Big Data Analytics Capabilities, Sustainability Reporting on Social Media, and Competitive Advantage: An Exploratory Study

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ABSTRACT

Manuscript type: Research paper

Research aims: Drawing from the lens of dynamic capability view (DCV), this study investigates whether companies with big data analytics (BDA) capabilities, specifically BDA management, infrastructure, and personnel capabilities, disclose more sustainability posts on social media and whether such disclosure affects their competitive advantage.

Design/Methodology/Approach: Data from 100 public listed firms in Malaysia were obtained from questionnaires and content analysis of Facebook pages. Smart PLS was employed to analyse the data.

Research findings: The results suggest that in the context of Malaysia, BDA management capability significantly impacts sustainability reporting on social media (SRSM). The evidence also points to SSRM positively impacting a company's competitive advantage.

Theoretical contribution/Originality: Theoretically, this study contributes to the literature on DCV. The findings provide insights into how BDA capabilities can help organisations focus on social media platforms and communicate with their stakeholders on sustainability performance. It also suggests that sustainability reporting on social media is associated with competitive advantage, as it allows for two-way interaction between organisations and its stakeholders.

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Practitioner/Policy implications: Practically, this study provides insights into the roles of accounting, social media, and big data within the current digital revolution. Specifically, it offers guidance to executives and managers on identifying the conditions that need to be present for BDA capability to add value to SRSM. Additionally, the findings here have implications for policymakers and businesses looking to use BDA in the context of SRSM to gain competitive advantage.
Research limitation/Implications: Future studies could consider increasing the sample size. This study sheds light on the relevance of BDA capabilities in promoting sustainability issues using social media.

Keywords: Sustainability reporting, Big data analytics, Dynamic capability view, Social media, Competitive advantage
JEL Classification: M41, Q560

1. Introduction

Big data's disruptive impact has changed how organisations carry out their businesses (Lombardi & Secundo, 2021). In the literature, the term 'big data' is often used to describe extremely large and complex data sets drawn from various sources using advanced techniques, such as big data analytics (BDA) capabilities. Specifically, to harness knowledge from big data, advanced techniques and technologies, commonly referred to as business analytics, or BDA capabilities, are needed. BDA capabilities enable organisations to collect, store, manage, and analyse data into useful information for decision-making (Mikalef et al., 2018). Prior literature highlights that organisations create value from big data when they are able to combine their resources (e.g., social media, big data, and cloud computing) and BDA capabilities (Oesterreich et al., 2022; Teece, 2014).

Organisations have increasingly become more focused on communicating their initiatives on corporate social responsibility (CSR) and sustainability to their external stakeholders. Two-way communication is essential due to the need to connect the way in which information is being presented via formal channels, e.g., sustainability reports, with the way in which people are seeking and sharing information, which is increasingly through social media. Applications such as Facebook and Twitter allow corporations to engage in a two-way dialogue with a large group of stakeholders in a more timely, cost-effective, interactive, and accessible manner. Additionally, in line with the ubiquity of the internet in people's daily lives, corporations have begun to disclose information via websites, and have increasingly adopted social media platforms to

communicate and disclose their sustainability practices. Dynamic sustainability communication via social media allows stakeholders to share and discuss relevant information, enabling the dissemination of corporate sustainability information to evolve from one-way communication to two-way transactional communication (Reilly & Hynan, 2014).

Social media platforms are generators of big data in the form of tweets, likes, comments, posts, shares, and reviews on various social media platforms and websites (She & Michelon, 2019). Big data is often structured or semi-structured, making it challenging to gain insights from it. Accordingly, using BDA for social media platforms allows companies to analyse the data descriptively, diagnostically, predictively, and prescriptively (Ghani et al., 2019). For instance, predictive analytics can be used to predict a certain outcome related to sustainability performance (Dubey et al., 2017). Despite offering several advantages, however, social media can also give rise to problems such as information overload (Roetzel, 2019), which hinders the ability of management to make meaningful decisions. Consequently, corporations need to match big data with appropriate data analytic capabilities to create value (Teece, 2014).

Despite the increasing use of social media for corporate disclosures, research in this area is underexplored, particularly in emerging economies. In the instances in which prior literature has examined this issue, it has focused on developed countries such as the United States, Australia, Spain, Italy, and the United Kingdom (Lombardi & Secundo, 2020). This is an interesting issue given that Global Reporting Initiative (GRI) chief adviser on innovation Nelmara Arbex is of the view that:

> *The information presented in sustainability reports should be used for making better-informed decisions. But this valuable information is currently locked-up in sustainability reports and often it is not used to its full potential, because it cannot easily be shared.*

Moreover, this study is motivated by the growing adoption of BDA in the Asean region. Malaysia's vision to fully digitalise its economy is directly linked with better sustainability performance and reporting. It is consistent with the GRI 2025 vision, which aims to fully digitalise reporting outside the bounds of the annual reporting system (GRI, 2015). Fully digital reporting means more transparency and a chance for two-way communication with stakeholders. Malaysia presents an ideal case to explore the proposed relationships among the variables of this study since it is in the process of implementing BDA

and uses GRI guidelines for mandatory sustainability reporting. Additionally, this study aims to extend the work of Al-Htaybat and von Alberti-Alhtaybat (2017), which suggests that BDA adoption improves corporate reporting on social media. However, they only focus on accountants' use of big data technology to improve financial reporting. In contrast, this study adds to the literature by investigating factors such as BDA infrastructure requirements and BDA management capability, besides focusing on the impact of BDA on non-financial reporting (sustainability reporting).

Prior studies have explored the links between sustainability performance, reporting, and competitive advantage (e.g., Danso et al., 2019; Haseeb et al., 2019; Papadas et al., 2018; Taliento et al., 2019). Better sustainability reporting strengthens a company's relationship with its stakeholders, potentially leading to the creation of competitive advantage. The links between sustainability reporting, engagement with stakeholders on social media, and competitive advantage have also been investigated (e.g., Zhao et al., 2019; Kumar & Pansari, 2016; Leonidou et al., 2018). In prior literature, much focus was placed on the roles of profitability indicators (Cho et al., 2019) and CSR (Nyuur et al., 2019) in helping companies achieve competitive advantage. However, the literature is limited on the voluntary sustainability reporting practices of companies on social media to achieve competitive advantage. Accordingly, another objective of this study is to examine the impact of SRSM on the competitive advantage of companies in the context of Malaysia.

This study is organised as follows. Section 2 explains the available literature on BDA management, infrastructure, and personnel capabilities and SRSM. It also provides the theoretical support for this study. The research methodology used to evaluate the hypothesised paths of the proposed variables is elaborated on in Section 3. The data analysis is presented in Section 4, and the findings are discussed in Section 5. Finally, Section 6 concludes with implications, limitations, and future research direction.

2. Literature Review and Hypothesis Development

2.1 Dynamic Capability View (DCV) Theory

The dynamic capability view (DCV) asserts that to thrive in a rapidly changing environment, organisations need to be able to integrate, build, and reconfigure internal and external competencies (Teece et al., 1997). Dynamic capabilities can be categorised into the tangible and intangible resources of an organisation (Mikalef et al., 2019)

that facilitate information management for better decision-making. There are various antecedents of DCV, including organisational structure (Felin & Powell, 2016), organisational culture (Song et al., 2016), tangible and intangible resources (Salge & Vera, 2013), and information technology (Pavlou & El Sawy, 2010). The underlying assumptions of DCV are based on its antecedents. First, an organisation must be able to sense arising opportunities and threats. Second, it must know how to seize an opportunity, and lastly, it should be able to reconfigure its resources (tangible and intangible) to build competitive advantage (Côrte-Real et al., 2017). Resources are generally categorised into ordinary and dynamic capabilities (Teece, 2014). The operational task and performance of organisations are associated with ordinary capabilities, whereas transformation and seizing and sensing capabilities are known as dynamic capabilities (Teece et al., 1997). Teece et al. (1997) argue that dynamic capabilities, which involve the experimentation, evolution, and growth of existing resources, are superior to ordinary capabilities.

Accordingly, BDA capabilities such as management, infrastructure, and personnel capabilities can be a source of dynamic capabilities that allows organisations and their top management to adapt to meet stakeholders' preferences and address new business problems. DCV allows organisations to achieve congruence between customers' needs, technology, and business opportunities. The DCV postulates that an organisation's dynamic capabilities are shaped by the aim of achieving competitive advantage through long-term consistent performance in a dynamic environment (Barney et al., 2021).

In a changing business environment, corporations are expected to cater to stakeholders' informational needs according to their choice of platform. Eikelenboom and Jong (2019) believe that dynamic capabilities are important for economic, social, and environmental performance. Studies also highlight that CSR practices and fulfilment of stakeholders' needs transform into an asset for corporations and contribute to achieving competitive advantage (e.g., Khan et al., 2019). A parallel stream of literature shows that social media leads to better communication and relationships with stakeholders (Bakri, 2017), and can also be a source of competitive advantage (Singla & Durga, 2015). Although stakeholder theory elaborates on the motivation behind stakeholders putting pressure on the corporation, it is limited on how to address the dynamic nature of stakeholders' informational needs and expectations (Chowdhury et al., 2022). This gap can be explained using DCV that conceptualises BDA as a dynamic capability. Unlike prior studies that use stakeholder theory to examine sustainability

reporting, this study uses DCV to analyse sustainability reporting on social media. Social media is selected due to its popularity as a platform for information sharing with stakeholders. Therefore, this study examines the impact of BDA on SRSM and subsequently its impact on the competitive advantage of organisations.

2.2 BDA Capabilities Dimensions

BDA capabilities are defined as "the competence to provide business insights using data management, infrastructure (technology), and talent (personnel) capability" (Wamba et al., 2017). BDA capability is an ability that enables organisations to collect, store, manage, and process data for better decision-making (Mikalef et al., 2018). According to Brynjolfsson and McAfee (2012), data-driven businesses are 6% more profitable and 5% more productive than their competitors. According to Mariani and Baggio (2021), the use of BDA for social media platforms allows corporations to analyse data descriptively (what happened), predictively (what will happen), and prescriptively (how to optimise). The technical challenge of using big data is real, but the managerial challenge is even greater, as corporations need to combine infrastructure, human resources, and management capabilities effectively to successfully adopt BDA. Accordingly, this study argues that BDA capabilities can be a dynamic capability to take advantage of opportunities or reduce threats. Wamba et al. (2017) categorises the tangible and non-tangible components of BDA as management, infrastructure, and personnel capabilities in their evaluation of the BDA implementation in corporations.

Big data management capability is defined as "the BDA unit's ability to handle routines in a structured (rather than ad hoc) manner to manage IT resources in accordance with business needs and priorities" (Wamba et al., 2017). It ensures that business decisions apply the proper management framework. Kim et al. (2012) consider IT planning, IT coordination, and IT control as IT management's foundational capabilities. These IT capabilities form the basis of BDA management capability. From the BDA perspective, IT management capabilities are termed as BDA planning, coordination, and control (Akter et al., 2016). BDA planning facilitates the development of procurement and production schedules by collecting and interpreting information appropriately (Wamba et al., 2017). BDA coordination is the synchronisation of operations, reports, direct contact, task forces, and informal and formal gatherings of interdepartmental teams among the corporation's entities.

BDA infrastructure's ability (e.g., applications, hardware, data, and networks) enables a corporation to develop, deploy quickly, and support the necessary system components for the corporation (Wamba et al., 2015). Existing IT infrastructure may prove to be insufficient in integrating data from various sources (Wamba et al., 2015). With the proliferation of big data, specific software that facilitates storage, the processing of massive unstructured datasets, visualisation, and decision aid is required (Gupta & George, 2016). Scholars have examined the big data infrastructure of corporations in terms of the investments made in specific technologies (Kamioka & Tapanainen, 2014), and others have focused on features of the technology itself (Garmaki et al., 2016). Prior studies use connectivity and compatibility as a common measurement of BDA infrastructure capability (Rialti et al., 2019). Similarly, connectivity and compatibility are used in this study as the sub-dimensions of BDA infrastructure capabilities.

BDA personnel capabilities are defined as "the BDA staff's professional ability (e.g., skills or knowledge) to undertake assigned tasks" (Wamba et al., 2015). These capabilities are further divided into sub-dimensions, namely technical knowledge (e.g., database management, data retrieval, programming knowledge); business knowledge (e.g., the decision-making routed within the organisation, strategic foresight for big data deployments, and application of insights extracted); relational knowledge (e.g., communication and collaboration skills between employees from different backgrounds); and business analytics knowledge (e.g., mathematical modelling, simulation and scenario development, and interactive data visualisation) (Rialti et al., 2019). Despite the increase in focus on the roles of data scientists, other skills and knowledge sets are also necessary for the employees at organisations engaging in BDA.

Although the IT infrastructure of a corporation and its BDA capabilities are similar in many ways, there are also differences. IT infrastructure focuses on implementing and using computers and IT resources, whereas BDA capabilities focus more on analysing data, drawing meaningful insights, and decision-making. Thus, IT infrastructure or technologies are about the technical aspects of IT infrastructure, whereas BDA capabilities technologies are about applying IT technologies in sharing and analysing information to facilitate strategy formulation (Wamba et al., 2017).

In line with DCV, it is vital to have tangible and intangible resources to implement BDA (Kim et al., 2012). Several studies have investigated the most important resources for the adoption of BDA

(Mikalef et al., 2017). Management, infrastructure, and personnel capabilities as BDA dimensions were identified to be important factors (Akter et al., 2016). Since this study aims to investigate SRSM, it also uses BDA management, infrastructure, and personnel capabilities as the main variables, in line with the existing literature.

2.2 Sustainability Reporting, Social Media, and BDA Capabilities

Traditional sustainability reporting entails one-way communication, which is considered the weakest form of communication (Kaur & Lodhia, 2014). As highlighted by Cummings (2001), since the early 2000s, stakeholder perceptions have changed dramatically from 'inform me' to 'engage me' to incorporate dynamic stakeholder needs and expectations in decision-making. With the rapid changes in media technology, social media platforms have enabled organisations to engage, interact, and communicate with stakeholders (Kucukusta et al., 2019). Trade publications report the public's tendency to rely more on social media than corporate websites when searching for information about a company (DEI Worldwide, 2008). There are many examples of stakeholder backlash in response to posts by businesses on social media platforms. For example, whilst his employees were demanding better working conditions at an Amazon warehouse, Jeff Bezos' tweet on Earth Day showed him vacationing in Norway. The public responded to Bezos' tweet and urged him to improve the minimum wage of his employees. Resultantly, the minimum wage of Amazon employees was increased to a minimum of US$15 per hour (Cheng, 2018). This example highlights the impact that social media platforms can have on corporations.

Due to the adaptation of emerging technological trends worldwide, corporations have shifted sustainability reporting from traditional to internet-based mediums. SRSM is defined as "the use of social media for external and internal corporate communication about sustainability, allowing a two-way interaction between an organisation and stakeholders" (Kaplan & Haenlein, 2010). Manetti and Bellucci (2016), in their examination of 332 global sustainability reports following the GRI guidelines and their social media platforms to assess the scope of communication with stakeholders, find that a small number of corporations use social media platforms to define sustainability reporting content. Lodhia et al. (2020) show that Australian corporations use social media platforms to share information and initiate dialogue on sustainability reporting indicators. However, the disclosures on social media platforms mainly focused on discussing social rather than environmental issues.

Nonetheless, it can be challenging for a corporation to manage social media platforms with large amounts of unstructured data for sustainability reporting purposes. A corporation needs a specific set of capabilities to manage and predict the possible threats from social media platforms. Men and Tsai (2016) suggest using BDA capabilities to engage digital-savvy stakeholders. Having BDA capabilities allows an organisation to identify when stakeholders need sustainability performance-related information, subject matter, and time on social media.

The development of BDA management, infrastructure, and personnel capabilities helps corporations predict, identify, analyse, and manage social media platforms. Eikelenboom and de Jong (2019) find corporations with better IT infrastructure and trained management to be better at sustainability performance and reporting. Khuntia et al. (2018) report a positive relationship between a corporation's IT capability and sustainability. Further, IT capabilities enable corporations to communicate sustainability reporting in a better way. Moreover, BDA was found to have the prospect of expanding the credibility of SRSM due to traditional reporting's failure to fulfil customers' informational needs (Amran et al., 2015).

The incorporation of big data in corporate reporting to transform the traditional reporting style into something more interactive has been suggested (Al-Htaybat & von Alberti-Alhtaybat, 2017). The implementation of BDA can help organisations focus on social media platforms and communicate with stakeholders about sustainability performance (Bellucci & Manetti, 2017). Thus, it facilitates proper engagement with stakeholders on social media platforms (Haro-de-Rosario et al., 2018). Accordingly, this study developed the following hypotheses to investigate the impact of BDA dimensions on SRSM in the Malaysian context:

H_1: BDA management capability has a positive impact on SRSM

H_2: BDA infrastructure capability has a positive impact on SRSM

H_3: BDA personnel capability has a positive impact on SRSM

2.3 Competitive Advantage

Arend and Bromiley (2009) identify a corporation's dynamic capabilities as a source of competitive advantage that contrasted traditional sources of competitive advantage. Panda and Sangle (2020) explain how stakeholder engagement is a source of competitive advantage for a corporation and what capabilities are required to

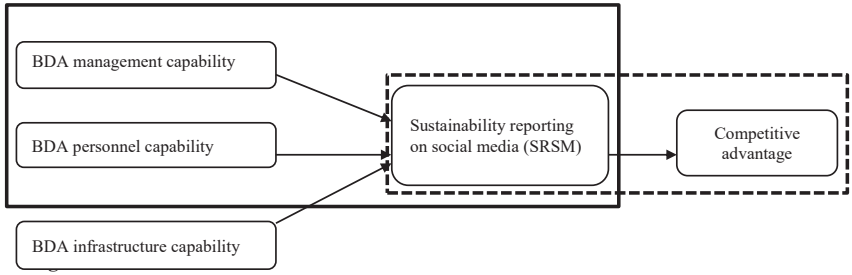
develop this source. They also provide suggestions for stakeholder engagement strategies. Given the changing traditional sources of competitive advantage, social media is also identified as a potential source. Singla and Durga (2015) argue that today's younger employees have a more positive view of social media, and bring that knowledge to the workplace.

Prior literature also suggests that CSR reporting on social media is associated with competitive advantage. Thaker et al. (2020) investigate CSR practices related to the environment and their impact on social media engagement. The study's results showed that stakeholder engagement on social media led to customer loyalty. Zhao et al. (2019) suggest sustainability reporting and engagement with stakeholders on social media as having a positive influence on competitive advantage. Haseeb et al. (2019) show that social and technological challenges impacted sustainable business performance in Malaysia. Although evidence in developed counties suggests that CSR reporting on social media is associated with competitive advantage, empirical evidence on the relationship between SRSM and competitive advantage is lacking. As such, the following hypothesis was developed:

H_4: There is a positive association between SRSM and the competitive advantage of corporations

This study utilises DCV to explain the relationships between BDA capabilities, SRSM, and competitive advantage. The research model is shown in Figure 1 below.

Figure 1: Research model on the relationships between BDA capabilities, SRSM, and competitive advantage



3. Methodology

3.1 Instrument

This study uses a questionnaire-based approach. The measurement scales for BDA management, infrastructure, and personnel capabilities are adapted from Wamba et al. (2017) and Gupta and George (2016). BDA management, infrastructure, and personnel capability are second-order variables with six first-order dimensions. The scale for SRSM was adapted from Dubey et al. (2017), and the scale for competitive advantage was adapted from Papadas et al. (2018). A questionnaire was used for this study to save time, energy, and cost (Dörnyei & Taguchi, 2009). The use of a web-based questionnaire sent through e-mail allowed the questionnaire to reach a geographically scattered sample. The respondents could complete the questionnaire according to their convenience (Ferreira et al., 2010). The questionnaire could also capture a causal relationship between the variables under study (Pinsonneault & Kraemer, 1993). This study uses a five-point Likert scale due to its higher reliability, quality, and validity (Revilla et al., 2014). Thus, the questions were structured based on a five-point Likert scale ranging from 1 to 5 (1 = strongly disagree, 5 = strongly agree). The questionnaire was pretested for reliability by using Cronbach's alpha. The reliability values ranged from 0.80 to 0.95, which fulfilled the minimum acceptable value of 0.7 for Cronbach's alpha (Taber, 2018).

3.2 Sample

Malaysia was chosen as this study's target population for several reasons. First, social media platforms are becoming increasingly popular in the country (Ainin et al., 2015). In 2019, the number of Facebook users in Malaysia grew by 0.4 million from the 22.4 million users in 2018. Given the popularity of Facebook in the country, Malaysian stakeholders are increasingly voicing out their views pertaining to sustainability issues on Facebook (Tim et al., 2018). Social media is one of the essential sources of big data, and it is also becoming an imperative platform for sustainability reporting (Reichert, 2017). However, empirical evidence on the role that BDA plays in the SRSM by Malaysian corporations to address stakeholders' concerns is lacking. Second, GRI has envisioned the full use of digital reporting by 2025, and Bursa Malaysia's sustainability reporting guidelines are in line with GRI. Hence, it is practical to analyse the digitalisation of sustainability reports through social media platforms in Malaysia with BDA implementation.

Additionally, Malaysia is among the first countries to envision a fully digitalised economy (UNCTAD, 2019).

As of June 2019, there were a total of 791 companies listed on Bursa Malaysia. The purposive sampling technique was used to identify the companies that used social media from their annual reports, sustainability reports, and websites. Based on their websites and annual reports, 320 companies provided social media usage information on their websites and in reports, and thus were deemed suitable for this study. Data collection commenced in August 2019. A web-based questionnaire was distributed via e-mail (Google Form link) to the 320 Malaysian public listed companies' corporate communication departments. It was sent to these departments so that they could forward it to the relevant respondents in the companies. The link for the web-based questionnaire was sent only to the sample companies' correspondence addresses, which only the respondents could open. The Google Form link included a cover letter that asked consent for participation and provided assurance that the confidentiality and privacy of the respondents would be preserved. Until April 2020, 114 companies had responded. The Google Form link was deactivated after April 2020 because the response rate based on the 114 responses received had fulfilled the statistical criteria. According to G*Power estimation, the number of responses for this study must be at least 85. Based on the guidelines by Hair et al. (2019), the minimum sample size can also be calculated using the 10 times approach. This means calculating the sample size by multiplying the number of variables in a study with 10 (Hair et al., 2017). Since this study has three variables, the minimum sample size required was 30. Thus, the minimum response rate requirement was achieved for the theoretical model.

3.3 Response rate and non-response bias

In total, 100 responses were collected, equivalent to a response rate of 31.25%. A low response rate in emerging topics is not uncommon. For instance, Spence and Lozano (2000) highlight that CSR-related topics yielded low response rates. A decade later, the same issue was reported by Ferreira et al. (2010). Their exploratory study contained a sample of 40 large Australian corporations. Similarly, studies on BDA have also reported low response rate issues (Mandal, 2018). Galbreath and Shum (2012) state that a response rate as low as 10% is acceptable in countries where the survey receives low participation from respondents. Hence, 100 responses (31.25%) were deemed sufficient for the exploratory purpose of investigating the impact

of BDAC dimensions on SRSM, and the impact of the latter on competitive advantage.

For studies with a low response rate, it is imperative to evaluate the non-response biases. An independent *t*-test was applied on early versus late responses to check the non-response bias. There were no notable differences between early and late respondents' responses, indicating that non-response bias was not an issue in this study. Missing values and common method variance (CMV) were also checked. The CMV, checked using Harman's single factor test, showed no issues at the variance level of 41%, which is below the recommended threshold of 50% (Song et al., 2018). Table 1 shows the demographic profile of the sample companies.

Table 1: Demographic profile

Industry affiliation	Frequency	Percentage
Conglomerate	15	15
Construction	7	7
Consumers products and services	11	11
Energy	6	6
Finance services	14	14
Healthcare	7	7
Industrial products and services	3	3
Plantation	2	2
Property	18	18
Technology	6	6
Telecommunication and media	4	4
Transportation and logistics	7	7

4. Data Analysis

4.1 Scale Validation

It is necessary to evaluate the measurement model to assess the validity and reliability of each variable before testing the structural model (Hair et al., 2017). The convergent validity of the model was analysed using factor loadings (see Table 2). All the items reported loadings above the threshold value of 0.7, indicating that each item of the constructs loaded significantly on their selected latent variables (Fornell & Larcker, 1981). The unidimensionality of a model was assessed using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). First, the unidimensionality was

confirmed with high internal consistency (i.e., loadings > 0.7), as recommended by Ramayah et al. (2018). Second, the Cronbach's alpha values exceeding 0.7 also support unidimensionality (Fornell & Larcker, 1981). Third, each construct's AVE value fell below the recommended threshold of 0.5, showing sufficient unidimensionality (Fornell & Larcker, 1981). CR is the most vigorous assessment of constructs' internal consistency. The CR values exceeded the threshold point of 0.8, ensuring that the measurement model fit requirement was fulfilled (Hair et al., 2017).

Table 2: Measurement items and properties

Items	Labels	Mean	Loading	α	CR	AVE
BDA management capabilities						
Planning (PLAN)						
We seek innovative opportunities to use data analytics for business sustainability practices	PLAN1	3.84	0.74	0.86	0.90	0.64
We use data analytics to plan strategies to communicate sustainability practices	PLAN2	3.37	0.82			
We plan to use data analytics for resolving sustainability concerns raised by stakeholders on social media	PLAN3	3.52	0.77			
We use data analytics to plan strategies to communicate sustainability practices on social media	PLAN4	3.16	0.84			
We use data analytics to adapt to changing demands of sustainability communication on social media	PLAN5	3.23	0.81			
Coordination and control (COD-COL)						
In our organisation, data analysts and other employees meet regularly to discuss important issues	COD1	3.43	0.80	0.85	0.89	0.57
In our organisation, data analysts and other employees coordinate their efforts	COD2	3.50	0.73			

Items	Labels	Mean	Loading	α	CR	AVE
In our organisation, data analysts and other employees coordinate their efforts	COD2	3.50	0.73			
In our organisation, information is widely shared between data analysts and decision-makers	COD3	3.31	0.73			
In our organisation, the responsibility for data analytics development is clear	COL1	3.72	0.80			
Data analytics project proposals are properly appraised in our organisation	COL2	3.79	0.75			
We monitor the performance of the data analytics function	COL3	3.49	0.71			
BDA infrastructure capabilities						
Connectivity (CN)						
Our organisation utilises open systems network mechanisms to boost data analytics connectivity	CN3	3.10	0.90	0.75	0.89	0.80
There are no identifiable communications bottlenecks within our organisation for sharing data analytics insights	CN4	3.43	0.88			
Compatibility (CP)						
Software applications can be easily used across multiple analytics platforms	CP1	3.55	0.78	0.62	0.79	0.57
Our user interfaces (the use of input devices and software) provide access to all the online platforms in our organisation	CP2	3.40	0.86			
Information is shared seamlessly across our organisation, regardless of the location	CP3	3.19	0.59			

Items	Labels	Mean	Loading	α	CR	AVE
BDA personnel capabilities						
Technical knowledge and Technological management knowledge (TK-TMK)						
Our data analytics personnel are capable in terms of programming skills	TK1	3.97	0.80	0.88	0.91	0.63
Our data analytics personnel are capable in terms of managing project life cycles	TK2	3.80	0.78			
Our data analytics personnel are capable in the areas of data management and maintenance	TK3	3.75	0.80			
Our data analytics personnel show an understanding of technological trends	TMK1	3.96	0.78			
Our data analytics personnel show the ability to learn new technologies to improve their analytical skills	TMK2	3.88	0.84			
Our data analytics personnel are knowledgeable about the critical factors for the success of analytics system in our organisation	TMK3	3.73	0.76			
Business knowledge and data driven sustainability culture (BK-DDSC)						
Our organisation considers data analytics important to analyse sustainability practices	BK2	3.70	0.80	0.89	0.92	0.65
Our organisation has support from data analytics for concerns raised by stakeholders about sustainability practices on social media	BK3	3.18	0.84			
Our organisation is knowledgeable about the ongoing status of sustainability practices communication on social media platforms	BK4	3.36	0.81			

Items	Labels	Mean	Loading	α	CR	AVE
We base our sustainability practices decisions on data rather than on instinct	DDSC2	3.47	0.82			
We coach our employees to make sustainability-related decisions based on data analytics	DDSC3	3.21	0.80			
We are willing to override our own intuition when data contradict our viewpoints about sustainability communication on social media	DDSC5	3.26	0.76			
Sustainability reporting through social media (SRSM)						
Big data analytics improves communication about the following on social media platforms:						
Environmental performance	SR1	3.57	0.89	0.85	0.91	0.77
Social performance	SR2	3.35	0.86			
Economic performance	SR3	3.49	0.89			
Competitive advantage						
Our company is more capable of research and development (R&D) than our competitors	CA1	3.36	0.78	0.89	0.91	0.64
Our corporate sustainability image is better than our competitors	CA2	3.14	0.73			
Our company is better than our competitors in stakeholder engagement	CA3	3.30	0.81			
Our company has better sustainability communication capability than our competitors	CA4	3.05	0.87			
Our quality of sustainability communication on social media platforms is better than our competitors	CA5	3.14	0.82			
Our company is better than our competitors in reducing the cost of sustainability communication on social media platforms	CA6	3.25	0.80			

Discriminant validity assesses whether each construct is genuinely distinct from other constructs when measured through same source. Henseler et al. (2015) suggest using the hetrotrait-monotrait ratio (HTMT) test of correlations to determine discriminant validity. Highly correlated items (CN1, CN2, BK1, DDSC1, DDSC4, TMK4 TK4, and TK5) were removed following the guidelines provided by Ramayah et al. (2018). Henseler et al. (2015) suggest a threshold value of 0.9 if the path model has constructs with similar concepts. Table 3 shows that all the values fell below the 0.9 threshold, indicating satisfactory discriminant validity.

Table 3: HTMT ratio results

		1	2	3	4	5	6	7	8
1	PLAN								
2	COL-COD	0.62							
3	CN	0.56	0.71						
4	CP	0.64	0.83	0.70					
5	TK-TMK	0.48	0.79	0.60	0.82				
6	BK-DDSC	0.82	0.71	0.67	0.71	0.69			
7	SRSM	0.84	0.57	0.52	0.61	0.43	0.80		
8	CA	0.68	0.52	0.48	0.53	0.45	0.75	0.72	0.80

4.2 Model testing

In this study, Smart PLS 3.0 was used due to the small sample size and minimal demands on the measurement scales (Hair et al., 2017). PLS does not resolve the issue of low statistical power for a small sample size. However, the bootstrap function in PLS is used to overcome the statistical insignificance. A bootstrap function with 5,000 sample rotations is suggested to achieve statistically significant results. Besides, prior literature recommends using PLS for cases where the theoretical background has limitations for hypothesis development in the exploratory research design (Benitez et al., 2020).

The path coefficient value of 0.68 and p-value < 0.05 for H1 showed that BDA management capability has significant impact on SRSM. However, BDA infrastructure and personnel capabilities did not. This was demonstrated by the path coefficient values of -0.023 and 0.111, respectively (Table 4). Hence, H2 and H3 were not supported. The results for H4 showed that SRSM had a positive impact on competitive advantage. Further, the explanatory power

of the model was highlighted by the coefficient of determination (R^2) and effect size (f^2). The R^2 value for SRSM of 0.565 indicated a moderate relationship with the independent variables (Chin, 2010). Similarly, the R^2 value of 0.52 for competitive advantage also showed a moderate variation caused by SRSM (Hair et al., 2011). A more precise and direct relationship between the proposed variables can be analysed by evaluating the effect size. Table 4 shows that compared to BDA infrastructure and personnel capabilities, BDA management capability had the greatest effect value of 0.261. This indicated a substantial impact of BDA management capability on SRSM. Although BDA personnel capability had an insignificant impact on SRSM, its small effect could be seen on SRSM. BDA infrastructure capability did not affect SRSM.

Table 4: Hypothesis results

Paths	Path coefficients	T-value	P-value	Result	(f2)
BDA management capabilities ➔ SRSM	0.680	5.469	0.000	Supported	0.261
BDA infrastructure capabilities ➔ SRSM	-0.023	0.249	0.804	Not supported	0.000
BDA personnel capabilities ➔ SRSM	0.111	0.692	0.489	Not supported	0.015
SRSM ➔ Competitive advantage	0.69	13.86	0.000	Supported	0.97

5. Discussion

DCV states that for organisations to compete, they need to have change-oriented capabilities that help them to be adaptive and innovative (Leonidou et al., 2015). Adapting to the changing environment requires a specific and organised set of routines. Prior studies have identified BDA capabilities as the dynamic capabilities of a corporation (Mikalef et al., 2018). Drawing on DCV theory, the result for H1 implies that BDA management capability reflected through planning, coordination, and control significantly impacts the sustainability reporting shared on social media platforms. Evidence suggests that Malaysian corporations are in the process of implementing BDA management (ITA, 2022). This finding also implies that Malaysian public listed companies are at the planning stage of implementing BDA to manage their social media platforms, as social media information is one of the components of big data (She

& Michelon, 2019). This indicates that Malaysian companies are in the process of building BDA as a capability. Another inference that can be drawn from the significant findings is that it is imperative to view BDA management sub-dimensions as a capability. This is consistent with the findings of other studies that used similar sub-dimensions of BDA management capabilities (e.g., Ferraris et al., 2018; Mikalef et al., 2019).

Another explanation for the significant impact of BDA management capability on SRSM is that it helps to overcome the challenges associated with social media disclosures. Social media platforms provide accessibility to both the company and its stakeholders, and this scenario may lead to information overload. The fast-paced movement of information on social media can be a challenge for companies that are moving towards sustainability practices. Accordingly, the management of a company equipped with BDA capability can manage issues and address stakeholders' concerns while engaging them (Sivarajah et al., 2020). The results of this study is consistent with Al-Htaybat and von Alberti-Alhtaybat (2017), who find that corporate reporting can greatly benefit from BDA implementation. BDA implementation can change reporting, including sustainability reporting, to be more interactive on social media platforms.

The result of H2 showed that BDA infrastructure capability had an insignificant impact on SRSM. This result suggests that Malaysian companies lack the infrastructural connectivity and compatibility to implement BDA for SRSM. A possible explanation for this lack of focus on infrastructure capability is that companies may have varying definitions of data analytics; therefore, their priorities regarding BDA infrastructure may differ (Mikalef et al., 2018). Shokouhyar et al. (2020) find that while many Iranian companies recruit highly qualified data analytics personnel, they do not focus on data analytics infrastructure. Although the finding is insignificant, it shows that the sub-dimensions of BDA infrastructure capabilities are an important part of BDA infrastructure capabilities (see Table 2). This is consistent with Wamba et al. (2017), who have a similar composition of BDA infrastructure capabilities.

The impact of BDA personnel capabilities on SRSM was also found to be insignificant. This finding indicates that technical and technological management knowledge does not significantly affect SRSM in the Malaysian context. It also indicates that business knowledge and data-driven decision-making for sustainability reporting are not significantly related to SRSM. In contrast to several

studies (e.g., Gupta & George, 2016), the sub-dimensions of BDA personnel capabilities examined in the Malaysian context are relevant, as they were found to be an important part of BDA personnel capabilities.

The result of H4 signifies that SRSM impacts the competitive advantage of Malaysian companies. This is in line with the assumption of DCV that dynamic capabilities result in competitive advantage for companies (Teece et al., 1997). Big data-generated insight from SSRM reinforces managers' decisions and enables them to meet stakeholders' expectations. Specifically, the value of BDAC for SSRM lies primarily in gaining new insights and generating business aptitude to support the transformation or adaptation of the company's operations in a competitive business environment (Bahrami & Shokouhyar, 2022).

6. Conclusions

Based on the growing importance of BDA applications in businesses worldwide, this study aimed to understand the impacts of BDA management, infrastructure, and personnel capabilities on SRSM and subsequently SRSM's impact on competitive advantage. Data was collected by administering an online questionnaire to 100 public listed companies in Malaysia. The empirical results revealed a positive association between BDA management capability and SRSM. However, BDA infrastructure and personnel capabilities had an insignificant impact on SRSM. Results from this study indicate that BDA is still in the early stages in Malaysia. Thus, this paper provides support to justify BDA investments and initiatives. Given the growing popularity of social media platforms, companies need to invest in the resources that help align sustainability practices and their disclosure on social media. This study's findings provide empirical support for the role of SRSM as a source of competitive advantage for companies. The unstructured data on social media platforms requires planning and insights so that the data that can be used for quality decision-making concerning sustainability reporting disclosure or communication on social media platforms (Akter et al., 2016; Mikalef et al., 2019).

6.1 Implications

This study has both theoretical and practical implications. It draws from DCV to explain the impacts of BDA management, infrastructure, and personnel capabilities on SRSM and SRSM's impact on

competitive advantage. Although these two concepts have been investigated in previous studies, this study extends the literature by examining the intertwined relationship between technology-enabled networks and accounting practice. Following Wamba et al. (2017), this study categorised BDA into three sub-dimensions. However, instead of looking at financial performance, this study specifically focused on SRSM. Practically, this study provides insights into the roles of accounting, social media, and big data within the current digital revolution. This study offers guidance to executives and managers on identifying the conditions that need to be present for BDA to add value to SRSM. This study's findings can help managers and experts in implementing BDA in Malaysia and other countries with similar BDA policies. The findings related to BDA implementation in this study provide an empirical insight for Malaysia Digital Economy Corporation (MDEC), which is the agency in charge of accelerating Malaysia's digital economy growth. For corporations, providing information from sustainability reports on social media can be a way to fulfil their stakeholders' informational needs. Accordingly, BDA can play a role in addressing multiple issues related to sustainability reporting on social media platforms.

6.2 Limitations and Future Research Direction

There are certain limitations in this study that provide directions for future research. First, this study focused on a sample of 100 public listed companies in Malaysia. The number of companies using social media may have increased after the data collection period of this study. Moreover, the scope of this study is limited to Malaysia. The operations and culture of public listed companies in Malaysia may differ from corporations operating in other parts of the world. A more diversified sample in future studies can provide additional analytical insights into the relationships between BDA management, infrastructure, and personnel capabilities and SRSM. Future research could conduct a cross-country study across the Asean region to investigate the associations between BDA dimensions, SRSM, and competitive advantage. This study can also be extended by exploring factors other than the BDA's three dimensions that can influence BDA implementation in developing or emerging economies and affect sustainability reporting. Another limitation of this study is that it did not incorporate stakeholder responses to the information disclosed by companies on Facebook; hence, future studies can opt for a triangulation method and validate the findings.

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