

Summary of the Doctoral Thesis

I. Introduction

1.1 The Purpose of the Doctoral Thesis

Big data analytics has been considered as the next “management revolution” by unleashing new organizational capabilities and value (Davenport et al., 2012; McAfee et al., 2012). With an unprecedented explosion of big data from social media, Internet of Things, and mobile devices, researchers and practitioners have devoted much attention to documenting the significance of big data analytics and business values derived from it (Abbasi et al., 2016). Big data analytics in business is commonly defined as “a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data, by enabling high velocity capture, discovery and/or analysis” (Davenport et al. 2012). In recent years, as business environments become more competitive and turbulent, the contemporary firms are increasingly relying on BDA to enhance a critical business capability, called organizational agility—a firm’s ability to sense and respond to environmental changes and seize novel opportunities (Overby et al. 2006; Sambamurthy et al., 2003; Tallon 2008). By analyzing a large volume of data flowing from the diverse sources, BDA can improve a firm’s organizational agility by allowing it to better understand their market conditions and effectively respond to external changes in a timely manner, i.e., be agile (Barton and Court 2012; Chatfield and Reddick 2018; Ghasemaghaei et al. 2017; Liu et al. 2016). In this sense, one of the seminal papers by Sambamurthy et al. (2003) argue that firms with agility are more likely to experience higher profits, reduced costs, and improved market shares.

Yet, in reality, it is often reported that there is still a sizeable number of companies that fail to generate the anticipated business value, such as organizational agility, from their big data investments (Popovič et al. 2018; Wamba et al. 2017; Wang et al. 2019). To address this issue, the literature has largely focused on either conceptual or technological aspects of BDA yet paid little attention to organizational or cultural dimensions (Kiron et al. 2012; Mikalef et al. 2020). This is an important gap to be addressed, because recent industry reports increasingly argue that one of the biggest barriers to success of BDA initiatives is attributable to the absence of an appropriate culture that supports use of BDA (Díaz et al. 2018; Kiron et al. 2012, 2014). They state that without a proper organizational culture, it is difficult to embed BDA into core business processes and to induce organization-wide impacts (Kiron et al. 2012, 2014; Mikalef et al. 2020).

Recognizing this research gap, the author especially focuses on organizational culture, because unlike technology-related factors that are fairly easily duplicated and become commodity like over time, organizational culture can make BDA-enabled processes more complex, hard to imitate, and capable of evolving (Gupta and George 2016; Wang et al. 2019). This increases probability to achieve and sustain a firm’s competitiveness through BDA. Further, in practice, because BDA is distributed throughout organizations involving multiple users from functional areas (Sharma et al. 2014), the effect of BDA will be largely influenced by how it is organizationally embedded and deeply rooted in people’s beliefs and behavior. That is, organizational culture which represents the basis of employees’ values, beliefs, and norms is considered an integral factor for success in BDA initiatives. Hence, the main interest of this study is to examine the role of organizational culture in generating agility (i.e., a critical business capability) through BDA.

To examine organizational culture, the author introduces democratization culture—an organizational culture that values the willingness to share information and the acceptance of diversity—by capturing an idea from data democratization which recently come into discussions in industry reports (Díaz et al. 2018; Kiron et al. 2012; Marr 2017). The reports argue that, with democratization of data, employees can readily draw on necessary data/information and make more informed and better decisions through BDA (Kiron et al. 2012). To realize this, the author proposes that it is necessary to create democratization culture that encourages employees' behaviors and attitude to share information and openly discuss their ideas (Gordon and DiTomaso 1992; Schein 2010). Thus, the author newly introduces democratization culture based an extensive literature review regarding cultural conditions of democratization.

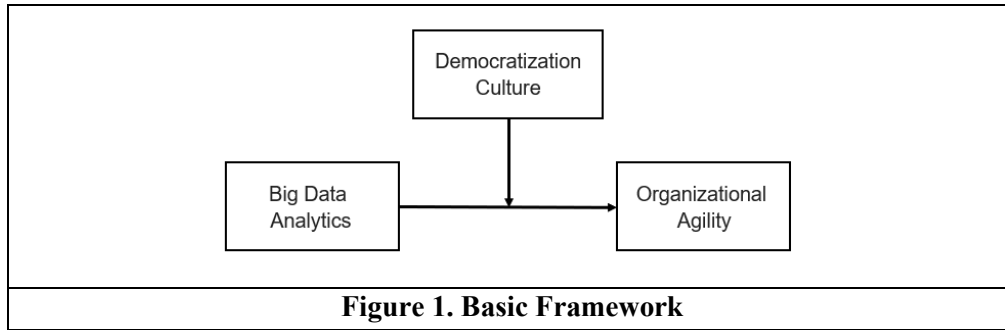
Therefore, the doctoral thesis especially examines the role of democratization culture in achieving agility through BDA. This could make several contributions to information systems (IS) literature. First, the introduction of democratization culture is expected to serve to bring the idea of 'data democratization' into the academic arena. So far, despite an increasing attention given to data democratization in relation to BDA, its arguments are somewhat fragmented, and there has been no academic research that either theoretically conceptualizes data democratization or empirically examines its effect pertaining to BDA. Thus, the introduction of democratization culture could add contribution to IS literature by increasing the current understanding about organizational culture in the BDA context.

Second, the empirical investigation of BDA, agility, and organizational culture in the same model setting will have meaningful contribution in IS literature. The reason here is that while the importance of organizational culture is underscored in the BDA and agility literature respectively, to the best of knowledge, there has been no research that empirically examines the relationship among BDA, agility, and organizational culture in the same model. For example, an emerging body of BDA research considers organizational culture an integral factor for the success of BDA initiatives and thus incorporates a culture element in their research model (Cao and Duan 2014; Dremel et al. 2020; Duan et al. 2020; Dubey et al. 2019a; Gupta and George 2016; Mikalef et al. 2019a, b; Pugna et al. 2019).

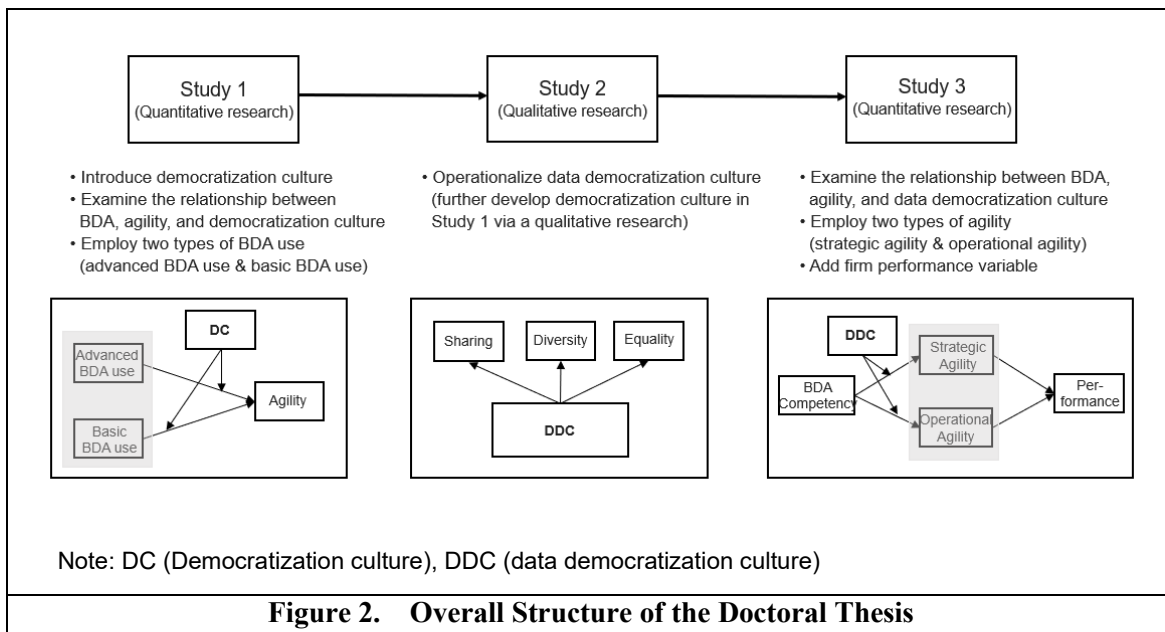
In addition, recent industry reports on agility also emphasizes organizational culture. They argue that organizational culture acts as a firm's backbone which provides firms with stability, allowing them to adapt governance, structures, and processes in accordance with the changing environments (Aghina et al. 2015; Ahlbäck et al. 2017). This in turn gives firms room for dealing with new opportunities and unexpected threats (i.e., be more agile).

Hence, by elucidating the role of democratization culture in shaping the relationship between BDA and organizational agility in the same model setting (shown as Figure 1), the doctoral thesis aims to address the significant research gap in IS literature and provide valuable theoretical and practical implications. In this sense, Figure 1 illustrates a basic framework for the present doctoral thesis, assuming an organizational culture as a contextual factor¹ that moderates the relationship between BDA and organizational agility.

¹ Organizational culture in IS literature is often posited as a contextual factor that moderates the relationship between technology use and the consequence of use (Lee and Lee 2003; Leidner and Kayworth 2006).



To address the purpose of the doctoral thesis, the author conducts three Studies (Study 1,2,3), and Figure 2 touches the points highlighted in each Study. First, Study 1 disaggregates BDA use into two types—advanced and basic BDA use. This enables Study 1 to draw on interesting results associated with moderating effects of democratization culture. On the other hand, in order to analyze the role of organizational culture from a different angle, Study 3 adopts two types of agility—strategic and operational agility while having BDA as a single construct. This allows for a parsimonious research model which places more focus on agility than BDA. In addition, the findings from Study 1 suggest there is a potential to develop democratization culture (DC) into a second-order formative construct. Thus, Study 2 conducts qualitative research to operationalize data democratization culture (DDC). Two cultures (DC and DDC) are both based on the same idea—data democratization, and therefore they are not contradictory from one another. Yet, the scope of literature review grounded on each culture construct is different, and DDC is more sophisticatedly developed by following established guidelines of construct development (Moore and Benbasat 1991). In this sense, Study 3 employs DDC in the research model and examines its moderating effect between BDA competency and two types of agility. For the details of each Study will be further outlined in the following Subsections.



II. Literature Review

In this section, the author conducted an extensive literature review for two rounds regarding BDA and organizational agility with a particular focus on organizational culture, which clearly identifies the research gaps in the literature.

2.1 Summary of Prior studies on BDA and Organizational Agility

First, as Table 1 summarizes, the author identifies two distinctive patterns in studies regarding BDA and organizational culture: 1) main streams of research largely adopt data-driven culture in examining the role of organizational culture related to BDA; 2) most of the previous BDA studies anticipate positive relationship between BDA and organizational culture with few exceptions that assume negative effect of organizational culture related to BDA.

Second, as Table 2 outlines, the author identifies two notable patterns in organizational agility research: 1) big data analytics (BDA) is started receiving attention as an enabler of organizational agility; 2) though the agility studies do not explicitly mention about organizational culture, there are some studies take cultural elements into account. In this sense, it is considered that despite the importance of organizational culture being recognized in agility research, their relationship is somewhat ambiguous and has not been empirically demonstrated in academic research.

2.2 Viable Three Research Gaps

Based on Table 1 and Table 2 which provides an overview of literature of BDA and organizational agility with a special focus on organizational culture, the current study has deduced *three* considerable research gaps. *First*, there is a dearth of research that investigates the relationship among BDA, organizational agility, and organizational culture. Although it has been identified that (1) BDA are increasingly deployed to enhance organizational agility, and (2) organizational culture is considered important in both BDA and agility research community, little research explores the relationship among BDA, organizational agility, and organizational culture. *Second*, most of BDA research employs data-driven culture or sometimes competing values model (CVM) to examine the role of organizational culture related to BDA. As for data-driven culture, the scope and measures of this culture construct is exclusively related to big data and data analytics, making it so obvious to have positive relationship between BDA and data-driven culture. This results in limited understanding on complexities of reality entangled with BDA-driven decision making. On the other hand, CVM is conceptual measurement approach to culture only provides the generic nature of culture, which may be not useful for the prediction of specific outcomes (Schneider et al., 2013). *Third*, although recent studies underscore that BDA is an enabler of organizational agility, there is a dearth of research that explores how BDA is leveraged to realize different types of agility in the same model setting.

Table 1. Overview of Big Data Analytics (BDA) Literature (Table continues by page 7)

Studies (methods)	Theoretical lens	Organizational culture (OC)	Relationship between BDA & OC	Key findings
Dremel et al. 2020 (Case study)	<ul style="list-style-type: none"> •Socio technical system theory •Affordance theory 	<ul style="list-style-type: none"> •<i>Data-driven culture</i> defined as the belief that large data sets offer a higher form of intelligence and knowledge that can generate insights that were previously impossible 	As a part of actor level entities, a data-driven culture is adapted to the new advanced technology (i.e., BDA) to actualize BDA affordances.	The study identifies how socio-technical actions (e.g., enhancing, constructing, coordinating, and integrating of socio-technical entities) contribute to actualizing BDA affordances.
Mikalef et al. 2019a (Quantitative research)	<ul style="list-style-type: none"> •Resource-based view •Dynamic capability theory 	<ul style="list-style-type: none"> •<i>Data-driven culture</i> defined as the degree to which top management is committed to BDA, and the extent to which it makes decisions derived from intelligence 	Data driven culture (i.e., intangible) as a subconstruct of BDA capability that is formed by the combination of tangible, intangible, and human skills.	The study confirms the indirect relationship between a BDA capability (BDAC) and two types of innovation capabilities: incremental and radical.
Lin and Kunnathur 2019 (Quantitative research)	<ul style="list-style-type: none"> •Dynamic capability theory 	<ul style="list-style-type: none"> •<i>Developmental culture</i> is combination of flexibility and external focus and emphasizes such values as innovation, growth, openness, risk-taking, creativity, and adaptability to external environment 	As an intrinsic motivator of BDA, developmental culture acts as a moderator on the relationship between strategic orientations and BDA capability.	The study identifies the strategic implications of the BDAC by testing its relationship to strategic orientations and developmental culture.
Dubey et al. 2019a (Quantitative research)	<ul style="list-style-type: none"> •Resource-based view •Institutional theory 	<ul style="list-style-type: none"> •<i>Big data-driven culture</i> defined as the extent to which organizational members make decisions based on insights extracted from data 	Big data-driven culture moderates the relationship between big data predictive analytics and other resources (tangible resources and human skills).	The study provides insights about the role of external pressures on the selection of resources under the moderating effect of big data culture and their utilization for big data predictive analytics.
Dubey et al. 2017 (Quantitative research)	<ul style="list-style-type: none"> •Dynamic capability theory •Competing value model (CVM) 	<ul style="list-style-type: none"> •<i>Flexible orientation (FO)</i> fosters organizations to be creative and risk-taker and open for embracing changes in environment •<i>Control orientation (CO)</i> emphasizes uniformity, coordination, efficiency, and close adherence to rules and regulations 	Organizational culture (i.e. FO and CO) does not have significant effect on the paths between big data & predictive analytics (BDPA) and social performance/ environmental performance.	The study finds BDPA has significant impact on social and environmental performance. However, it does not find evidence for moderating role of flexible orientation and control orientation in the links between BDPA and social/environmental performance.
Dubey et al. 2019b (Quantitative research)	<ul style="list-style-type: none"> •Organizational information processing theory •Competing value 	<ul style="list-style-type: none"> •<i>Flexible orientation (FO)</i> fosters organizations to be creative and risk-taker and open for embracing changes in environment •<i>Control orientation (CO)</i> 	FO has a positive and significant moderating effect on the path joining BDA capability and collaborative performance, whereas	The findings reveal that FO and CO have no significant effect on the path joining BDA capability and swift trust. On the other hand, FO (+)/CO (-), has significant

	model (CVM)	emphasizes uniformity, coordination, efficiency, and close adherence to rules and regulations	CO has negative and significant moderating effect on the path joining BDA capability and collaborative performance.	moderation effects on the path joining BDA capability and collaborative performance.
Mikalef et al. 2019b (Mixed empirical study using survey data & case study)	•Complexity theory	• <i>Data-driven culture</i> refers to whether a firm considers its data a tangible asset, and determines the extent to which organizational decisions are made based on the extracted insight	Infused with strategic directions related to BDA, data-driven culture helps firms move toward a more data-driven decision-making structure.	The study identifies 4 configurations of BDA resources that lead to high firm performance.
Popovič et al. 2012 (Quantitative research)	—	• <i>Analytical decision-making culture</i> relies on how much organizations use quality information provided by BDA in their business processes	Analytical decision-making culture moderate the link between information quality content and use of information in business processes. And analytical decision-making culture also directly impacts use of information in business processes.	The study identifies that the link between information content quality and use of information in business processes is weather the higher level of analytical decision-making culture; the direct path from analytical decision-making culture to information use in business processes is positive and significant.
Cao and Duan 2014 (Quantitative research)	•View of Information processing capabilities •Contingency theory	• <i>Data-driven culture</i> refers to a pattern of behaviors and practices by a group of people who share a belief that having, understanding and using certain kinds of data and information plays a critical role in the success of their organization	Data-driven culture acts as a mediator between business analytics and information processing capabilities.	The study identifies that business analytics have stronger indirect effect on information processing capabilities through the mediation of a data-driven culture
Germann et al. 2013 (Quantitative research)	•Upper echelons theory •Resource-based view	• <i>Analytics culture</i> denotes shared values and beliefs which positively influence the degree to which decision makers incorporate the insights gained from marketing analytics in their decisions.	An analytics-oriented culture has a positive and significant effect on the deployment of analytics.	The study finds that the deployment of marketing analytics leads to improved firm performance and to identify the factors that lead firms to deploy marketing analytics.
Duan et al. 2020 (Quantitative research)	•Absorptive capacity theory	• <i>Data-driven culture</i> refers to a pattern of behaviors and practices by a group of people who share a belief that having, understanding and using certain kinds of data and information plays a critical role in the success of their organization	Business analytics have a significant and positive impact on data-driven culture; there is significant and positive moderating effect of data-driven culture on the link between environmental scanning and new product newness.	The study suggests that a firm's absorptive capacity of business analytics, environmental scanning and data-driven culture directly improves a firm's innovation in terms of new product newness and meaningfulness.

Gupta and George 2016 (Quantitative research)	•Resource-based theory	• <i>Data-driven culture</i> indicates the extent to which members (including top-level executives, middle managers, and lower-level employees) make decisions based on the insights extracted from data	Data-driven culture is a positive and significant sub-component (subconstruct) comprising BDA capability.	The study presents a theoretical framework of BDA capability consisting of several technical and nontechnical resources classified across three categories (tangible, intangible, and human resources)
Pugna et al. 2019 (Grounded theory approach)	—	• <i>Data-driven culture</i> reflects people's current attitudes and how these can be modified to accept and empower data	The study identifies managers as holding exclusive responsibilities for implementing the data-driven culture within their organizations, which in turn leads to successful BDA projects.	The study explores executives' perception about the transformation of business environment and to determine the most likely approaches for establishing an appropriate data-driven culture within the organization.

Table 2. Overview of Organizational Agility Literature (Table continues by page 10)

Studies (method)	IT capabilities/resources	Agility Description	Organizational culture-related components	Key arguments and findings
Sambamurthy et al. 2003 (Conceptual research)	IT competency	Agility is a firm's ability to <i>detect</i> opportunities and <i>seize</i> those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise.	—	IT competency provides digital options (knowledge and process rich/richness), which improves agility. Further, entrepreneurial alertness <i>mediates</i> the link between these enablers and agility.
Overby et al. 2006 (Conceptual research)	IT capability	Agility is a firm's ability to <i>sense</i> environmental change and <i>respond</i> readily.	—	IT capability improves a firm's process and knowledge reach and richness, thus providing digital options, which enables firms to increase sensing and responding capabilities to cope with rapidly changing business environments.
Nazir and Pinsonneault 2012 (Conceptual research)	Electronic integration (internal/external)	Agility is a firm's ability to <i>sense</i> and <i>respond</i> to opportunities and threats with ease, speed, and dexterity.	—	IT external/internal electronic integration facilitates knowledge exploration, exploitation and process coupling, which in turn improves a firm's sensing and responding capabilities (i.e., agility).
Lu and Ramamurthy 2011 (Quantitative research)	IT capability	Agility is a firm's ability to <i>cope with</i> rapid, relentless, and uncertain changes and thrive in a competitive environment of continually and unpredictably changing opportunities.	IT proactive stance (opportunity orientation) refers to the extent to which firms strive to constantly seek new ways to enhance its effectiveness of IT use, and fosters a climate that is supportive of trying new ways of using IT.	IT capability has a significant positive impact on agility. Further, moderation effect of IT spending proves that while more IT spending does not lead to greater agility, spending it in a way that fosters IT capabilities does.
Tallon and Pinsonneault 2011 (Quantitative research)	(Strategic IT alignment)	Agility is a firm's ability to <i>detect</i> and <i>respond</i> to opportunities and threats with ease, speed, and dexterity.	—	Alignment positively affects agility, which in turn improves firm performance. Further, while IT flexibility does not moderate the link between alignment and agility, it has a <u>positive main effect on agility</u> .
Roberts and Grover 2012 (Quantitative research)	IT infrastructure, Analytics	Agility is the extent to which a firm is able to <i>sense</i> and <i>respond</i> quickly to customer-based opportunities for innovation and competitive action.	—	IT plays an important role in facilitating sensing capability (interaction between IT infrastructure and analytical ability) and responding capability (interaction between a firm's coordination effort and the level of its IS integration).

Fink and Neumann 2007 (Quantitative research)	Infrastructure capabilities	Agility is a firm's ability to <i>respond</i> operationally and strategically to changes in the external environment through IT.	—	IT personnel capabilities (technical and behavioral capabilities) positively affect infrastructure capabilities, which in turn directly and indirectly (mediated by system agility and information agility) affects strategic agility.
Park et al. 2017 (Quantitative research)	BI technologies, Communication technologies	Agility is achieved by the combination of <i>sensing</i> agility, <i>decision making</i> agility and <i>acting</i> agility.	—	IT's effect on agility is embedded in configuration and organizational environmental elements. In addition, agility can be achieved by the core tasks of sensing/decision making and acting (<i>responding</i>).
Lee et al. 2015 (Quantitative research)	IT ambidexterity	Agility is a firm's ability to <i>detect</i> opportunities and threats, assemble the needed assets and capabilities to launch a proper <i>response</i> with speed.	—	IT ambidexterity enhances its agility through the mediated effects of operational ambidexterity.
Chakravarty et al. 2013 (Quantitative research)	IT competencies	Agility is a firm's ability to <i>sense</i> opportunities for competitive action and marshal the necessary resources to seize those market opportunities.	—	IT competencies play the dual roles in directly enhancing agility and complementing agility to improve firm performance. Also, the dual roles of IT competencies are moderated by environmental dynamism.
Lowry and Wilson 2016 (Quantitative research)	--	Agility is the ability to <i>respond</i> operationally and strategically to changes in the external environment through IT.	Internal IT service perception (\approx IT-service climate) reflects IT professionals' shared perceptions of the practices and behaviors in their workplace that support the provision of IT service to business customers	Internal IT service perceptions positively impact IT agility, both directly and indirectly, through facilitating positive IT service quality.
Breu et al. 2002 (Quantitative research)	Information and communications technology (ICT)	Agility is an exploitation of competitive bases (innovation, speed, quality, profitability, flexibility) through integration of resources and best practices.	—	The determinants of workforce agility are flexible infrastructure platforms. Also, ICT applications increase workforce agility most when used for collaboration.
Chen et al. 2014 (Quantitative research)	IT capability	Agility is the ability to <i>detect</i> changes, opportunities, and threats and to provide swift and focused <i>responses</i> to customers and stakeholders by reconfiguring resources and processes.	—	The impact of IT capability on organizational performance is fully mediated by business process agility. Also, there is a positive link between IT capability and agility, which is moderated by environmental complexity and hospitality.

Zhou et al. 2018 (Quantitative research)	Text analytics	Agility is the extent to which a product developer can effectively detect and respond to customers' demands.	—	Review volume has a curvilinear relationship with customer agility. Further, customer agility has a curvilinear relationship with product performance.
Côrte-Real et al. 2017 (Quantitative research)	Big data analytics	Agility is a firm's capacity to efficiently and effectively redeploy/redirect its resources to value creating and value protecting (and capturing) higher-yield activities as internal and external circumstances warrant	—	BDA can create organizational agility via knowledge management and its impact on process and competitive advantage. Also, the paper demonstrates that agility can partially mediate the effect between knowledge assets and performance
Ghasemaghaei et al. 2017 (Quantitative research)	Big data analytics use	Agility is the firm's ability to sense and quickly respond to changes in the environment which often involves reconfiguring firm resources	—	The study identifies impacts of data analytics use on firm agility, while also providing guidance to managers on how they could better leverage the use of such technologies via fit perspective.
Chatfield and Reddick 2018 (Conceptual research)	Big data analytics	Agility is the firm's ability to sense and respond to these changing customer needs tend to be more successful in improving organizational performance	—	The study explores how systemic use of big data analytics embedded into critical processes enables the government to co-create public values with citizens through 311 on-demand services.
Ravichandran 2018 (Quantitative research)	Digital platform capabilities	a firm's capacity to respond with speed to environmental changes and opportunities and define it in three dimensions: customer responsiveness, operational flexibility and strategic flexibility.	Innovation capacity indicates organizational climate that enables innovative behavior of the firm, allowing firms to experiment and pursue different course of actions	The study identifies that the innovation capacity of a firm has a positive relationship with organizational agility and that firms with higher innovation capacity are better able to leverage their digital platforms to enhance agility.

III. Summary of Study 1, 2 and 3

3.1 Study 1

Improving Organizational Agility Using Big Data Analytics: The Role of Democratization Culture²

3.1.1 Research Purpose

The purpose of Study 1 is to explore the role of democratization culture in the achieving organizational agility through big data analytics (BDA) use. As previously noted, Study 1 addresses its purpose by disaggregating BDA use into two types—advanced and basic BDA use—based on the functions and types of BDA.

To the best of the author’s knowledge, previous studies have broadly defined BDA use as a single construct and examined its effect on organizational agility (Chatfield and Reddick 2018; Ghasemaghaei et al. 2017). Yet, since different types of BDA are built for distinct purposes from one another³ (Sivarajah et al. 2017), the effect of BDA use on agility is likely to differ by the type of BDA. In this sense, Study 1 by classifying BDA use into two types is expected to provide an enhanced understanding of how each type of BDA use influences agility and invite more fruitful insights associated with the moderating effects of democratization culture.

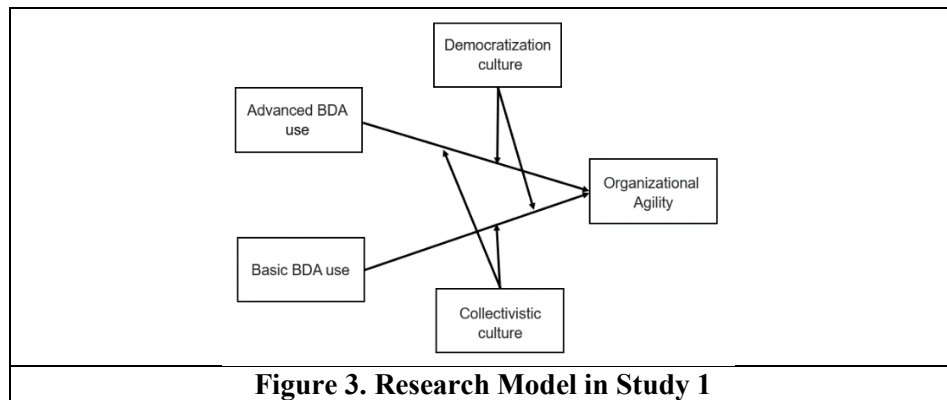
Moreover, Study 1 additionally employs collectivistic culture in the research model. Since behavioral patterns of collectivistic culture is proven to be conducive to cooperation, which is a critical factor for achieving agility (Gligor and Holcomb 2012; Palmer 2000; Wagner III 1995), prior research has examined the effect of collectivistic culture on agility or flexibility (Lin et al. 2015; Liu et al. 2015). In this sense, by incorporating collectivistic culture, Study 1 compares the effects of democratization culture with those of collectivistic culture. This is expected to further clarify the characteristics and role of democratization culture.

3.1.2 Research Method and Analysis

To achieve research purpose in Study 1, the author conducts quantitative research using data collected from 304 managers and executives who are currently engaged in BDA-related business affairs Japanese firms. The five constructs presented in the research model (Figure 3) meets the criteria of reliability and discriminant validity. The model was validated through structural equation modeling (SEM) with Amos 22 software.

² Study 1 is based on the journal published by Hyun, Y., Kamioka, T., & Hosoya, R. (2020). “Improving Agility Using Big Data Analytics: The Role of Democratization Culture,” *Pacific Asia Journal of the Association for Information Systems*, 12(2), 35-63. <https://doi.org/10.17705/1pais.12202>

³ Basic BDA use is primarily employed in standardized processes, acting as a central function to sustain firms’ efficiency and make speedy decisions (Aghina et al. 2015; Sivarajah et al. 2017). Whereas advanced BDA use is pertinent to decision making closer to the point where frontline businesses are carried out, responding to changing market needs in an agile manner (Bose 2009; Chatfield and Reddick 2018).



3.1.3 Research Findings

Here, the author outlines some important findings from Study 1. First, Study 1 confirms that both advanced and basic BDA use positively and significantly influences organizational agility. Also, Study 1 responds to the main research purpose by empirically proving significant moderating effects of democratization culture in the relationship between big data analytics (BDA) use and organizational agility. Interestingly, democratization culture has significant and positive moderating effects on the link between advanced BDA use and agility, whereas it shows a significant and negative moderating effect on agility when entangled with basic BDA use. The results imply that democratization culture is not a one-size-fits-all solution for all BDA-using situations. These findings may pose challenging tasks for managers to decide how to weave democratization culture into their organization. To avoid potential negative results accrued from democratization culture, managers should incorporate democratization culture into their organizations with careful consideration of the required functions, task responsibilities, and business processes in which democratization culture can play an effective role. Otherwise, democratization culture may hinder a firm’s agility by impeding work efficiency and retarding decision making.

In addition, by comparing the moderating effects of democratization culture with those of collectivistic culture, the characteristics of democratization culture are clearly identified. For instance, both cultures share common characteristics in that they value interaction among members, which is known to lead to information sharing (Arpaci and Baloğlu 2016). Whereas the acceptance of diversity, which is featured in democratization culture but not in collectivistic culture (Triandis and Gelfand 1998), seems to bring about differences in the moderating effects between them. Recognizing such difference between two types of culture helps provide meaningful interpretations for empirical results, and it also implies that there might be sub-concepts that comprise democratization culture—willingness to share information and acceptance of diversity. In this sense, Study 1 suggests that democratization culture may need to be further developed and refined as a second-order formative construct.

3.2 Study 2

The Construct Development of Data Democratization Culture

3.2.1 Research Purpose

As Study 1 suggested, democratization culture (DC) potentially consists of subconcepts—the willingness to share information and the acceptance of diversity. This implies that DC can be operationalized into a second-order formative construct as shown in Figure 2.

In this sense, Study 2 aims to develop data democratization culture (DDC) by following the established guidelines of construct development (Moore and Benbasat 1991). Consistent with DC, DDC is also based on the idea of data democratization; thus, DC and DDC are not contradictory from one another. Yet, there are a few differences between them. First, while Study 1 by taking a holistic approach focuses on cultural conditions of democratization, Study 2 confines its research domain to the literature of data democratization. The reason here is that, since the concept of democratization is widely used in multiple academic domains, DC may lead to multiple interpretations depending on the research context it is discussed. Therefore, Study 2 develops DDC by confining the scope of literature to data democratization. Second, Study 2 takes the more established construct development process compared to Study 1. Although DC is also valid as it is developed by literature review and empirical analysis, the construct development processes are still at primary level. Thus, by taking rigorous instrument development stages, Study 2 aims to develop DDC to have greater reliability as a variable.

3.2.2 Research Method and Analysis

To provide the theoretical underpinnings for this new construct (i.e., data democratization culture), Study 2 follows the established guidelines of instrument development stages (i.e., item creation, scale development, and instrument testing) espoused by Moore and Benbasat (1991). To do so, Study 2 first conducts an extensive literature review and refines the potential dimensions (subconstructs) and measurement items that comprehensively explain the concept of data democratization from a cultural perspective. The author then performs in-depth interviews with IT and marketing managers from nine companies to ensure that the dimensions and measurement items derived from the literature review are applicable to the BDA context (Benbasat et al. 1987). After completing the draft scales based on the literature review and field interviews, the author conducts a test of content validity to observe the degree to which each measurement item reflects its nominated dimensions (subconstruct).

3.2.3 Research Findings

Through an extensive literature review and field interviews, Study 2 identified three dimensions (subconstructs) of data democratization culture— (1) Sharing of information, (2) Acceptance of Diversity, (3) Equality. Along with the identified subconstructs, the measurement items are developed, via iteratively refined and validated by feedback from the panel to ensure clarity and validity of data democratization culture items (content validity). In all, without altering the conceptual domain, the author defines data democratization culture as an organizational culture that values the sharing of information and the acceptance of diversity at all levels of the organization.

The development of DDC construct is expected to contribute to IS literature, because, to the best of knowledge, it is one of the first studies that theoretically conceptualizes the idea of data democratization in the academic arena and empirically examines its reliability and validity as a construct. The majority of IS research has examined an organizational culture by adopting data-driven culture (referring to Literature Review in Section 2) (Cao and Duan 2014; Dubey et al. 2019a;

Germann et al. 2013; Gupta and George 2016; McAfee et al. 2012; Mikalef et al. 2019a ,b, 2020; Popovič et al. 2012). Data-driven culture (or sometimes analytics culture) mostly focuses on the importance of data and evidence-based decision making. It significantly contributes to uncovering the importance of organizational culture in making use of BDA, yet it does not consider real-world complexities in the BDA context. For example, in order to effectively reflect BDA-derived insights into business decisions, employees should willingly share their opinions and ideas gained from BDA (Kiron et al. 2012). Further, since BDA is utilized across different functional areas, employees may also need to have attitude to hear out diverse opinions and perspectives on BDA results, regardless of job titles. In such a context, firms are likely to gain greater understanding about data analyses, therefore, make more informed and qualified decisions. On the other hand, even though employees understand the value of data and evidence-based decision making, if they do not share their information or respect other people’s opinions with different backgrounds, their decision making are likely to be biased in some way. In this sense, by considering the real-world complexities revolved around BDA-based decision making, Study 2 develops data democratization culture that consists of the sharing of information, the acceptance of diversity, and equality. This is expected to provide fruitful insights regarding the role of organizational culture in the BDA context.

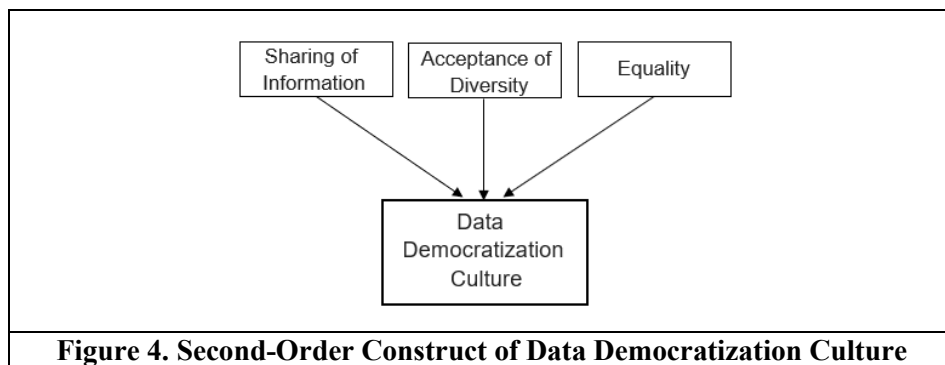


Figure 4. Second-Order Construct of Data Democratization Culture

3.3 Study 3

The Moderating Role of Data Democratization Culture in Strategic and Operational Agility Enabled by Big Data Analytics

3.3.1 Research Purpose

Consistent with the overall purpose of this doctoral thesis, Study 3 aims to examine the role of data democratization culture in the relationship between BDA competency and organizational agility. Especially in Study 3, the author addresses this research purpose by employing two types of agility—strategic and operational agility.

In the domain of agility studies, there are many types of agility depending on research context, such as customer agility, partnering agility, operations agility, entrepreneurial agility, and adaptive agility (Chakravarty et al. 2013; Roberts and Grover 2012; Sambamurthy et al. 2003). Among various types of agility, Study 3 especially focuses on strategic and operational agility, because firms that incorporates BDA are actively leveraging BDA insights to address strategic and operational issues (LaValle et al. 2011; Sharma et al. 2014; Wamba et al. 2015). In this sense, Study 3 by positing strategic an operational agility in the research model, aims to identify how BDA can enable them and to understand how DDC moderates the relationship between BDA and each type of agility. This is expected to make important contribution to IS literature, because while a growing number of studies recognize BDA as an enabler to achieve agility, little knowledge has explored how BDA accomplishes different types of agility in the same model setting.

In addition, Study 3 employs firm performance in the research model as a dependent variable. Organizational agility is already theoretically and empirically proven conducive to firm performance (Sambamurthy et al. 2003; Tallon and Pinsonneault 2011). Yet, since Study 3 employs two types of agility (i.e., strategic and operational agility) in the same model setting, the inclusion of firm performance may allow to identify which type of agility is more closely pertinent to firm performance. This could invite more useful insights from the research model.

3.3.2 Research Method and Analysis

In the pursuit of examining the moderating effect of data democratization culture in the relationship between BDA competency and agility (i.e., strategic and operational agility), Study 3 conducts quantitative research using data collected from 105 managers and executives who are currently engaged in BDA-related business affairs in Korean firms. The five constructs presented in the research model (Figure 5) meets the criteria of reliability and discriminant validity. The model was validated through structural equation modeling (SEM) with SmartPLS 3.0.

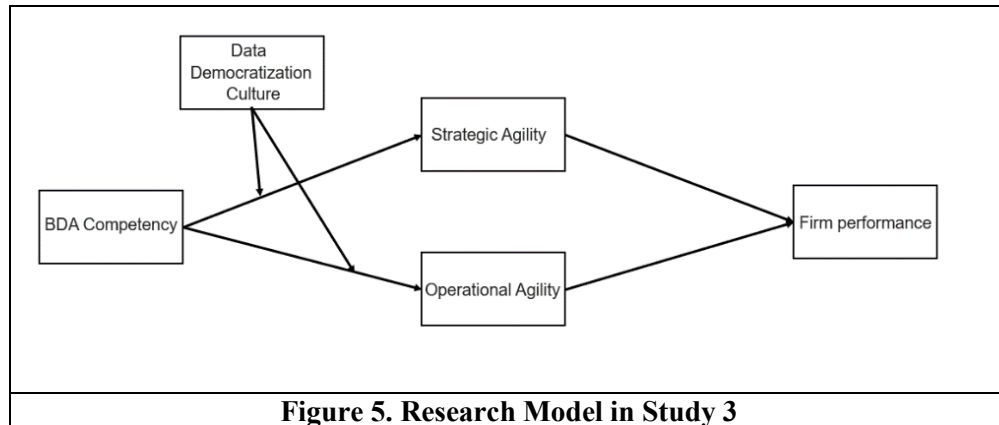


Figure 5. Research Model in Study 3

3.3.3 Research Findings

The author summarizes important findings in Study 3, which will be further elaborated in Section 4. First, Study 3 by employing two types of agility in the same model setting, found that they are both significantly enabled by BDA competency, and in turn positively influence firm performance. The findings are consistent with capability building perspective that a firm's IT resources (BDA competency) are translated into high-level dynamic capabilities (strategic and operational agility), and thus, leads to improved firm performance. In particular, Study 3 by conducting a mediation test finds that the relationship between BDA competency and firm performance is fully mediated by two types of agility (i.e., strategic and operational agility). This indicates that while BDA competency is widely known to have significant influence on firm performance, it may not lead to improved performance gains unless BDA competency is translated into organizational capabilities like agility.

Second, Study 3 empirically proves different effects of data democratization culture (DDC) in the BDA context. Study 3 suggests that organizational culture (DDC) advocated in research does not necessarily exert positive influences on BDA-related performance; instead, it could even give negative effects depending on the type of agility it is intertwined with. For example, DDC positively moderates the relationship between BDA competency and strategic agility, thereby enhancing firm performance, whereas its moderating effect is nonsignificant and negative on the relationship between BDA competency and operational agility, exerting nonsignificant influence on firm performance. This by empirically proving DDC is not a one-size-fits-all-solutions, provides novel and complementary perspectives to the main streams of BDA research which has been skewed to the positive side of organizational culture.

In all, fostering the appropriate organizational culture is a salient factor that makes the process of building higher-level capabilities (agility in Study 3) more complex, hard to imitate, and capable of evolving. Considering organizational culture is sticky and difficult to change or replicate (Germann et al. 2013), building strategic agility through BDA competency, which is embedded in data democratization culture (DDC), would be difficult or next to impossible for competitors to imitate. This would effectively help firms improve their competitive performance in a sustainable manner.

IV. Conclusions

4.1 Conclusions and Implications

This doctoral thesis is the first attempts to empirically examines a moderating effect of organizational culture on the relationship between big data analytics (BDA) and organizational agility which ultimately contributes to superior firm performance. In this section, the author briefly outlines the findings for the present study and elaborates the theoretical and practical implications.

4.1.1 Summary of the Findings

Throughout the study, the author first aims to identify whether there is a moderating effect of organizational culture in the relationship between big data analytics (BDA) and organizational agility. This objective was successfully proven in Study 1 and Study 3 by introducing democratization culture and examining its moderating effects on the relationship between BDA and organizational agility. Specifically, Study 1 finds that democratization culture has significant and positive moderating effects on the link between advanced BDA use and agility, whereas it shows a significant and negative moderating effect on agility when entangled with basic BDA use.

Based on the findings in Study 1, the author captures the potential that democratization culture comprises sub-concepts, such as the sharing of information and the acceptance of diversity. This implies that it may be more reasonable to develop democratization culture into a second-order formative construct by clearly identifying subconstructs and measurement items. Therefore, Study 2 develops and refines ‘data democratization culture (DDC)’⁴ by following the established guidelines (Moore and Benbasat 1991). As a result, the author identifies three dimensions (subconstructs) that consist of data democratization culture—the sharing of information, the acceptance of diversity and equality and iteratively refines measurement items assigned for each subconstruct. The construct of data democratization culture developed this way is expected to have greater reliability as a construct.

Finally, in Study 3, the author by employing two types of agility analyzes the moderating effect of organizational culture (i.e., data democratization culture). Although BDA is recently recognized as an enabler of agility (Chatfield and Reddick 2018; Ghasemaghaei et al. 2017; Mandal 2018), little knowledge has explored how BDA is leveraged to realize different types of agility in the same model setting. In this sense, the author especially focuses on strategic and operational agility which involve different decision making and execution processes from one another and identifies how BDA competency can enable them and how DDC moderates the relationship between BDA competency and each type of agility. The empirical results show that DDC positively affects firm performance by strengthening the effects of BDA competency on strategic agility, thereby enhancing firm performance. Whereas it shows negative and non-significant effect on the relationship between BDA competency and operational agility, thereby having not much of influence on firm performance.

From the findings from Study 1 and Study 3, the author suggests an important insight that organizational culture advocated by research (e.g., democratization culture or data democratization culture) is not a one-size-fits-all solution. That is, although a certain organizational culture can be advocated by researchers, it does not necessarily lead to positive outcomes in all BDA-using situations. Such an insight derived from the present doctoral thesis is expected to open a new line of research that advances our understanding about the role of organizational culture in BDA research community.

⁴ It is important to note that the author calls ‘data democratization culture (DDC)’ in Study 2, instead of democratization culture. This is because DDC is specifically based on cultural context of ‘data democratization’ and formulated by taking different construct development approach in terms of field interviews, content validity, etc.

In all, this doctoral thesis achieves to derive meaningful findings from Study 1,2, and 3 and advances the understanding of organizational culture in the context of big data analytics (BDA). As follows, the author illustrates the overall theoretical and practical implications throughout the study.

4.1.2 Theoretical Implications

Throughout the doctoral thesis, it has been proven that organizational culture exerts subtle yet powerful influences on people's behavior and closely pertinent to the effective utilization of BDA to improve organizational agility. This finding addresses an important gap in information systems (IS) literature by illuminating the process of implementing BDA initiative from a cultural perspective. While major streams of BDA research so far have focused on either conceptual or technological aspects of BDA to explain the nature of BDA and its potential effects, there is little knowledge that explores how BDA can be embedded into the organizational fabric and under what cultural conditions BDA can exert its full potential. In this sense, the author believes that this study makes important contributions in the advancement of the current understanding of organizational culture in the BDA context.

In recent years, some IS researchers started paying attention to organizational culture and applying this element to their studies. This contributes to IS research by uncovering the importance of organizational culture to achieve success in big data analytics (BDA) initiatives. Yet, most of them examine culture factor (e.g., in most cases, data-driven culture) as a part of BDA capability or one of the elements affecting organizational performance realized by BDA, instead of exploring the role of organizational culture as their major research purpose. In this sense, this current study distinguishes itself from prior research in that its primary objective is to introduce new culture construct (i.e., data democratization culture) and to rigorously investigate how organizational culture affects the dynamics of decision making and execution processes intertwined with big data analytics (BDA).

Furthermore, the study newly introduces the culture construct, called data democratization culture (DDC)⁵ by following the established guidelines of instrument development stages espoused by Moore and Benbasat (1991). This will contribute to IS research by providing scholars with the well-developed culture construct besides data-driven culture that has been widely used in the BDA research (Cao and Duan 2014; Dremel et al. 2020; Duan et al. 2020; Dubey et al. 2019a; Gupta and George 2016; Mikalef et al. 2019a,b; Pugna et al. 2019). So far, the term, data democratization has often come into discussion in industry research as organizational conditions favorable for BDA-based decision making, yet there has been no academic research that particularly focuses on its cultural aspects and systematically develops data democratization culture (DDC) construct. Hence, this study lays the foundation for data democratization culture and potentially encourages more scholars to derive meaningful implications about organizational culture in IS research community.

In addition, having organizational agility as the major outcome achieved by BDA is another important contribution to the extant literature. To the best of the author's knowledge, BDA and agility scholars both recognize the importance of organizational culture, yet organizational culture has been studied separately in each research arena (elaborated in Literature Review in Section 2). Thus, by examining the role of organizational culture pertaining to both BDA and organizational agility in the same model setting, the study opens a new line of research that explores the role of organizational culture in translating BDA into organizational agility which is a critical business capability in today's highly turbulent environments.

With having the basic framework that examines the moderating role of organizational culture in shaping the relationship between BDA and agility. In Study 1, the author specifically disaggregates BDA use

⁵As previously noted, Study 1 first introduces democratization culture (DC), and then Study 2 and 3 develops and empirically examines data democratization culture (DDC). Two culture factors basically in the same line, as they are both backgrounded in the idea of 'data democratization.' Since DDC is developed more sophisticatedly and rigorously by following the established construct development guidelines (Moore and Benbasat 1991), the author considers DDC a major culture construct that contributes to the literature.

into two types—advanced and basic use of BDA. This is a novel approach as the extant literature so far has broadly defined BDA use as a single construct and examined its impact on organizational agility. In Study 1, the author proposes that BDA use will differently influence agility by its functions and the types of BDA being utilized, because different types of BDA are built for distinctive purposes from one another. This approach enables the author to derive interesting results associated with democratization culture in Study 1. On the other hand, to analyze the role of organizational culture in a different angle, Study 3 employs two types of agility—strategic and operational agility while having BDA as a single construct. Although IS scholars are increasingly paying attention to BDA as a driver of organizational agility, there is a dearth of research that explores and compares how BDA is leveraged to attain different types of agility in the same model setting. Therefore, Study 3 enhances the current understanding of agility in relation to BDA and further explores the role of organizational culture (data democratization culture in Study 3) in achieving each type of agility through BDA competency. This is expected to provide meaningful contributions to IS literature.

Finally, the current study is one of the first studies suggesting that an organizational culture advocated by research (e.g., data democratization culture) is not ‘one-size-fits-all-solution.’ The extant literature so far has dominantly focused on identifying the positive role of organizational culture in relation to BDA and its related performance, but the author found that democratization culture shows significant moderating effects in both positive and negative ways depending on the type of BDA use it is intertwined with. Consistent with Study 1, Study 3, it is also found that data democratization culture (DDC) has significantly different effects on firm performance depending on two types of agility (i.e., strategic agility and operational agility) it is combined with. This provides novel and complementary perspectives on the main streams of BDA research which has been skewed toward the positive side of organizational culture pertaining to BDA performance. In this sense, the study is expected to open a new line of research that advances our understanding about the role of organizational culture.

4.1.3 Practical Implications

Exploring the effect of organizational culture is not only addressing a significant gap in IS literature but also providing practitioners with a deeper understanding about big data analytics (BDA). This is particularly important, as a sizeable number of companies are increasingly failing to reap significant improvement in their outcomes through BDA. In this reality, as one of feasible solutions to tackle such expensive failures, the author provides theoretical and empirical evidence regarding organizational culture and urges practitioners to pay careful attention to organizational culture in designing their BDA initiatives.

The author first emphasizes the role of organizational culture in creating meaningful outcomes (agility in this study) through BDA. For example, unlike conventional ITs such as enterprise resource planning (ERP) or transaction process system (TPS) that are exclusively managed by IT department (Presthus 2014), BDA systems are distributed across organizations involving multiple users from many functional areas (Shanks et al. 2010). This has brought an interesting paradigm shift in how organizations create and leverage knowledge for decision making (Abbasi et al. 2016). That is, as a broader range of employees (including top-level executives, middle managers, and lower-level employees) started engaging in decision-making processes in the BDA context, it has become important how effectively BDA is woven into organizations and how deeply BDA is rooted in employees’ mindset and beliefs. In this sense, organizational culture, which represents the basis of employees’ values, beliefs, and norms, is considered a critical factor that decides the success of BDA initiatives. Hence, by providing rigorous empirical evidence that identifies the importance of organizational culture in the BDA context, the author encourages practitioners who struggle to generate business value through BDA to realign their BDA initiatives with careful considerations of organizational culture.

In addition, data democratization culture (DDC) construct suggests important practical implications by deriving the subconstructs and measurement items of DDC grounded on not only literature review, but field-interviews. This multidimensionality of DDC allows managers to realize that it is difficult to effect

cultural changes without a thorough understanding of the various culture dimensions and a systematic approach accompanied with them. That is, this study by providing a deeper understanding about multi-dimensions of DDC (i.e., the sharing of information, the acceptance of diversity, and equality), enables managers to properly assess their organizational culture and devise the reasonable and comprehensive approach to weave their organizations into DDC. Hence, the present study offers the significant diagnostic value to practitioners and allow them to take a series of targeted actions to foster the appropriate organizational culture that facilitates successful utilization of big data analytics.

Lastly, the study suggests that managers should not blindly expect the overall success of big data initiatives by accepting an organizational culture advocated by academic and industry research. It is easy for practitioners to fall into such misconception, as most of academic and industry research takes one-sided perspective on organizational culture and focuses on a specific organizational culture (e.g., data-driven culture) that brings about positive outcomes on BDA usage. Yet, as theoretically and empirically proved, it is important to note that the effect of an organizational culture can be largely differently depending on the situations it is combined with (In Study 1, the effect of organizational culture differs by the type of BDA and in Study 3, it differs by the type of agility). For example, in the case of data democratization culture (DDC), it works effectively well when facilitating the BDA effect on strategic agility, which ultimately improves firm performance; whereas, it works negative and non-significant effect on firm performance when BDA is geared toward operational agility, thereby showing not much influence on firm performance. This result gives paramount implications to practitioners who make efforts to adjust their organizational culture for successful use of BDA, because their endeavors may result in vain when organizational culture mismatches with their BDA purposes or processes. Hence, the author believes that the present study urges managers to carefully design their organizational culture in a way that is aligned with organizational purpose of using BDA as well as the context where BDA activities are performed.