTERIS / ProjMAN / HCist 2017, 8-10 November 2017, Barcelona, Spain

Big Data, Analytic Culture and Analytic-Based Decision Making – Evidence from Australia

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Abstract

This study investigates how managerial decision making is influenced by Big Data, analytics and analytic culture. The results of a cross-sectional survey (n = 163) of senior IT managers reveal that Big Data Analytics creates an incentive for managers to base more of their decisions on the analytic insights. However, we also find that the main driver of analytic-based decision making is analytic culture. Considering that culture – in contrast to Big Data Analytics tools and skills – is a *resource* which cannot be change easily or quickly, we conclude that firms with a highly analytic culture can use this resource as a competitive weapon. Finally, our analysis reveals that managers in smaller organizations are significantly more likely to base their decisions on analytic results than managers in large organizations, which suggests the former use analytics to remain competitive against their larger counterparts.

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Peer-review under responsibility of the scientific committee of the CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies.

Keywords: Big Data Analytics, Decision Making, Analytic Culture, Organizational Culture, Data Science

1. Introduction

During the past few years, the terms ‘Big Data’ (BD) and ‘Big Data Analytics’ (BDA) have become increasingly important for both academics and business professionals in IT-related fields and other disciplines. Furthermore, executives increasingly acknowledge the potential benefits associated with BD¹ and global private and public

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investment in BD has reached billions of dollars per annum^{2,3}. BD has become a popular term which essentially represents the fact that data generated and available today is ‘big’ in terms of volume, variety, and velocity^{4,5}.

But being ‘big’ does not per se make data useful. It is rather the *insights* gained from analyzing the data which provide benefits⁷, which in turn requires organizations to develop or acquire analytic capabilities⁴. The claimed power of BD does not replace the need for human insight⁸. Equipped with BDA experts, who can provide such insights from data, managers are expected to make better (informed) decisions^{4,9,10}.

High-performing organizations believe that BDA is a critical differentiator and a key to growth^{1,11,12}. However, executives still struggle to understand and implement BD strategies effectively¹³, and it is unclear to what extent managers actually use the available BDA output to support their decisions. Some even argue that the biggest challenge in BDA is that managers do not comprehend how to gain benefits from analytics¹¹, and managers themselves are concerned about their ability to uncover and take advantage of meaningful insights¹². Accordingly, the first research question in this paper is: *Are managers in organizations with sophisticated BDA more likely to base their decisions on analytics (facts, evidence) than managers in organizations low on BDA?*

The second research question addresses the role of culture in the context of BDA and decision making. Organizational culture refers to an aggregation of values, beliefs, knowledge, attitudes, tasks, habits, morals, customs, and norms which are shared and strongly held by members of an organization, so as to provide a frame of reference that indicates organizational practices, behavior, and goals¹⁴⁻¹⁶. One aspect of organizational culture is analytic culture, i.e. the attitude towards the usefulness, use and benefits of analytics¹⁷. Since the emergence of knowledge-based systems such as expert systems, researchers have attempted to understand the relationship between (analytic) culture and the use of information generated by those systems¹⁸. There is some evidence that the perceived value of data analytics influences the configuration of the decision-making process¹⁷, and in organizations that believe in the reliability and accuracy of the information available, managers tend to use more of that information to support their decisions¹⁹. In addition, it is suggested that organizations high on analytic culture invest more into data analytic capabilities in terms of tools, methods, and people^{17,20}. This leads to our second research question: *Does the level of organizational analytic culture influence (a) how much analytic information managers use in decision making, and (b) the level of sophistication of an organization’s BDA?*

The remainder of the paper is organized as follows: Section 2 elaborates on the constructs of interest and makes predictions about their relationships (hypotheses); section 3 explains the research methods, including construct measurement, and section 4 presents the results. Finally, the results, their implications and the limitations of our research are discussed in section 5.

2. Theory/Hypotheses Development

2.1. Background

Big Data (BD) refers to a set of techniques and technologies that require new forms of integration in order to uncover hidden value from large datasets that are diverse, complex, and of a very large scale. The *volume* of BD is massive, so conventional hardware and software are incapable of handling it within a suitable time-frame²¹. Data volume has increased dramatically and the unit of measuring data will change from zettabytes (10^{21} bytes) in 2012⁴ to yottabytes (10^{24} bytes) in 2030²². The *variety* of data used for analytics also increased enormously, because it now includes not only traditional relational data, but also semi-structured, and unstructured data from various sources. Unstructured data, such as emails, text-based documents, images, videos, call-center recordings, and sensor-generated data cannot be stored easily within a standard relational database¹³ and require new analysis techniques. *Velocity* refers to the speed of both data generation and data processing. Data generation is rapidly increasing as a result of widely-used mobile technologies and ‘The Internet of Things’. Real-time or near real-time information enables organizations to be more agile than their competitors⁸. Data today is generated, changed, and removed more frequently than in the past and consequently organizations need new platforms and tools for analyzing them.

“Analytics is the science of analysis”²³. Data analytics uses data for quantitative and/or qualitative analysis to help an organization better understand its business and markets (knowledge discovery) and to make timely decisions^{5,20,24}. Data analytics in a BD environment is different from conventional data analytics for the reasons mentioned above⁸.

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