

6-18-2022

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Recommended Citation

Madhala, Prashanth; Li, Hongxiu; and Helander, Nina, "Exploring Data Analytics Capability Building: An IS Success and Resource-Based View" (2022). *ECIS 2022 Research-in-Progress Papers*. 15.

https://aisel.aisnet.org/ecis2022_rip/15

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EXPLORING DATA ANALYTICS CAPABILITY BUILDING: AN IS SUCCESS AND RESOURCE-BASED VIEW

Research in Progress

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Abstract

Business organizations are increasing their investments in resources related to data analytics. However, these investments would not be transferred to business value unless business organizations use these resources efficiently for value creation. Prior literature has suggested that data analytics capabilities (DAC) are critical in generating value from data and data analytics for business organizations. However, prior research has primarily centered on examining the role of resources in data and data-related technologies and ignored the importance of data services and the quality of data-related resources in building DAC and in generating value. Thus, this study develops a data analytics capability building model based on the resource-based view and the information systems success model to explain how data quality, data system quality, and data service quality in business organizations may help build DAC, which could enhance business organizations' business performance.

Keywords: Data analytics capabilities, IS success model, Resources, Business performance.

1 Introduction

Business organizations are increasing their investments in resources related to data analytics (DA) to help develop data analytics capabilities (DAC) and extract the value created by data and DA, such as data, data-related technology/systems, data-related talents, etc. (Bharadwaj, 2000). Some business organizations have even set up their own data centre/data unit to provide data services (Dremel et al., 2020). DAC has been argued to be vital in generating the value of DA in business (Ghasemaghaei et al., 2018; Mikalef & Gupta, 2021). DAC has been found to increase decision-making efficiency, organizational performance, and organizational creativity in business organizations (Ghasemaghaei et al., 2018; Mikalef & Gupta, 2021). Generating value from data-related resources springs from effective and efficient application practices rather than simply owning resources (Amit & Schoemaker, 1993). According to the literature, one important reason for business organizations' failure in accruing returns from resources is the lack of understanding of how to use these resources effectively (Bharadwaj, 2000). Prior research has mainly focused on the resources needed for building DAC from a resource-based perspective. For instance, Gupta and George (2016) identified tangible resources, human skills, and intangible resources as prerequisites for DAC. Grover et al. (2018) regarded technology infrastructure as a precondition for DAC. According to Mikalef et al. (2020), data, technology, skills, and data-driven culture are the resources for building DAC in business organizations. Strategies in using resources can help generate value rather than simply possessing resources (Bharadwaj, 2000; Iyer et al., 2006). Investment in DA resources alone cannot generate value but using these resources appropriately to address business needs could generate value from DA. Prior research has highlighted the importance of resources in building DAC in business organizations but has not yet considered the importance of

resource quality in building DAC. Even though business organizations have data-related resources, they differ from each other in DAC and value creation (Bharadwaj, 2000). The variation of DAC and value creation among business organizations might be linked to the quality of resources (Prahalad & Bettis, 1986; Wang & Ang, 2004). The variation of DAC and value creation could be better explained from the perspective of resource quality as quality is one of the dominant logics that may help explain the link between diversity and performance (Prahalad & Bettis, 1986). However, there is a lack of knowledge in the literature explaining how the quality of DA related resources may affect DAC, which is also associated with value creation (e.g., business performance) in business organizations.

To address the aforementioned research gap, we develop a research model to explain DAC building and its link to a specific value of business performance in business organizations based on the RBV (Barney, 1991) and the information systems (IS) success model (D&M IS success model) introduced and revised by DeLone and McLean (2003). The RBV could explain what resources are needed as inputs in building DAC in business organizations and how these resources are applied to create output (e.g., business performance), whereas the IS success model could explain how the quality of resources is associated with the DAC level, which further, enhance the business performance in business organizations. By combining these two theories, we strive to explain the resources that are needed in building DAC and the quality of these resources in determining the level of DAC and business performance.

To this end, the aim of this investigation is to bridge the knowledge gap by borrowing the concepts of information quality, system quality, and service quality from the IS success model and developing data quality, data system quality, and data service quality as the three facets of resources in business organizations to explain how data and DA resources could help build DAC and enhance business performance from an integrated view of resources and resource quality. This study aims to investigate the quality of the resource components (data quality, data system quality, and data service quality) for building DAC in business organizations and the role of DAC in enhancing business performance. This study would enrich the literature by developing data service as an important resource in building DAC and by including the concept of resource quality in explaining the level of DAC and business performance in business organizations.

The rest of the paper is organized in the following manner. Section two presents the theoretical background to establish the theoretical argument for this research, including the RBV, the IS success model, and the link between the two theories. Then, we discuss the proposed conceptual model and the propositions. Furthermore, we present the planned research method for the study followed by a discussion on the expected contributions and the limitations of the current study.

2 Theoretical Background

2.1 Resource-Based View

According to the RBV, the resources in a business organization consists of assets, capabilities, procedures, knowledge, information, etc., consisting of both tangible and intangible resources (Barney, 1991). Under the conditions of resource heterogeneity and resource immobility, organizational resources possess four characteristics to attain sustained competitive advantages: value (V), rarity (R), inimitability (I), and non-substitutability (N). Wade and Hulland (2004) stated that the efficient use of organizational resources will lead to both short-term and long-term competitive advantages. Business organizations should combine different resources to create strategies and capabilities that are leveraged to secure performance returns in business organizations (Nwankpa & Datta, 2017) as well as to address and overcome issues in business (Y. Chen et al., 2014). Combining different resources in business can generate synergies which help create new capabilities and renewed business processes (J. L. Chen, 2012). According to Bharadwaj (2000), the processes of combining and using resources with VRIN attributes are embedded into organizational routines and are difficult for competitors to imitate.

The RBV has been utilized in the IS field to explore the role of IS resources in business in different contexts. For instance, Iyer et al. (2006) employed the RBV to explain why a business organization

should invest in IT consulting services. In their study, they found that appropriate combinations of IT resources, organizational structure, and work processes can generate non-imitable resources (services) and unique capabilities in business organizations that are a result of organizational-specific processes and are difficult to imitate. Bharadwaj (2000) examined the association between IT resources and organizational performance based on RBV and argued that IT resources can affect organizational performance as the presence of IT-enabled intangible resources can form the organization's IT capabilities, which cannot be imitated by other business organizations. According to Liu et al. (2020), resources integrated into a business organizations' own activities and unique business context can produce unique services and products that are hard to imitate and substitute. Therefore, a business organization's capabilities can be enhanced by adding new resources in business (Pan et al., 2015).

In the context of DA, business organizations could apply data and data technologies/systems to build DAC and provide data services to different units in organizations. Therefore, the DAC of a business organization would be complex to imitate by others in the presence of intangible resources and would help in building DAC and enhancing business performance. Business organizations invest in different resources for creating value based on DA, such as data, technology, and human resources, which are essential in building data services and DAC for enhancing business performance. Thus, in this study, following the prior research, we apply RBV as a theoretical base to investigate how DA-related resources are applied in business organizations to build DAC and enhance business performance.

2.2 Information Systems (IS) Success Model

DeLone and McLean (1992) introduced the IS success model to identify the components that promote IS success. In their initial IS success model, DeLone and McLean (1992) recognized system quality and information quality as the two factors that explain IS success. Later, DeLone and McLean (2003) published a revised version of the IS success model, also known as the D&M IS success model, by incorporating service quality as another critical component to explain IS success. According to Pitt et al. (1995), assessing service quality is crucial due to the transition of the role performed by IS departments from providing products to the dual role of providing both products and services (DeLone & McLean, 2003).

The revised IS success model has been extensively used in the IS field to investigate IS success in different contexts. In a study involving business organizations from various industries, Gorla et al. (2010) examined the effects of the system, information, and service quality on organizational impact and found a positive association between the three dimensions of quality and organizational performance, such as organizational efficiency, product/service enhancements, and market information support. The IS model has also been applied to evaluate the fruition of e-government systems from an employee perspective (Stefanovic et al., 2016). The findings show that both information and service quality has been found to significantly affect employees' motivation to make use of e-government systems, while system quality affects the satisfaction of the users and their motive to utilize e-government systems. These three quality dimensions predict employees' perceived net benefits in the form of time savings, ease of use and usefulness (Stefanovic et al., 2016). In the literature, there are conflicting findings on the role of the three quality dimensions in explaining IS success, which might be related to the different contexts in which the IS success model has been utilized and researched in prior literature.

2.3 The link between the IS Success model and RBV

In this study, we combined the IS success model and the RBV to explain the resources needed for building DAC and the role of DAC in enhancing business performance in business organizations. The three main quality aspects of the IS success model (e.g., information quality, system quality, and service quality) involve resources in business organizations. Accordingly, information, system, and services are different resources in business organizations (Barney et al., 2001). These resources are necessary for IS success, but they cannot guarantee the success of IS. The quality of these resources plays an important role in determining IS success (DeLone & McLean, 2003).

Following the RBV, business organizations should apply resources associated with DA to create value for them, such as data, data-related technologies/systems, and DA talents (Bharadwaj, 2000). They should combine data, data technologies/systems, and DA talents to provide data services to meet the business needs of business organizations. The demand for good quality information and knowledge based on DA to address business needs could be addressed by the business organization’s ability to provide data services (Gu & Jung, 2013). The configuration of these resources could help build the DAC of business organizations and the quality of these resources will be vital for the DAC level in business organizations (Torres et al., 2018). Thus, borrowing the concept of quality from the IS success model, we developed data quality, data system quality, and data service quality to explain the resources needed in building DAC and the link between resource quality and DAC for value creation.

Therefore, in this study, we integrate RBV, and the D&M IS success model to explain how the quality of different resources might help determine DAC building in a business organization, which could lead to value creation (e.g., business performance) in business organizations. Specifically, we follow the three quality concepts from the D&M IS success model and modify them to fit the context of DA. We name the three quality concepts as data quality, data system quality, and data service quality. Combining the data, data system, and data service with quality could help build the DAC and determine the level of DAC in business organizations, which might lead to the output (e.g., business performance enhancement) in business organizations.

3 Theoretical Model and Propositions

3.1 Data Analytics Capability Building Model

Based on the RBV and D&M IS success model, we develop a data analytics capability building model. Following the D&M IS success model, we raised three quality dimensions related to resources: data quality, data system quality, and data service quality. We assume that data quality, data system quality, and data service quality are three important resources to help build DAC, and DAC may determine the value creation, such as business performance. Applying resources to build DAC and enhance business performance in an organization is a dynamic process. Table 1 presents the concepts and definitions of the concepts included in the model.

Concepts	Definition
Data Quality	Data quality refers to the usability, importance, accuracy, timeliness, completeness, and relevancy of data in an organization (DeLone & McLean, 2003).
Data System Quality	Data system quality is defined as to what degree the hardware and software of the data system in an organization can cater to the needs of the organization (DeLone & McLean, 2003).
Data Service Quality	Data service quality is defined as to what degree the data service in an organization provides services to its users efficiently and effectively (DeLone & McLean, 2003).
DAC	DAC refers to the ability of a business organization to identify, develop, and deploy its data analytics resources (Gupta & George, 2016).
Business Performance	Business performance is defined as a business organization’s ability to create profits, save costs, retain customers, etc. by effectively and efficiently deploying its capabilities (Božič & Dimovski, 2019; Torres et al., 2018).

Table 1. Definitions of concepts in the research model.

Figure 1 displays the proposed conceptual model. In the model, organizational resources as input comprise both tangible and intangible resources. Data consist of intangible resources, such as data and data sources. The quality of data is important since wrong data might lead to misleading or even wrong insights and knowledge based on data analysis. The timing of data, such as historical data or streaming data, might also be an important factor related to data quality when deciding what data to be used in data analytics. Data system consist of both hardware and software related to data and data analysis as well as the technological infrastructure required for handling and processing data, including tangible and

intangible resources. The quality of data systems is vital for the efficient application of DA in business. Data service involves the processes of generating information, insights, and knowledge for business decision-making via data analysis, which consists of various intangible resources such as DA skills, knowledge, know-how, expertise, DA alignment with business, and data governance. Such as regarding data governance, how data have been collected, what data should be distributed and shared in business units, and employees' access right to different databases are all important aspects linked with data service quality. DAC is an important new organizational resource (intangible resources as capabilities) built based on data quality (intangible), data system quality (tangible), and data service quality (tangible and intangible) from the lens of RBV. The three quality dimensions could determine the level of DAC, which might lead to business performance (output) enhancement. With regard to output, business organizations aim to achieve business performance (Krishnamoorthi & Mathew, 2018; Torres et al., 2018). Thus, in this study, we set business performance as the main output for evaluating value creation in business organizations. Due to the changing business environment and the needs of business organizations and the continuous updating of data, applying resources to build DAC and enhancing business performance in the organization would be an iterative process or a dynamic process.

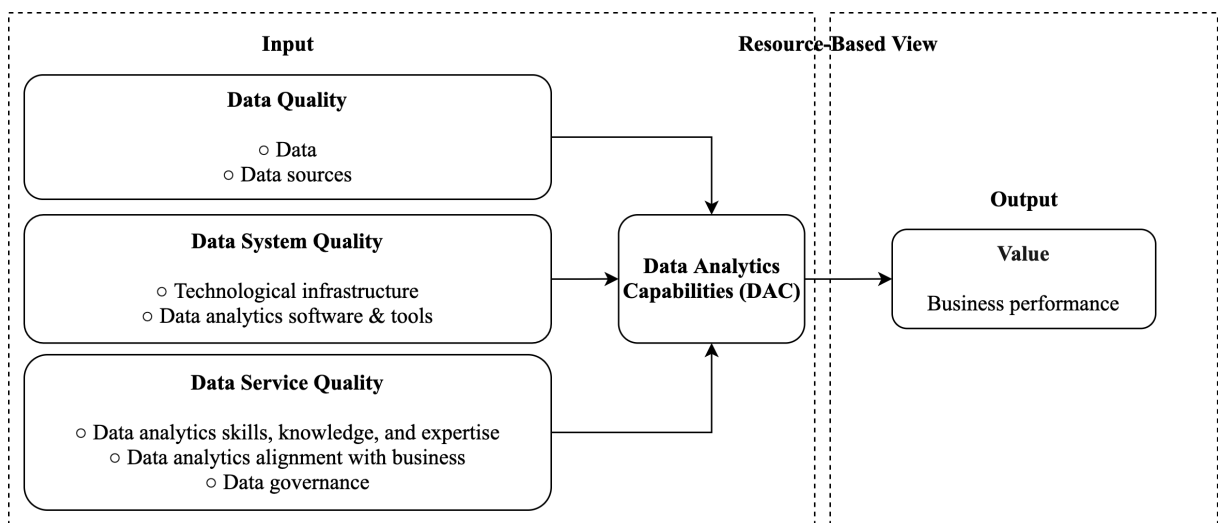


Figure 1. Data analytics capability building model.

3.2 Proposed propositions

Data quality has been identified as a critical component in the process of DAC development, as it supports the knowledge and insights drawn from DA. Data quality is related to the availability of data and data sources. Data generated in business organizations should be relevant, timely, complete, reliable, and accurate. For example, relevant and accurate data could contribute to the development of DAC (Ghasemaghaei, 2019). In the manufacturing sector, accurate data have been argued to enhance the quality of manufacturing planning (Chae et al., 2014). Also, data sources are essential for building DAC (Krishnamoorthi & Mathew, 2018). For instance, Zhang et al. (2019) stated the importance of having different data sources for achieving predictive analytics success in air pollution management. Both data and data sources are essential for data quality, which could affect DAC building. In this regard, we posit the following proposition:

Proposition 1: Data quality (e.g., data and data sources) is associated with DAC.

The availability of technology infrastructure and assets plays a vital role in DA applications in business organizations (Krishnamoorthi & Mathew, 2018; Shamim et al., 2019). Technology infrastructure supports the easier deployment of analytics, helps provide access to data whenever it is needed and helps with data sharing in business organizations (Fink et al., 2017). Technology infrastructure also enables the development of new tools and provides the technologies required for DA (Fink et al., 2017). E.g., Data technologies like cloud computing have been essential in enhancing organizational DAC, which

could serve as a reliant technological infrastructure in business organizations. In addition, analytics software and tools might facilitate efficient DA in business organizations. For example, analytics software is imperative for producing efficient dashboards for monitoring and enhancing forecasting accuracy (Jha et al., 2020). Some sophisticated DA tools may help efficient data analysis and enhance the quality of decision making in business (Ghasemaghaei, 2019). Therefore, we postulate the following proposition:

Proposition 2: Data system quality (e.g., technology infrastructure and DA software and tools) is associated with DAC.

DA skills and expertise are indispensable for mining knowledge and insights from various data sources (Suoniemi et al., 2020). For example, data services based on data, data system, and good data analysis skills have been found to improve marketing performances and decision-making across an organization (Hitt et al., 2015). Good data service is needed in smart manufacturing to help with monitoring production lines in real-time (Fay & Kazantsev, 2018). In addition, DA alignment with business and domain expertise is necessary for solving business problems in different business contexts based on DA (Krishnamoorthi & Mathew, 2018). Furthermore, data governance is essential for the efficient application of DA in business, which helps build DAC in a business organization (Dremel et al., 2020; Mikalef & Krogtie, 2020). Based on the above, we posit the following proposition:

Proposition 3: Data service quality (e.g., DA expertise, DA alignment with business, and data governance) is associated with DAC.

DAC has been found to positively affect business performance in different business contexts. For instance, DAC has been found to enhance operational performance in manufacturing industries (Chae et al., 2014). Concerning cyber security, it has been found that DAC could enhance the efficiency and effectiveness of handling cyber security threats (Naseer et al., 2018). By creating and exploiting business insights, business organizations could improve their performance by innovating and producing value for internal and external stakeholders (Alexander & Lyytinen, 2019). Business organizations may also achieve competitive performance by developing marketing and technological capabilities using DAC (Mikalef et al., 2020). Therefore, we assume that DAC is linked with value creation, especially the business performance of a business organization, and we propose that:

Proposition 4: DAC is associated with organizations' business performance.

Resources such as data, data infrastructure, skills, and knowledge would be combined and applied to build DAC and to achieve business performance, and these resources would be updated during the process (Teece et al., 1997). For instance, human resources could be sourced externally and upskilled internally, the data used for analytics would be updated constantly, and the data infrastructure used for collecting, storing, gathering, analysing, and sharing knowledge may also be renewed to meet new computational demands. The quality of updated resources may also renew the DAC and the business needs in organizations which might prompt business organizations to reconfigure resources to build their DAC for enhancing business performance. Therefore, we propose that:

Proposition 5: Building DAC and enhancing the business performance of business organizations based on DA resources is a dynamic process.

4 Planned Research Method

The proposed conceptual model will be evaluated empirically through multiple case studies. Multiple case studies involve studies from various contexts and may lead to greater confidence in findings (Yin, 2011). We would select business organizations with different backgrounds, such as small, medium, and big companies, as cases with different backgrounds, might help identify the variances among organizations in different contexts. The empirical data collection will focus on the sales and marketing business area in business organizations. On one hand, data analytics has been applied in different business contexts in business organizations. The findings from one business context might not work for the other business context. Focusing on one specific business area might provide deep understanding and more meaningful insights into the specific business context. In addition, data analytics has been

applied in business organizations to better understand customers due to the availability of customer data. It is necessary to explore how business companies have applied different data analytics resources to build DAC and create value (e.g., business performance).

At least three different case organizations in Finland will be selected for this study. We will conduct semi-structured interviews with at least five employees in each case. The target interviewees are the employees in the case companies who are in the management teams or are involved in data and DA and marketing and sales in business. In total, at least 15 interviews will be conducted in this study. The interviews will be organized face-to-face or remotely based on the preferred arrangement from the interviewee's point of view. The duration of each interview could be between 60 and 90 minutes. The interviews will be recorded based on permission from the interviewees and will be kept confidential for information security reasons. NVIVO software will be applied to analyse the interviewed data.

The content of the interview would be related to what resources are needed in building DAC, how the quality of the resources is associated with DAC, and how DAC will affect the business performance of a business organization. Specifically, some questions regarding the interviewees' work background, work experience and their work responsibility will be asked in the interviews. In addition, the resources that are required for building DAC in business organizations from the data, data system, and data service perspective will be asked. We will also ask the interviewees about their data, data system, and data service resources from their organizations. Furthermore, the interviewees will be asked to evaluate the quality of the data, data system, and data service resources, and how the quality of these resources could be associated with DAC, and how DAC affects business performance.

5 Expected Contributions and Research Limitations

This study expects to extend the understanding of DAC building by integrating both the RBV and the IS success model and by explaining how data quality, data system quality and data service quality could affect DAC and enhance business performance. Also, this study contributes to the DAC literature via borrowing the quality concept from the IS success model to develop the quality dimensions regarding resources needed for building DAC as well as by developing data service as an important resource in business organizations for building DAC and to achieve enhanced business performance.

Regarding practical contributions, this study may provide business organizations with practical suggestions on the importance of resource quality in building DAC and enhancing business performance when they apply data analytics in sales and marketing, specifically the quality of data, data systems, and data service in building good DAC, which is critical for enhancing business performance. For companies that have data and data technology resources but failed to achieve business performance, this study might provide them with practical suggestions on why they have been unsuccessful and what they should do to achieve value via building good DAC when applying data analytics in sales and marketing field. Specifically, they should consider whether they both quality data and data system and quality data services which will be vital in building DAC for enhancing business performance.

A couple of limitations of this study should be acknowledged. First, this study aims to examine DAC building and value creation through DA from an integrated view of the RBV and the IS success model. Some other factors or theories that might also explain value creation in business organizations through DA should be considered in future research, such as data strategies, leadership, agility, organizational structure, and data-driven organizational culture. Second, this study focuses on the sales and marketing business field. The findings can be generalized to the specific business context of sales and marketing. Future research should consider replicating this study in other business contexts, such as service and process development, business operation, business innovation, which could help generalize the findings of this study to other business contexts. Third, there might be bias from the interviewees' point of view due to the nature of the research method. Forth, the multiple-case study approach will be applied in this study. Future research can also apply other research methods, such as survey research and action research, to empirically validate and develop the proposed research model.

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