BIG DATA ANALYTICS CAPABILITIES AND SUSTAINABILITY REPORTING ON SOCIAL MEDIA: THE MODERATING ROLE OF TONE AT THE TOP

FAREYHA SAID

FACULTY OF BUSINESS AND ECONOMICS
UNIVERSITI MALAYA
KUALA LUMPUR

2023

BIG DATA ANALYTICS CAPABILITIES AND SUSTAINABILITY REPORTING ON SOCIAL MEDIA: THE MODERATING ROLE OF TONE AT THE TOP

FAREYHA SAID

THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OF BUSINESS AND ECONOMICS
UNIVERSITI MALAYA
KUALA LUMPUR

2023

UNIVERSITY OF MALAYA

ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: **FAREYHA SAID**
Regisration/Matric No.: **17013636/1**
Name of Degree: **DOCTOR OF PHILOSOPHY**

Title of Project Paper/Research Report/Dissertation/Thesis ("this Work"):
"BIG DATA ANALYTICS CAPABILITIES AND SUSTAINABILITY REPORTING ON SOCIAL MEDIA: THE MODERATING ROLE OF TONE AT THE TOP"

Field of Study: **SUSTAINABILITY REPORTING**

I do solemnly and sincerely declare that:

(1) I am the sole author/writer of this Work,
(2) This Work is original,
(3) Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work,
(4) I do not have any actual knowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work,
(5) I hereby assign all and every rights in the copyright to this Work to the University of Malaya ("UM"), who henceforth shall be owner of the copyright in this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of UM having been first had and obtained,
(6) I am fully aware that if in the course of making this Work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by UM.

(Candidate Signature) Date: 24 August 2022

Subscribed and solemnly declared before,

Witness's Signature Date: 24 August 2022
Name:
Designation

ABSTRACT

Corporate reporting including sustainability reporting is changing due to the emergence of big data analytics capabilities (BDAC). The BDAC implementation offers a wide range of benefits. It assists firms in managing their operations in areas including sustainability issues and social media platforms. The current study aimed to examine the impact of BDAC on sustainability reporting through social media (SRSM). Evidence from the literature suggests that top management's attributes affect firms' sustainability reporting practices. Therefore, tone at the top was analysed as a moderator between BDAC and SRSM in the current study. Literature also suggests that better sustainability reporting strengthens firms' relationship with stakeholders, potentially leading to competitive advantage. Hence, the current study also aimed to analyse the impact of SRSM on competitive advantage. The theoretical model was formulated based on dynamic capability view (DCV) to explain the variables of the current study. The study's sample included 320 firms listed on Bursa Malaysia that used social media platforms. Among 320 firms, 114 firms responded to the questionnaire, after unavailability of data of some firms, final sample was comprised of 100 firms. The multimethod research design was used in the current study. Web-based questionnaire and content analysis were used to measure SRSM. Sustainability reporting perception on social media (SRPSM) was measured using the web-based questionnaire, and sustainability reporting disclosure on Facebook (SRDF) was measured via content analysis of the Facebook pages of the sample firms. The web-based questionnaire was also used to measure BDAC and competitive advantage. The tone at the top was measured using an automated content analysis of CEOs' letters to stakeholders. The results obtained from SmartPLS showed that BDAC had a significant positive impact on SRSM. However, the results on SRSM's impact on competitive advantage were mixed. SRPSM had a significant positive impact on competitive advantage, but SRDF

had no impact on competitive advantage. The moderation effect of tone at the top between BDAC and SRSM was also insignificant, indicating that tone at the top neither strengthens nor weakens the relationship between BDAC and SRSM. However, additional analysis with the inclusion of certainty as a tone at the top variable produced a significant positive moderation between BDAC and SRDF. The current study's findings may assist the authorities, regulators, and policy makers in improving the BDAC implementation in Malaysia and similar countries. Moreover, the results of SRSM can help firms improve their sustainability reporting outside the bounds of traditional modes and gain a competitive advantage.

ABSTRAK

Pelaporan korporat, termasuk pelaporan mapan sedang mengalami perubahan dengan kemunculan keupayaan analitis data raya (BDAC). Perlaksanaan BDAC menawarkan pelbagai manfaat. BDAC membantu dalam pengurusan operasi syarikat dalam pelbagai bidang, termasuk isu kemapanan dan platform media sosial. Tesis ini bertujuan memeriksa kesan BDAC terhadap pelaporan kemapanan pada media sosial (SRSM). Bukti daripada literatur mencadangkan bahawa sifat pengurusan atasan memberikan kesan terhadap amalan pelaporan kemapanan syarikat. Oleh yang demikian, nada di bahagian atas dianalisis sebagai penyederhana antara BDAC dan SRSM dalam tesis ini. Literatur juga mencadangkan bahawa pelaporan kemapanan yang lebih baik dapat mengukuhkan hubungan syarikat bersama pemegang taruh, yang berpotensi membawa kepada kelebihan saingan. Maka, tesis ini juga bertujuan menganalisis kesan SRSM terhadap kelebihan saingan. Model teori dirumuskan berdasarkan perspektif keupayaan dinamik (DCV) untuk menerangkan pemboleh ubah kajian ini. Sampel kajian merangkumi 320 syarikat yang disenaraikan di Bursa Malaysia yang menggunakan platform media sosial. Reka bentuk kajian kaedah berbagai digunakan dalam kajian ini. Soal selidik berasaskan web dan analisis kandungan digunakan untuk mengukur SRSM. Persepsi pelaporan kemapanan terhadap media sosial (SRPSM) diukur menggunakan soal selidik berasaskan web, dan pendedahan pelaporan kemapanan di Facebook (SRDF) diukur melalui analisis kandungan halaman Facebook syarikat sampel. Soal selidik berasaskan web juga digunakan untuk mengukur BDAC dan kelebihan saingan. Nada di bahagian atas diukur menggunakan analisis kandungan berautomatik surat-surat Ketua Pegawai Eksekutif kepada pemegang taruh. Dapatan yang diperoleh daripada SmartPLS menunjukkan bahawa BDAC mempunyai kesan positif yang signifikan terhadap SRPSM dan SRDF. Walau bagaimanapun, dapatan daripada kesan SRSM terhadap kelebihan saingan adalah bercampur. SRPSM

mempunyai kesan positif yang signifikan terhadap kelebihan saingan namun SRDF tidak memberikan kesan terhadap kelebihan saingan. Kesan penyederhana nada di bahagian atas antara BDAC dan SRSM juga tidak signifikan, yang menunjukkan bahawa nada di bahagian atas tidak mengukuh mahupun melemahkan hubungan antara BDAC dan SRSM. Walau bagaimanapun, analisis tambahan dengan kemasukan kepastian sebagi pemboleh ubah nada di bahagian atas telah menghasilkan penyederhanaan positif yang signifikan antara BDAC dan SRDF. Dapatan tesis ini boleh membantu pihak berkuasa dalam menambah baik perlaksanaan BDAC di Malaysia serta negara yang serupa. Tambahan pula, dapatan dariapda SRSM boleh membantu syarikat menambah baik pelaporan kemapanan di luar sempadan kaedah tradisional dan memperoleh kelebihan saingan.

ACKNOWLEDGEMENTS

All praise to God (Allah, the Almighty) who provided me with the opportunity to enrol in this prestigious university and enabled me to complete this degree despite my limited knowledge. I would like to express my gratitude to those who contributed throughout my PhD journey. Firstly, I would like to thank my supervisors, Dr Azlina Abdul Jalil and Dr Dalilawati Zainal, for their continuous guidance and valuable feedback on my research work. They equipped me with the necessary tools through their time, encouragement, and constructive feedback throughout my PhD journey. I am lucky to have such great mentors who supported me through thick and thin. I would also like to extend my appreciation and gratitude to my friends and family. Special thanks go to Dr Wajiha Haq, who taught me how to present your own research idea in simple words. Due to her guidance in answering basic questions, I was able to learn and keep finding the solutions. I would also specifically like to mention Dr Iffat Ali Aksar, who constantly guided me and supported me emotionally during the Covid-19 lockdown. Without her, it would have been impossible to bear the lockdown period in Malaysia. Her constant motivation in one sentence, "you can move the mountains," gave me the confidence and courage to endure each difficulty with a smile. I am forever grateful to her. My family has also played an imperative role. The constant prayers of my Father and Mother helped me through turbulent times. I am also thankful to my husband Dr Tariq Javed; without his support, it would have been impossible to complete my last year of PhD. I am also thankful to my friends in Pakistan and Malaysia, the Department of Accounting, UM, and respondents. Finally, I am also grateful to panellists during the proposal, candidature, and thesis seminar for their valuable suggestions.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

BDA	:	Big data analytics
BDAC	:	Big data analytics capabilities
CA	:	Competitive advantage
CSR	:	Corporate social responsibility
DCV	:	Dynamic capability view
GCC	:	Gulf cooperation countries
GRI	:	Global reporting initiative
SRSM	:	Sustainability reporting on social media
SRPSM	:	Sustainability reporting perception on social media
SRDF	:	Sustainability reporting disclosure on Facebook
RBV	:	Resource-based view
US	:	United states

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Background

Prior literature has mainly focused on sustainability reporting via traditional mediums such as annual reports or standalone sustainability reports (Zahid et al., 2020; Zahid et al., 2019). In contrast, the current study focuses on sustainability reporting on social media (SRSM), specifically how big data analytics capabilities (BDAC) affect SRSM. Dynamic capability view (DCV) proposes that firms need to have capabilities that are dynamic in nature. Prior literature suggests that BDAC is a dynamic capability that has resulted from Industrial Revolution 4.0. Social media platforms are a source of BDAC (She & Michelon, 2019). Compared to traditional media, social media has expanded firms' abilities to engage with stakeholders beyond information dissemination (Cho et al., 2017). It is a cost-effective, dialogic, and democratic means of communication between stakeholders and a firm.

Despite the many benefits of communication on social media, there are drawbacks. While businesses have been adept at using social media strategically (Cho et al., 2017), its usage has given rise to challenges, including information overload and privacy and credibility issues. These challenges must be addressed to enable firms to address their stakeholders' informational needs. BDAC can help solve social media challenges through better management of unstructured data obtained from social media platforms. Keeso (2014) proposed utilising BDA to improve firms' environmental sustainability performance, and Al-Htaybat and von Alberti-Alhtaybat (2017) suggested using BDAC to improve corporate reporting. Accordingly, this research investigated the research gap regarding the use of BDA for sustainability reporting (Wanner & Janiesch, 2019), especially BDAC, for sustainability communication through social media platforms.

Literature suggests that strategies channel from the top management (Latan et al., 2018). The top management can play an important role in ensuring effective SRSM. For instance, Dubey et al. (2016) reported that top management's commitment to disclose non-financial information was stronger in greener firms, and they were more likely to strategise the engagement with stakeholders. Hart (2000) identified five attributes in the CEO's non-verbal tone, termed as tone at the top, that shows how the organisation intends to proceed. Cho et al. (2010) investigated the impact of two attributes of CEO's non-verbal tone, namely certainty and optimism, to determine their impacts on sustainability reporting. The findings showed that firms with better environmental performance and disclosures had higher certainty in the CEOs' tones. Drawing on the literature on tone at the top, the current study included tone at the top as a moderator between BDAC and SRSM.

Literature suggests that sustainability performance can be transformed into a capability that can be a source of competitive advantage for firms. DCV also states that a firm's dynamic capabilities result in a competitive advantage. For example, Simanaviciene et al. (2017) opine that the implementation of corporate and social responsibility (CSR) elements comprising social, economic, and environment dimensions will improve a firm's competitiveness. Zameer et al. (2020) reported that prioritising green practices led to improved sustainability performance and resulted in a competitive advantage for firms. These two examples imply that sustainability practices can be a competitive advantage for firms. Literature shows that social media usage is a source of competitive advantage (Singla & Durga, 2015). However, research on the link between SRSM and competitive advantage is scarce. Thus, the current study used DCV as a theoretical support to fill this literature gap by analysing the impact of SRSM on competitive advantage.

1.2 Problem Statement

Online communication platforms are rapidly replacing traditional ones (SHIFT Communications, 2020). Firms use social media to communicate with the stakeholders and fulfil their informational demands and expectations because it is an effective communication platform (Briones et al., 2011). However, with the increasing usage of social media, its management has become a challenge for firms (Wu et al., 2019). Billions of texts, images, and videos are shared online daily (Thomson et al., 2020). While social media has removed physical barriers and enabled worldwide participation, it has also resulted in information overload (Wang et al., 2023). Fowler and Pitta (2013) believe firms are having difficulty incorporating social media data into decision-making, partly due to the challenges in collecting and analysing data. The traditional setups of firms also need to be updated since the lack of capabilities, quality, time, and size, as well as the cost of information, is resulting in data deluge (Müller et al., 2018). The vast and diverse information sets on social media require firms to have an intelligent algorithm and a system to make sense of information.

The BDAC implementation can help firms improve their understanding of external stakeholders' needs and create value (Zheng et al., 2022). Wanner and Janiesch (2019) suggested implementing BDAC to improve the credibility of sustainability reports. Arnaboldi et al. (2017) argued that big data revolution in line with the popularity of social media platforms, could change accounting practices, including sustainability reporting. The use of BDAC has become widespread (Favaretto et al., 2020). A systematic review of the previous studies on the relationship between management theories and BDAC implementation is provided by de Camargo Fiorini et al. (2018). The review shows that many studies have empirically investigated the impact of BDAC on various phenomena associated with firms, such as performance, supply

chain, social media, and sustainability practices. However, some research areas have yet to be empirically investigated such as SRSM.

In the context of Malaysia, the expectation from the firms is increasing regarding their disclosure of sustainability issues. Malaysia is rapidly adopting industry 4.0 technologies (Luthra & Mangla, 2018). The majority of Malaysians are active social media users (Müller, 2021). Given the rising importance and role of social media, the pressure from the regulating bodies is also increasing on how firms can report on sustainability issues effectively and accurately (Lyons, 2022). The role of digitalisation is emphasized concerning the sharing of information related to sustainability reporting. In other words, it is also termed as 'Smart reporting' (Lyons, 2022). Since the evidence in the literature shows BDAC's positive role in firms' decision-making pertaining to their stakeholders, de Camargo Fiorini et al. (2018) suggested exploring the relationship between BDAC and the phenomenon related to firms' stakeholders. The informational needs of stakeholders are important, but sustainability reporting through social media (SRSM) and BDAC were investigated separately in prior literature. The lack of research on the relationship between BDAC and SRSM has prompted the current study to investigate this relationship.

Organisational success requires the leadership to be committed to building a strong relationship with the stakeholders. The chief executive officer (CEO) of an organisation holds a critical position in shaping the strategic decisions (Sariol & Abebe, 2017). Stakeholders expect the CEO to be the principal architect of the firm's sustainability goals. CEO language has a great influence on shareholders' value creation, and the influence is greater when the stakeholder activism is higher (Shin & You, 2017). The CEO channels the tone that sets the organisation's direction (Cong et al., 2014). For example, Latan et al. (2018) reported better environmental performance in firms with an ethics-oriented tone at the top. The CEO's language communicates the

vision and values of the firm on external communication platforms (Mayfield et al., 2014). A lack of a supportive tone at the top may impede the implementation of strategies.

Empirical evidence from the literature shows that tone at the top attributes affect sustainability reporting. Cho et al. (2010) investigated the link between two attributes of tone at the top (certainty and optimism) and the level of environmental disclosure and found a positive relationship. Given that social media platforms are sensitive to the tone and type of content, tone at the top plays a crucial role in determining the extent of sustainability reporting. However, there is a dearth of research on the role of top management's non-verbal tone in directing firms' strategies, culture, and daily routines to adapt to the changing stakeholders' expectations regarding sustainability reporting. Hence, the current study aimed to investigate tone at the top as a moderator between BDAC and SRSM to fill the gap in the literature and improve the understanding of the relationship between BDAC and SRSM.

Literature shows that reporting sustainability practices is a tool for strengthening firms' competitive advantage (Saeidi et al., 2015). Firms enjoy competitive advantage when they understand their primary stakeholders' needs better (Harrison et al., 2010). Stakeholders value a firm with better sustainability practices. Cantele and Zardini (2018) opine that sustainability practices are a source of competitive advantage for small firms. Similarly, Wang (2019) reported that a sustainability-oriented culture in an organisation led to green performance and competitive advantage. Sustainability reporting is done via various communication channels such as stand-alone reports and websites. Social media is used to communicate with customers and obtain their feedback on various business operations domains. However, literature on the link between SRSM and the competitive advantage of firms is limited. Hence, the current study aimed to investigate the impact of SRSM on competitive advantage.

1.3 Research Objectives and Questions

The current study has the following objectives:

1. To investigate the impact of big data analytics capabilities on sustainability reporting on social media.
2. To investigate the moderating role of tone at the top on the association between big data analytics capabilities and sustainability reporting on social media.
3. To examine the impact of sustainability reporting on social media on the competitive advantage of firms.

In line with the research objectives, the current study aimed to answer the following research questions:

1. Do big data analytics capabilities impact sustainability reporting on social media?
2. Does tone at the top moderate the relationship between big data analytics capabilities and sustainability reporting on social media?
3. Does sustainability reporting on social media impact competitive advantage?

1.4 Significance and Contributions

The current study makes significant theoretical and practical contributions, as explained in the following sub-sections.

1.4.1 Contributions to the Literature

Digital technologies such as social media may improve the effectiveness of corporate reporting (Lombardi & Secundo, 2020), given the advancements of technology and social media. They also argued that BDA plays a key role in voluntary and mandatory financial and non-financial corporate reporting. Even though social media is the centre of digitalisation and an important platform for information sharing between stakeholders and firms (Elving & Postma, 2017), there is limited research on the role of big data role in corporate reporting through social media. Prior literature has

examined this matter mainly in the context of developed countries such as the United States (US), Australia, Spain, the United Kingdom (UK), and Italy (de Camargo Fiorini et al., 2018; Lombardi & Secundo, 2020). The current study is motivated by the research gap highlighted by de Camargo Fiorini et al. (2018) and Lombardi and Secundo (2020) to analyse the impact of BDAC on sustainability practices of the firms and the increasing adoption of BDA in Malaysia. Malaysia's vision to fully digitalise its economy is directly linked to better sustainability performance and reporting. This vision is also consistent with the aim of Global Reporting Initiative (GRI) Reporting 2025, which is to fully digitalise reporting outside the bounds of the annual reporting system. Fully digital reporting means increased transparency and a chance for two-way communication between firms and stakeholders.

Al-Htaybat and von Alberti-Alhtaybat (2017) suggested that BDAC adoption improves corporate reporting on social media. However, the authors solely focused on accountants' use of big data technology to improve financial reporting and did not incorporate factors such as BDA infrastructure requirements and BDA management capability. They also did not include personnel capability other than accountants' capability. Hence, they suggested investigating the effects of other capabilities on corporate reporting, sustainability performance (Dubey et al., 2017; Keeso, 2014), and social media platforms management (Ghani et al., 2019). Thus, the current study aimed to fill the gap in literature by investigating the impact of BDAC on SRSM.

From the theoretical perspective, there has been a significant change in the adoption of theories to examine sustainability reporting. For example, prior studies used media richness theory, legitimacy theory, institutional theory, and signalling theory or a combination of these theories to investigate SRSM. In line with Al-Htaybat and von Alberti-Alhtaybat (2017) and de Camargo Fiorini et al. (2018), dynamic capability view (DCV) was used to examine the relation between BDAC and SRSM in the current

study. The use of DCV allows to view SRSM as a capability. DCV is the "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997). Regarding the measurement of SRSM under DCV, mostly studies have focused on the content analysis technique. In contrast, SRSM was investigated using a multimethod research design in the current study, thus lending more credence to the current study's data. The current study's findings will be helpful to firms since combined efforts are necessary to implement sustainable ways of operation. The growing number and magnitude of sustainability issues worldwide demand a holistic approach for their treatment. Effective management of stakeholders' demand will benefit them. Thus, firms with a great impact on society can derive meaningful insights from the current study's findings. The capability to manage social media platforms using big data technologies will enable firms to manage their relationship with the stakeholders and allow combined efforts to address sustainability issues.

Evidence from the literature shows that top management plays a critical role in sustainability reporting (Henry et al., 2019). One of the methods to analyse the top management is termed 'tone at the top' provided by Hart (2000). Many studies have examined the relationship between tone at the top and various variables in the accounting domain (Fisher et al., 2019; Tailab & Burak, 2018). However, few studies have examined tone at the top including all its master variables (activity, certainty, commonality, optimism, and realism) concerning sustainability reporting. Another theoretical gap in the literature is pertaining to the limited use of DCV. The current study was motivated by the research gap on tone at the top. Therefore, the current study utilised DCV to analyse tone at the top because DCV states that a firm needs to be able to adapt the changing routines and processes according to changing external and internal environment. Given the literature evidence concerning the importance of tone at the top

for environmental disclosures (Cho et al., 2010), the current study aimed to analyse its moderating role between BDAC and sustainability reporting (economic, environmental, and social dimensions) on social media.

The invention of the internet has led to intense competition for survival among firms. Previously, technological capabilities were considered a competitive advantage for a firm because it made the firm superior to competitors in operations. Little attention was given to other factors contributing to competitive advantage. One of those factors is reporting of sustainability practices. Initially, a firm's effort towards sustainability was seen as a legitimisation tool. There is a lacuna in literature regarding whether or not sustainability reporting through social media can be conceptualised as a firm's capability. The current study was motivated by the possibility of leveraging SRSM under DCV as a capability that can result in competitive advantage. The findings of the current study on SRSM as a potential source of competitive advantage will help firms identify how SRSM can be utilised as a competitive advantage to achieve their goals pertaining to profit, planet, and people. Further detail on theoretical contributions is provided in section 6.3.1 of the current study.

1.4.2 Practical Contributions

The findings of the current study provide several contributions to the practice of firms. Firstly, Malaysia Digital Economy Corporation (MDEC) can use the findings to further improve and amend the policies related to the BDAC implementation. For instance, they can provide trainings that specifically aim to boost the analytical skills of the employees. Secondly, the current study's findings are also in line with the vision of GRI Reporting 2025 to fully digitalise sustainability reporting. Social media is an important part of BDAC, which means that BDAC is required to facilitate the full digitalisation of sustainability reports. The traditional communication of sustainability reporting is changing rapidly, so it is important to integrate technology with

sustainability reporting. Thirdly, firms aiming to gain competitive advantage can improve their SRSM to improve their relationship with the stakeholders and enhance profitability. The practical contributions are discussed in detail in section 6.3.2 of the current study.

1.5 Thesis Organisation

The current study consists of six chapters. A summary of the chapters' arrangement is as follows:

Chapter one introduces the current study. It states the research problem upon which the research objectives and questions are based. The chapter continues with the motivation and significance of the research and ends with an elaboration of the current study's organisation.

Chapter two provides the literature review of the current study's variables. The general review of the literature is followed with a specific review of the current study's proposed variables to identify the research gap.

Chapter three illustrates the research framework based on DCV. Subsequently, the formulation of hypotheses for the context of the current study is discussed.

Chapter four discussed the methodology used to conduct the research. It explains the research paradigm, design, sample selection, variable measurements, data collection, and data analysis.

Chapter five reports the empirical findings of the current study. SPSS and SmartPLS were used to carry out the protocols before conducting the main data analysis. The chapter includes interpretation of the results of the descriptive statistics. The results of the hypothesised regression paths, along with the included control variables, are interpreted and discussed.

Finally, chapter six presents a summary of the research objectives and findings and outlines the conclusion drawn from the empirical investigation carried out in the current

study. The chapter ends with the research limitations and recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter discusses the relevant literature on the variables of the current study. Section 2.2 provides an overview of the background of sustainability reporting. It also discusses the previous literature on sustainability reporting worldwide and in Malaysia. The literature review in section 2.3 elaborates on the studies that focused on social media's link with sustainability reporting. The evolution from big data to big data analytics capabilities (BDAC) is discussed in section 2.4, followed by a discussion on the dimensions of BDAC in section 2.5. The literature on BDAC and sustainability reporting on social media (SRSM) is discussed in section 2.6. Section 2.7 deliberates on the moderating role of tone at the top. In section 2.8, the literature review of the relationship between SRSM and competitive advantage is provided. The last section provides the chapter summary.

2.2 Development of Sustainability Reporting

The terms CSR and sustainability reporting is used interchangeably in accounting literature (Reilly & Larya, 2018). CSR refers to the *"conduct of a business so that it is economically profitable, law abiding, ethical and socially supportive"* (Carroll, 1991). Similarly, the European Commission (2011) defines CSR as *"the responsibility of enterprises for their impacts on society to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy."* In parallel to the European Commission, ISO 26000da provides a global standard for social responsibility, defining it as the "responsibility of an organisation for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour" (International Organization for Standardization, 2010) while directly referring to the maximisation of contribution to sustainable development as the *"overarching objective for an organisation"* (p. 10).

These characteristics demonstrate CSR's direct link with sustainability (Hahn & Kühnen, 2013). It can be noted here that environment, economy, and society are the common themes in both definitions of CSR.

CSR also refers to voluntary actions not required by law that attempt to further some social good, counter some social ill, or address the externalities of organisations' operations in the world (Steenkamp, 2017). Matten and Moon (2008) categorised CSR into explicit and implicit CSR. While explicit CSR refers to the firm's policies that assume responsibility for some societal interests, implicit CSR signifies the firm's role within the wider formal and informal institutions for society's interests and concerns (Matten & Moon, 2008). The difference between them is that explicit CSR is the firm's voluntary action and implicit CSR is the firm's mandatory or customary action in playing its role in society (Matten & Moon, 2008).

Initially, firms could not integrate CSR into their core business strategy properly due to profit maximisation concerns, but preserving the environment is equally important (Sarkar & Searcy, 2016). Firms first adopted CSR as a legitimisation tool (Font & Lynes, 2020). Gradually, CSR became an integral part of the firms and now includes wider concepts. For instance, economic, employee, community, environmental, legal, social objectives, stakeholders, sustainability strategy, and triple bottom line are CSR-related concepts (Sarkar & Searcy, 2016). CSR is also interchangeably used with various other terms such as *"industrial ecology," "CSR," "business ecology," "cradle to cradle," "green capitalism," "eco-efficiency,"* "*social and environmental responsibility*," *and "triple bottom line"* (people, profit, planet).

2.2.1 From CSR to Sustainability Reporting

CSR and sustainability are overarching concepts that cover energy consumption, habitat conservation, financial results, and stakeholder satisfaction. Some scholars define sustainability as an "environmentally friendly phenomenon" (Enquist et al.,

2007). However, it is inclusive of many other aspects and cannot be measured using the environmental dimension only. In literature, the most widely used and accepted definition of sustainability was given by Brundtland Commission (1987), stating that "it is meeting present needs without compromising future generations' ability to meet their needs." Further, Elkington (1997) defined corporate sustainability as "a balanced integration of economic performance, social inclusiveness and environmental resilience, to the benefit of current and future generations." Dyllick and Hockerts (2002) defined sustainability as "meeting the needs of a firm's direct and indirect stakeholders without compromising its ability to meet the needs of future stakeholders as well." To operationalise this goal, firms need to maintain their economic, environmental, and social capital base, which directly relates to Elkington's triple-bottom-line (TBL) approach.

Elkington's TBL approach is believed to be embedded in the concept of sustainable development. Sustainable development is defined as the "aim to meet the need of both current and future generations" (Brundtland Commission, 1987). Brundtland Commission was formed to address unsustainable practices in the world. The increasing impact of unsustainable consumption, production, and lifestyle led to the creation of sustainable development goals of SDGs (Osborn et al., 2015). The SDGs were established by the United Nations General Assembly in 2015. Firms, regardless of their size, are part of this world, and they meet people's needs by exhausting natural and man-made resources (Guliyev, 2022). This is especially true for firms that have substantial impacts on society. Thus, it is imperative for firms to implement the SDGs and adopt sustainable practices (Batista & Francisco, 2018). By doing so, they will attain good sustainability performance.

Sustainability performance is defined as "the performance of a company in all dimensions and for all drivers of corporate sustainability" (Schaltegger & Wagner,

2006). Sustainability performance requires a sound management framework to link the environmental and social dimensions with the firm's competitive strategy and management. Better environmental performance will not necessarily lead to better financial performance, but recent environmental changes have prompted firms to revisit their sustainability practices, as their functions have been affected by the rising global warming phenomenon that has socio-economic and environmental impacts (Rocha et al., 2022). Lozano and Huisingh (2011) criticised the existing concept of sustainability performance and added "time" as another dimension. They asserted that all dimensions of sustainability performance, namely economic, social, and environmental, need to be aligned with each other. It means that the economic dimension in the present must relate to the environmental and social dimensions in the future and vice versa.

After establishing sustainability as a phenomenon, firms started to integrate it into their annual reports, depicting it as a part of their corporate personality. However, there is no single definition for sustainability reporting (Dissanayake et al., 2016). It refers to disclosures in reports to engage the stakeholders (Herremans et al., 2016). Generally, it encompasses disclosures about a firm's social, economic, and environmental performance (Herremans et al., 2016). According to GRI, the sustainability report is an important platform to communicate positive and negative sustainability performance dimensions. Wanner and Janiesch (2019) view communication and sustainability reporting as being directly linked. Godeman and Michelsen (2011) view the communication of corporate sustainability or non-financial information as a strategy to secure legitimisation. Online mediums allow firms to produce tailored and interactive reports. Social networking sites, or informally known as social media, allow more customisation and target a wider stakeholder set. Given the growing focus on online mediums and sustainability reporting, the next sub-section outlines the commonly explored themes pertaining to sustainability reporting.

The empirical evidence on sustainability reporting is not limited to a certain discipline. Recent studies have focused on the link between technological advancement and sustainability reporting. Modern text mining tools were used to check the quality of sustainability reports (Tiwari & Khan, 2020). Ning et al. (2021) analysed the impact of Industry 4.0-related technologies, such as blockchain, on sustainability reporting. Another stream of literature focused on the link between financial indicators and sustainability reporting. Table 2.1 provides a summary of the studies (i.e., Schiehll & Kolahgar, 2020; Ortiz-Martínez & Marín-Hernández, 2020; Zahid et al., 2020) that explored the relationships of industry 4.0, sustainability reporting in the digital age and the associated challenges. From the summary of research shown in Table 2.1, it can be inferred that these are the on-going research trends related to sustainability reporting.

Table 2.1: Summary of Sustainability Reporting Research

Themes	Sources
Industry 4.0, Sustainability in digital economy and transparency, text mining to assess sustainability reports, Use of technology (blockchain), Online sustainability reporting, challenges and management of sustainability reporting	Zakaria et al. (2021); Kumar and Das (2021); Bakarich et al. (2020); Tiwari and Khan (2020); Ning et al. (2021); De Micco et al. (2020)
Financial materiality, services and performance	Schiehll and Kolahgar (2020); Zahid et al. (2020); Oncioiu et al. (2020)
Corporate governance and business strategy	Hernawati (2020); Husnaini and Basuki (2020); Correa-Garcia et al. (2020)
Evaluation of sustainability reporting based on GRI and disclosure, Integrated reporting	Ferrarez et al. (2020); Cho et al. (2020); Orazalin & Mahmood (2018); Mauro et al. (2020)
Corporate performance, value, and sustainability performance	Hongming et al. (2020); Jadoon et al. (2021)
Stakeholder engagement	Stocker et al. (2020); Kaur and Lodhia (2019); Romero, Ruiz and Fernandez-Feijoo (2019); Kaur and Lodhia (2018)

Table 2.1 also shows that there is a growing focus on the linkages between technological advancement, stakeholder engagement, and sustainability reporting. Further, the table indicates that most studies were conducted in developed countries, and

not much is known about the linkage between the latest technological trends and sustainability reporting in developing countries. Stakeholder engagement via sustainability reports was also a major focus in prior literature. The stakeholders are defined as those individual or group of individuals that have a direct or indirect stake in a firm (Freeman, 1984). Clarkson (1995) termed the stakeholders as primary and secondary. The primary group of stakeholders include shareholder, employees, suppliers, customers, government, and community. In contrast, the secondary stakeholder includes trade unions and environmentalists. The primary and secondary stakeholders are also termed external and internal stakeholders (Harrison et al., 2010). Stocker et al. (2020) used a classification system to examine the extent of stakeholder engagement via sustainability reports. They categorised stakeholder engagement into information, response, and involvement strategy.

Both groups of stakeholders have their own opinions on the firm's performance and its footprint on society (Bellucci & Manetti, 2018). The pressure caused by the stakeholders forced firms to incorporate their view in the business arena. Moreover, the questions on the 'profit earning' motive of businesses provided this parallel view that since businesses have the capability, they need to use this capability for society's greater good. It strengthened the firms' need to incorporate CSR practices in their business operations and further encouraged the adoption of sustainable development. Lombardi and Secundo (2020) conducted a systematic literature review and found that digital technologies such as social media may improve and increase the effectiveness of corporate reporting thus providing a greater good to the society. This presents a gap in the literature that is worthwhile to explore through the investigation of the link between technological advancement sustainability reporting.

2.2.2 Background of Sustainability Reporting in Malaysia

Sustainability reporting is emphasised in Malaysia in light of the rising sustainability issues. Prior studies focused on the oil palm plantation industry due to its impact on the environment and Malaysia's role as the leading palm oil exporter globally (Mahlia et al., 2019). Zahraee et al. (2019) examined the greenhouse gas (GHG) emissions from Malaysia's oil palm plantation industry. They found that oil palm plantation operations generated high amounts of GHGs in Malaysia and that the industry needed to improve their transportation and production efficiency to reduce their environmental footprints. A similar study by Mahlia et al. (2019) focused on the oil palm plantation industry's environmental impact and suggested ways to improve Malaysia's environmental footprint. Tang and Al Qahtani (2020) explored the economic, social, and environmental performance of Malaysia's oil palm plantation industry. In terms of environmental footprints, the findings showed that although the industry had a low contribution to deforestation in Malaysia, it had caused environmental pollution. Further, the industry added to the social issues due to its induction of foreign labourers. Overall, the industry disclosed more information on the economic and social aspects of sustainability practices than on the environmental aspect.

Other works on sustainability reporting in Malaysia include Amran and Haniffa (2011). They found that large government-linked companies (GLCs) in Malaysia engaged in a substantial amount of sustainability reporting. Further, Amran et al. (2014) examined the influence of corporate governance structure on the quality of sustainability reports in Asia-Pacific countries. Public listed firms in Malaysia were also included as the study's sample. They found that the board of directors had a weak role in improving the quality of sustainability reports. Chang et al. (2019) presented a comparative analysis of the quality of sustainability reports worldwide. The results

showed that developed countries produced higher quality sustainability reports than developing countries.

Sustainability reporting is improving in Malaysia (Jamil et al., 2020), with firms also exploring other mediums to communicate their sustainability performance. Amran et al. (2015) examined the extent of online sustainability reporting using stakeholder theory as theoretical support. The content analysis of firms' websites showed that the firms disclosing more information online were those with a diverse product line. The study concluded that Malaysian firms need to increase their online disclosures to boost their image among the stakeholders. The studies conducted in Malaysia mostly focused on the sustainability reporting practices on websites (Rahim & Omar, 2017; Hashim et al., 2016). A limitation of the aforementioned studies is that they did not include social media platforms although such platforms are more popular than websites (Esteban Ortiz-Ospina, 2019). This can be seen in Table 2.2. Another gap in the literature is pertaining to the role of technology in sustainability reporting and stakeholder engagement. In light of this gap, de Camargo Fiorini et al. (2018) suggested using other theoretical underpinnings such as DCV to explore the latest technologies' role in sustainability reporting.

2.2.2.1 Sustainability Reporting Regulation in Malaysia

Malaysian firms paid little attention to environmental disclosures due to their limited involvement in physical environment-related activities (Zain, 1999). Association of Chartered Certified Accountants (ACCA) Malaysia was a pioneer in the development of Malaysia's sustainability reporting framework. ACCA launched the Environmental Reporting Awards in 1999 with 25 participants. This award was expanded, and ACCA Malaysia introduced The Malaysian Environmental and Social Reporting Award (MESRA) and reporting guidelines in 2005. Several well-known reporting standards, such as the GRI, were adapted to create MESRA. In 2006, the inaugural year of

MESRA, 16 participants registered in the category of Environmental Reports and 45 in the category of Social Reports.

In 2007, Bursa Malaysia amended its Listing Requirements by adding a provision requiring listed firms to produce a statement on their CSR activities. The provision is part of Bursa Malaysia's Listing Requirements under Appendix 9C, Para 29 (Ministry of Finance, 2006). Bursa Malaysia took another significant step in 2015 in promoting sustainability practices among listed firms. The bourse set the standard in ASEAN by introducing a globally benchmarked Environment, Social, and Governance (ESG) Index in December 2014, dubbed as the FTSE4Good Bursa Malaysia ESG Index. Listed firms are now required to include sustainability statements in their annual reports submitted to Bursa Malaysia. The amended Listing Requirements specifies that the annual report must include a narrative sustainability statement that addresses economic and social risks and opportunities. Following the Listing Requirements amendment, the Sustainability Reporting Guide was published for detailed reference. It is consistent with the 1997 GRI principle to include economic, environmental, and social performance in reporting (Ioannou & Serafeim, 2017).

2.3 Sustainability Reporting on Social Media (SRSM)

Online disclosures have increased in importance since the advent of social media platforms. Kaplan and Haenlein (2010, p. 67) defined social media as a platform that "allows firms to engage in timely and direct end-consumer contact at relatively low cost and higher levels of efficiency than can be achieved with more traditional communication tools." Another definition for social media was provided by Reilly and Hynan (2014, p. 749), as follows:

"Social media (e.g., Facebook, Twitter, YouTube) refers to technology-facilitated dialogue conducted through platforms including blogs, wikis, content sharing, social networking, and social bookmarking. It differs from traditional media in that it allows for a two-way interactive experience between organizations and stakeholders, rather than media outlets broad-casting information to the masses with no direct reaction or response."

Both definitions highlight the advantages of social media as a cost-effective platform that facilitates two-way communication and allows for better stakeholder communication than through traditional media. Keeping this in view, sustainability reporting on social media (SRSM) in the current study's context is defined as "the use of social media (Facebook) for external and internal corporate communication about sustainability, allowing a two-way interaction between organisation and stakeholders" (Kaplan & Haenlein, 2010; Reilly & Hynan, 2014).

2.3.1 SRSM Perception

Sustainability reporting is perceived as an imperative part of businesses strategies to formulate a robust relationship with the stakeholders. This is why it is constantly investigated in the existing literature. Trireksani et al. (2018) is of the view that the firm's sustainability frameworks are important because they are the key component of on-going economy. The firm's sustainability reporting perception is also shaped by their stakeholder's expectations. These expectations shape the strategies that a firm adopts to communicate. The inclusion of social media as an important communication channel can be explained because of the stakeholder's expectations. She and Michelon (2019) examined the CSR perceptions of stakeholders on Facebook concerning S&P 100 listed firms and found that Facebook provides an interactive communication platform for both stakeholders and firms. The firms when interact with stakeholders try to improve their sustainability disclosures, which is an outcome of better sustainability reporting practices.

When a firm interacts with its stakeholders, it improves its sustainability performance/reporting but also formulates a certain perception towards itself. Although their performance can be evaluated by publicly available sources such as annual reports/websites/social media, but it lacks the viewpoint and emotions/attitudes of its

employees towards the sustainability performance and reporting. Id Bouichou et al. (2022) analysed how the firm's CSR perception affects the emotion-attitude-behaviour sequence of the employees. The study found that organizational pride and affective commitment towards CSR mediates the relationship between perceived CSR and emotion-attitude-behaviour sequence of the employees.

2.3.2 SRSM Disclosure

Previous studies have shown that firms have two primary motives to disclose information on social media. The first motive is based on legitimacy theory, and the second is based on stakeholder theory. According to legitimacy theory, firms use social media platforms for sustainability reporting disclosures to legitimise their presence in the society in which they are operating. Lodhia et al. (2020) presented empirical evidence on this stance and underpinned legitimacy theory to analyse the use of social media by the 50 largest Australian firms for sustainability reporting. The result showed that Australian firms used social media platforms to seek legitimacy by sharing information and initiating dialogue on sustainability reporting-related indicators. The disclosures on social media platforms mainly focused on social issues instead of environmental issues and maintained a positive tone. Despite the efforts to engage with the stakeholders, social media use was limited, as only 46% of the sample firms used social media. The study stated that the use of social media for sustainability reporting has limited coverage in the literature, which presents a research gap.

Legitimacy theory was also used by Reilly and Larya (2018). They compared how 11 global firms used formal and informal channels for CSR and SRSM. The informal channels included social media. The firms selected for the analysis were categorised into high-ranked and low-ranked groups based on Newsweek's Greenest Companies 2014 ranking. The findings showed that high-ranked firms displayed more efforts than low-ranked firms in communicating about sustainability. Zakaria et al.

(2018) found annual reports, websites, and social media platforms to be influential platforms for sharing sustainability reports. They measured transparency in the sustainability reports on those platforms and found that the sustainability reports on all platforms had a moderate transparency level.

Previous studies have used stakeholder theory as theoretical support to investigate sustainability reporting (e.g., Mahmood & Orazalin, 2017; Spence et al., 2010). The purpose of sustainability reporting is to communicate firms' sustainability performance to stakeholders, and social media offers a cost-effective and interactive platform for sustainability reporting and engagement with the stakeholders (Zizka, 2017). Given the importance of stakeholders for firms, fulfilment of their needs will lead to competitive advantage (Chowdhury et al., 2019). Cantrell et al. (2015) proposed that CSR in the form of charities can be a dynamic capability for firms. Firms may gain a competitive advantage because of the relationship built with the stakeholders. Since social media provides firms with a cost-effective way to manage their relationship with the stakeholders, it can be assumed that sustainability reporting via social media platforms may also be a capability.

Studies using stakeholder theory as a theoretical underpinning believe that firms need to address stakeholders' concerns about their practices. These concerns are often raised on social media platforms, given these platforms' rising popularity. Al-Sartawi and Hamdan (2019) stated that social media technologies have changed the ways firms share sustainability information and engage with stakeholders. Due to firms' transition towards using social media platforms, the authors investigated the use of social media by firms in the Gulf countries for sustainability reporting. They found that 84% of the firms used social media, with 70% of them using it for reporting purposes. Their finding also showed that sustainability reporting on social media platforms helped firms create value.

Stakeholder theory was also used by Manetti and Bellucci (2016) to examine the effectiveness of Facebook, Twitter, and YouTube for stakeholder engagement to define the contents of sustainability reporting. They examined 332 global sustainability reports for 2013 that were prepared according to the GRI guidelines and subsequently analysed the social media platforms of organisations that relied on these platforms to assess the scope of communication with the stakeholders. The study found that only a few firms used social media platforms to define the sustainability reporting content. Meanwhile, Lodhia (2018) asserted the role of new media communication channels, inferring that these platforms can transform sustainability reporting. New media platforms can enhance stakeholder engagement compared to the traditional reporting style that discourages stakeholders from communicating. Given the rising importance of new media platforms, the author concluded that it is important to align them with sustainability reporting.

While legitimacy theory's propositions are firm-centric, stakeholder theory's propositions are stakeholder-centric. Stakeholder theory advocates the notion that stakeholders have a powerful voice on social media. Hence, firms need to align their sustainability reporting approaches with stakeholders' information needs. An overview of the literature on the link between sustainability reporting and social media is provided in Table 2.3. It shows that previous studies tended to focus on the link between CSR and social media in the accounting domain. Stakeholder theory is commonly used in studies that analyse the various types of social media platforms (Manetti & Bellucci, 2016; Ali et al., 2015; Kucukusta et al., 2019; Saxton et al., 2020).

Table 2.3 also shows that other theories are seldom used to examine SRSM. Further, previous studies commonly examined sustainability reporting in relation to variables such as stakeholder engagement and organisational performance. There are limited studies on the use of the latest technology, namely BDAC. Previous research

used DCV to analyse firms' external and internal capabilities to examine their impacts on various variables (Buzzao & Rizzi, 2021). DCV propositions are used in the current study to analyse whether firms with BDAC disclose more about SRSM because BDAC allows them to analyse unstructured data obtained from social media platforms and convert it into meaningful data analytics. The current study proposes BDAC contributes to better management of SRSM, thus helping to satisfy stakeholders' informational needs. Nevertheless, adopting dynamic capabilities requires a certain organisational environment that is channelled through the top management. Hart (2000) has identified a set of attributes termed "tone at the top" that adds to a firm's internal environment for the adoption of dynamic capabilities. Further, DCV states that incorporating dynamic capabilities may give firms a competitive advantage. Since social media platforms constitute an important part of BDAC, the forthcoming section includes the literature review on BDAC.

Table 2.2: Literature on Sustainability Reporting and Social Media

Authors	Aim	Methodology	Sample	Theory
Sustainability reporting and social media				
Lodhia et al. (2020)	To examine social media usage for sustainability reporting	Qualitative content analysis on three social media platforms: Facebook, Twitter and LinkedIn	Top 50 Australian stock exchange-listed firms	Legitimacy theory
Manetti & Bellucci (2016)	To explore if the stakeholder engagement on Facebook, Twitter and YouTube helps in the determination of sustainability reporting contents	Content analysis on pages of Facebook, Twitter and YouTube	332 worldwide sustainability reports	Stakeholder and legitimacy theory
Testarmata et al. (2018)	To analyse the use of innovative technologies such as social media for the disclosure of sustainability reporting	Content analysis	Italian firms	Used the green ranking system
Triple bottom line and social media				
Lock & Araujo (2020)	how far businesses' visual sustainability language reflects a balanced triple bottom line on the sample firms' websites and Twitter	Automated content analysis on website images and Twitter	Top-performing European firms	None
Masud et al. (2019)	To explore the mediation of triple bottom line (TBL) between strategic organisational performance (OSP) and corporate social responsibility performance (CSRP)	Used Structural equation modelling (SEM) to test the hypothesis	Bangladesh	stakeholder, institutional, legitimacy and resource-based view theories
Sustainability performance and social media				
Basri & Siam (2019)	To explore the link between social media and corporate communication as an antecedent of sustainability performance	Conceptual study	Arab world	None
CSR and social media				
Lee (2021)	To explore the link between internal CSR and employee behaviour on the websites	Survey	405 full-time employees in the US	Social exchange theory and relationship management theory

Table 2.3: Continued

Authors	Aim	Methodology	Sample	Theory
Pizzi et al. (2020)	To explore how oil and gas firms engage with stakeholder holders on the CSR topic	Tweets were analyzed with the statistics software program "TwitteR" and classified by their content	Trans Adriatic Pipeline experience	Legitimacy theory
Mądra-Sawicka & Paliszkiewicz (2020)	To examine the financial measures related to CSR	Secondary data analysis	448 food companies from 50 countries in 2009-2020	Stakeholder theory
Saxton et al. (2020)	To explore the firm's response to the stakeholders on Twitter	Content analysis	Fortune 200 firms	Stakeholder theory
Chu et al. (2020)	To investigate cross-cultural differences between the US and China in terms of their engagement with the stakeholders	Survey	421 Chinese social media users 486 US social media users	Reasoned action theory
Fatma et al. (2020)	To investigate how banks CSR engagement affects consumer's electronic word of mouth on Facebook	Survey	Indian banks	Legitimacy theory and social identity theory
Saxton et al. (2019)	To investigate how messages conveying CSR-related topics resonate with the public and which CSR topics and signal qualities are most effective	Content analysis on Twitter	Fortune 500 firms	Signalling theory
Kim & Xu (2019)	To examine message source and presence of positive social cues influence the evaluations (attitude toward the corporate social responsibility (CSR) message and company, and word-of-mouth intention to support the campaign) of the decreased use CSR messages on Facebook.	Factorial experimental design	138 MTurk users living in the US	Signalling theory
Ali et al. (2015)	To investigate the role of social media in designing effective CSR strategies for engagement with the stakeholders.	Survey	Randomly distributed to the author's links on Facebook	Stakeholder theory

Table 2.3: Continued

Authors	Aim	Methodology	Sample	Theory
CSR and Facebook				
Kucukusta et al. (2019)	To explore the CSR communication and stakeholder engagement on Facebook by the hotel industry	Content analysis with data extracted from Netvizz	Four-to-five-star hotels in Hongkong	Stakeholder theory and communication theory
She & Michelon (2019)	To examine the CSR perceptions of the stakeholders on social media through interaction on Facebook	Content analysis on Facebook pages of the sample firms	S&P 100 firms	Organised hypocrisy theory
Abitbol & Lee (2017)	How firms use Facebook to engage with the stakeholders strategically	Content analysis on Facebook pages of the 16 fortune 500 firms	Fortune 500 firms	Dialogic theory

2.4 Big Data Evolution, Characteristics, and Definition

Big data requires "the use of powerful computational techniques to unveil trends and patterns within and between these extremely large socio-economic datasets" (George et al., 2014). These techniques are termed as big data analytics (BDA). BDA provides physical (hardware technology) and digital (software technology) materiality representing stable properties across contexts and time. Examples of physical technologies include in-memory databases (chiefly volume, velocity) or contemporary compute storage and network capabilities. Software examples are more diverse and include NoSQL databases such as Apache Cassandra or Amazon Dynamo (volume), event streams processing engines such as Esper (velocity), or statistical software such as R (variety). They provide affordances as potentials to process data and create comprehensive media information such as sustainability reports (Lehrer et al., 2018).

Researchers from various domains have used different terms for big data, for example, business analytics, big data analytics (BDA), and big data analytics capabilities (BDAC). The difference between these terms is in their operational definitions. Mikalef et al. (2018) looked at the origins of data, focusing on the various channels for data collection. Despite the debate on the difference between business analytics and BDA, businesses use analytics as part of BDA (Rialti & Marzi, 2019).

Many scholars have highlighted the “three Vs” of big data, namely volume, variety, and velocity (Sun et al., 2015). Volume depicts a large size of data arising from an enormous number of variables and observations (George et al., 2016). Data, often expressed in petabytes or exabytes, is used in the refined form for strategic decision-making. Velocity is the speed at which data is collected, analysed, and updated (Davis, 2014; George et al., 2016). It also shows how fast data becomes obsolete for business decision-making and agility. Variety is explained as different types of data sources including text, audio, video, image, network, and graphic (Constantiou & Kallinikos,

2015; George et al., 2016). To date, there is no universal holistic benchmark for defining the three Vs of big data. It is dependent on firm size, sector, and location (Gandomi & Haider, 2015).

Scholars have added various other dimensions to the three Vs of big data. One commonly added dimension is veracity, which refers to data authenticity and truthfulness (Demchenko et al., 2013). Dijks (2012) emphasised another aspect, i.e., value. Businesses need to create value through high quality and reliable data for decision-making (Akter et al., 2016). Seddon and Currie (2017) added two more dimensions to big data: visualisation and variability. Visualisation refers to the presentation of data in understandable ways through technology, and variability refers to the set of opportunities underlying big data (Seddon & Currie, 2017). The various classifications used to characterise big data are shown in Table 2.4 below.

Table 2.3: Big Data Characteristics

Characteristics	Authors
3Vs: volume, velocity, variety	Chen and Zhang (2014); Wamba et al. (2017)
4Vs: volume, velocity, variety, veracity	Schroeck et al. (2012); Abbasi et al. (2016)
5Vs: volume, velocity, variety, veracity, value	Dijks (2012); Naeem et al. (2022)
7Vs: volume, velocity, variety, veracity, value variability, visualisation	Seddon and Currie (2017)

Source: Mikalef et al. (2018)

The analysis of big data's definitions is provided by Ylijoki and Porras (2016). They identified 17 definitions from 479 scientific articles and found that volume (95%), variety (89%), and velocity (74%) were commonly used to define big data. Volume represents an unusually huge amount of data (Géczy, 2014). Variety covers the diversity of data sources and formats and enables the processing of unstructured data, and velocity refers to the speed of data modification and evaluation (Géczy, 2014). In other words, big data requires "the use of powerful computational techniques to unveil trends and patterns within and between these extremely large socio-economic datasets"

(George et al., 2014). These techniques are termed BDA, which provides physical (hardware technology) and digital (software technology) materiality representing stable properties across contexts and time. Examples of physical technologies include in-memory databases (mainly volume, velocity) or contemporary computing, storage, and network capabilities. Software examples are more diverse and include NoSQL databases, Apache Cassandra or Amazon Dynamo (volume), event stream processing engines (velocity), or statistical software such as R (variety). They enable data processing and the creation of comprehensive media information such as sustainability reports (Lehrer et al., 2018).

Initially, scholars solely focused on data and its characteristics (e.g., Davis, 2014; Akter et al., 2016; Abbasi et al., 2016). Other scholars then expanded the focus to include analytical tools, techniques, and procedures (e.g., Russom, 2011; Bharadwaj et al., 2013). For instance, Gantz and Reinsel (2012) defined BDA as "the data itself, the analytics applied to the data, and the presentation of results in a way that allows the creation of business value." So far, the definitions have not linked data sources with tangible or intangible business outcomes. Various scholars have used the term BDA to highlight the combination of data, analytical tools, infrastructure, and methods for visualising it. While the definitions of BDA are comprehensive, organisations lack the required resources to transform big data into actionable sights (Mikalef et al., 2018). A firm intending to become a fully data-driven organisation needs actions at multiple levels to integrate data into the business. To address the gap, scholars have started using the term "BDAC" to highlight a firm's ability to utilise big data to gain strategic and operational insights (Mikalef et al., 2018).

Literature shows that a broader range of BDA must be integrated to make it a success (Garmaki et al., 2016). However, scholars have different opinions regarding the right combination of BDA characteristics for firms (Galbraith, 2014). BDA has been

conceptualised as BDAC to address this issue. Akter et al. (2016) and Wamba et al. (2017, p.358) proposed a holistic definition for BDAC: "the competence to provide business insights using data management, infrastructure (technology) and talent (personnel) capability to transform business into a competitive advantage force." A more holistic definition is provided by Gupta and George (2016, p.1054) as "a firm's ability to assemble, integrate, and deploy its big data-based resources." Many scholars have used this definition to empirically test BDAC in various business settings (Akter et al., 2016; Ferraris et al., 2018; Wamba et al., 2017). In light of the discussion above, the definition by Wamba et al. (2017) is appropriate in the context of the current study's first objective to investigate the impact of BDAC on SRSM in Malaysian firms.

2.4.1 BDAC Benefits and Challenges

Human beings can be measured and quantified due to the large amount of data they can produce (Hilbert, 2013). BDAC implementation has various benefits and challenges. Accenture (2015) highlighted that BDAC enables firms to be proactive in monitoring assets and identifying problems. It also provides useful insights to firms. Furthermore, big data may help firms improve their performance and environmental safety. However, studies have also highlighted the challenges of using big data (Gupta & George, 2016). According to Tole (2013), building a solution for large and multifaceted data is challenging. Firms are continually learning and implementing new approaches. One of the main problems associated with big data is the high cost of hardware equipment and cloud computing (Wang & Wiebe, 2014). Furthermore, valuable information can be constructed only with human analysis, which often requires sorting through data.

There are various difficulties confronting the plan, execution, and activities of continuous enormous information applications. Most customary enormous information applications are carried out utilizing an open-circle approach. In this methodology,

enormous information for a particular space is investigated to get some new data and information that can be utilized to upgrade the activities or productivity of that space. The time expected to investigate the enormous information and settle on choices is for the most part extremely lengthy furthermore, could fundamentally diminish the advantages and viability of the applications. In contrast to customary enormous information applications, genuine time applications should start quick activities that are for the most part limited by unambiguous time periods directed by the designated space. Continuous enormous information applications are for the most part carried out utilizing a shut circle approach in which activities are generally founded on the current and past circumstances.

While computer technology needs to be updated to support the data, business leaders need to be updated to utilise it (Sivarajah et al., 2017). Collecting and integrating data involves several challenges. First, the right data must be selected. Second, the data must be recorded correctly. Third, firms face challenges associated with external data (e.g., social network data) and internal data (e.g., transactional records) (Zhao et al., 2017). Next, several techniques are needed to transform and analyse data (Kaisler et al., 2013). Finally, the data collected needs to make sense of the findings. Studies show that three fundamental components are required for the BDAC implementation, as discussed in the forthcoming sections.

2.5 Big Data Analytics Capabilities (BDAC)

Information technology (IT) capabilities consist of several dimensions. Kim et al. (2012) categorised IT capabilities into management, infrastructure, and personnel capabilities. Gupta and George (2016) considered BDAC as an advanced form of IT capabilities. Thus, they underpinned management, infrastructure, and personnel capabilities as BDAC's dimensions. Brynjolfsson and McAfee (2012) found that data-driven firms were 6% more profitable and 5% more productive than non-data driven

firms. Human resource, management, and infrastructure capabilities are vital for the BDAC implementation and superior financial and operational performance. The technical problems surrounding big data are genuine, but the managerial issues are even greater (Brynjolfsson & McAfee, 2012). They suggested focusing on five areas in implementing BDAC "technical innovation, leadership, decision-making, talent management, and corporate culture". Barton and Court (2012) supported the idea of interconnections between technology, people, and management in a big data environment. They emphasised an integrated approach to model building, data sourcing, and organisational transformation to benefit from big data. The dimensions identified by Mikalef et al. (2018) as contributing factors to the BDAC implementation are similar to those identified by Barton and Court (2012) and Brynjolfsson and McAfee (2012). A review of the BDAC dimensions (see Table 2.5) shows that most prior studies used a combination of management, infrastructure, and personnel capabilities to examine the link between BDAC and various variables (Akter et al., 2016; Wamba et al., 2017; Dubey et al., 2019). Therefore, in line with prior literature, the current study utilised these dimensions of BDAC for the measurement and analyse its impact on the proposed variable (i.e., SRSM).

Table 2.4: Taxonomy of BDAC Dimensions

BDAC dimensions	Components	Sources
Management capability/ intangible sources	Planning, policies, rule structures, top management support, coordination, control, decision-making	Garmaki et al. (2016); Akter et al. (2016); Mikalef et al. (2017)
Infrastructure capability/ tangible sources	Connectivity, compatibility, agility, large-scale, unstructured databases, cloud services, reliability, adaptability, software and IS systems	Erevelles et al. (2016); Gupta and George (2016); and Mikalef et al. (2018)
Personnel capabilities/ human skills	Technical knowledge, technological management knowledge, business knowledge, data-driven culture	Dubey et al. (2019); Hamilton and Sodeman (2020)

2.5.1 BDA Management Capability

Among the various capabilities related to BDAC, BDA management, infrastructure, and personnel capabilities are commonly used as BDAC's dimensions. BDA management capability ensures that a proper management framework is applied in business decision-making. BDA management capability is derived from IT management capability (Kim et al., 2012). The authors propose that IT planning, investment decision-making, coordination, and control are IT management capabilities that are core to the IT management cycle and key IT daily tasks. These IT management capabilities form the basis of BDA management capability, and they are termed as BDA planning, investment, coordination, and control (Akter et al., 2016).

BDA planning aids in developing procurement and production schedules through the appropriate collection and interpretation of information (Wamba et al., 2017). Firms need to prepare for the deployment or utilisation of IT to achieve organisational goals and strategies. This preparation includes identifying the relevant IT applications and the selected IT project's priorities, managing the IT project and its execution, and making revisions according to the changing environments (Karimi et al., 2001). BDA planning is important because it provides a roadmap for coordination, including security planning.

BDA investment decision helps supply chain professionals develop an infrastructure that facilitates real-time business intelligence and decision-making. It entails selecting optimal resources through structured mechanisms such as the enterprise funding model to balance investment costs and strengthen a firm's strategic position (Makadok, 2001). Poor foresights in investments may lead to failed decisions that will affect other decisions related to the BDAC implementation.

BDA coordination emphasises synchronising operations, reports, direct contact, task forces, and informal and formal gatherings of inter-departmental teams among the

firm's entities. It includes the structural design that aims to facilitate communication between the departments within the firm. BDA coordination also includes deciding how to communicate and the frequency of interactions between the departments (Wamba et al., 2017).

BDA controls operations by ensuring the existence of appropriate authority lines in different entities through appropriate software and hardware (Mandal, 2018). The control routine guarantees that the functions are organised and performed properly. Undertaking BDA projects of various sizes requires resources, including budgets and human resources, to ensure proper control and utilisation. Among the controlling functions are evaluating proposals, clarifying units' responsibilities, developing monitoring and evaluation criteria for units, and continuous evaluation of the BDA unit. While IT capabilities and BDAC have many similarities, IT capabilities do not have some aspects of BDAC. While IT capabilities focus on implementing and using computers and IT resources, BDAC emphasises analysing data, drawing meaningful insights, and decision-making. Thus, IT capabilities refer to the technical aspects of IT infrastructure, whereas BDAC capabilities are about applying IT technologies to share and analyse information to aid strategy formulation (Wamba et al., 2017).

2.5.2 BDA Infrastructure Capability

Like BDA management capability, BDA infrastructure capability is also derived from IT capabilities. It refers to "the ability of the BDA infrastructure (e.g., applications, hardware, data, and networks) to enable the BDA staff to quickly develop, deploy, and support necessary system components for a firm" (Wamba et al., 2017; Kim et al., 2012). Wamba et al. (2015) emphasised the integration and availability of data from different sources, including social media, machine, and transactional data. Sometimes, firms buy data to complement their customers and business operations

(Mikalef et al., 2017). Regardless, firms need support from infrastructure to extract the maximum output from data (Gupta & George, 2016).

IT infrastructure must be flexible to cater for the changing business environment. The existing IT infrastructure may be insufficient to integrate data from various sources (Wamba et al., 2015). A flexible IT infrastructure allows firms to develop applications for effective information sharing across business departments, resulting in improved business processes (Karimi et al., 2001). Connectivity and compatibility are also important for the IT infrastructure (Kim et al., 2012), and hence, the BDA infrastructure. The BDA infrastructure requires connectivity among various systems in the firm such as supply chain management, resource planning, and customer relationship management. It also needs to be compatible to allow a transparent flow of information. An example is a firm's data bases that are managed by metadata. Thus, BDA infrastructure capability refers to firms' ability to have strong and flexible connectivity when the need arises. Many previous studies have used connectivity and compatibility to measure BDA infrastructure capability (e.g., Davenport & Patil, 2012; Rialti et al., 2019; Wamba et al., 2017; Yasmin et al., 2020).

2.5.3 BDA Personnel Capability

BDA personnel capability is defined as "staff's professional ability (e.g., skills or knowledge) to undertake assigned tasks" (Wamba et al., 2017). Previous studies categorised this capability into the following sub-dimensions: (1) technical knowledge such as database management, data retrieval, programming knowledge such as MapReduce, and cloud service management; (2) business knowledge such as decision-making routed within the firm, strategic foresight for big data deployment, and application of insights extracted); (3) relational knowledge including communication and collaboration skills between employees of different backgrounds, and (4) business analytics knowledge including mathematical modelling, simulation and scenario

development, and interactive data visualisation (Lozada et al., 2019; Rialti et al., 2019; Mikalef et al., 2019). Data scientists and firms need data analytics to enable them to understand business problems and how to apply relevant data sources to solve the problems (Prescott, 2014).

Numerous studies have noted a lack of BDA capabilities in firms' personnel, thus preventing firms from realising these technologies' full potential (Tambe, 2014). McKinsey's report forecasted that by 2018 there would be a shortage of the talent required for effective handling of big data, with estimates ranging from 140,000 to 190,000 positions (Domingue et al., 2014). Despite the increasing focus on data scientists' roles, other skills and knowledge sets are also necessary for employees at firms engaging in BDA. The technical skills required include those possessed by big data engineers that can be used to acquire and cleanse data from multiple sources and various formats (Mikalef et al., 2017). Besides, data architects need to help develop the data sources' blueprints and the appropriate technologies to leverage the data's potential. The fusion between business and IT departments in BDA firms has given rise to the importance of liaison persons to facilitate seamless communication between the departments (Akter et al., 2016). The skills required from these employees include mastery of all areas within the department and communicating with other departments to work as a team (Mikalef et al., 2017).

Knowing the goals and directions of the business and measuring and improving the critical key performance indicators (KPIs) are necessary for BDA because BDA is mostly grounded on an existing problem. Therefore, the ability to utilise big data to identify a problem and make improvements is critical for both business executives and data analysts (Gupta & George, 2016). Hence, the BDAC implementation requires employees to have the professional ability (e.g., skills or knowledge) to undertake the assigned tasks (Akter et al., 2016; Wamba et al., 2017). Analysts must have four

important skills for BDAC implementation, namely technical knowledge, technological management knowledge, business knowledge, and relational knowledge (Davenport & Patil, 2012). Since the literature shows that capabilities are created by combining resources, the BDAC measurements are adapted from Wamba et al. (2017) and Gupta and George (2016) to achieve the objectives of the current study.

2.5.4 BDAC Applications

BDAC is widely applied in business. For instance, Pejić Bach et al. (2019) analysed the financial services sector's use of big data technologies. They aimed to identify the intellectual core of the field; the machine learning techniques used in the financial sector, especially in the era of the internet, big data, and social media; and the frequency and purpose of text mining in the financial sector. The findings revealed a significant use of BDAC technologies. Similar applications of BDAC in other domains are shown in Table 2.6. Apart from businesses, other fields are also applying BDAC. For example, Liao and Chen (2019) used social computing to identify important social structure patterns. They blended anticipatory computing and social network analysis and designed an application interface to utilise big data. The aim was to apply data analytics for various applications, including business, disease, and symptom analyses. The study deepened the understanding of social computing and the data received from social media.

Table 2.5: Applications of BDAC

BDA techniques	Description	Application	Sources
Social network analysis	To view social relationships in terms of social network theory	Anthropology Social media	Liao & Chen (2019); Kolmakov et al. (2020)
Data mining	To explore data mining in the financial sector	Digital libraries E-government E-learning	Pejić Bach et al. (2019)
Machine learning	To allow computers to evolve behaviour based on empirical data	Healthcare Customer	Chen and Zhang (2014)

Source: Yaqoob et al. (2016)

2.5.4.1 Literature Overview and Theories Used in BDAC

Resource-based view (RBV) and dynamic capability view (DCV) are the commonly used theoretical lens to examine the implementation of BDAC (see Table 2.7). RBV is the foundation of DCV (Ambrosini & Bowman, 2009). RBV sees firms' resources and capabilities as a source of competitive advantage (Barney, 2001). There are several criticisms of RBV. First, RBV does not explain why and how certain firms develop competitive advantage in changing environments (Cavusgil et al., 2007). Second, RBV does not consider the new capabilities in the firm; in contrast, DCV focuses on not only the competitive advantage gained from dynamic resources but also how the competitive advantage is configured by the firm's managers (Cavusgil et al., 2007). In other words, the fundamental question of how firms sustain their competitive advantage is not addressed by RBV but answered by DCV (Teece et al., 1997). Further, RBV focuses on ordinary capability arising from firms' tangible assets, intangible assets, and operational capability (Teece et al., 1997). In contrast, DCV emphasises purposeful modification of these assets (Schilke et al., 2018). Hence, DCV has emerged as an alternative theory to explain firms' resources.

The existing literature provides a broad spectrum of DCV definitions that are all built upon the three basic definitions provided by Teece et al. (1997). DCV is defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments." Dynamic capabilities thus reflect "a firm's ability to achieve new and innovative forms of the competitive advantage given path dependencies and market positions (...)" (Døving & Gooderham, 2008; Witcher & Chau, 2012).

There are various antecedents of DCV. Organisational structure (Felin & Powell, 2016), organisational culture (Song et al., 2016), tangible and intangible resources (Salge & Vera, 2013), information technology (Pavlou & El Sawy, 2010), and

leadership (Day & Schoemaker, 2016) are among the commonly identified DCV antecedents. The underlying assumptions of DCV are based on its antecedents. First, a firm 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 tangible and intangible resources 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 firms 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—involving experimentation, evolution, and growth of existing resources—are superior to ordinary capabilities. Some scholars add agility into a firm's dynamic capabilities (e.g., Blome et al., 2013; Zhou & Wu, 2010). Teece (2007) defined agility as a capability that allows firms to adjust their behaviour according to the opportunities and threats in the environment.

Dynamic capabilities result from purposeful adoption of resources (Teece et al., 1997). Such capabilities allow a firm to react timely to external environmental changes. IT capabilities have changed rapidly over time, and firms that failed to transform their abilities have faced major problems. One of the examples is Nokia, which could not survive in the market because the company did not change its internal environment to cater for the changing competition in the market (Bhalodiya & Sagotia, 2018). Another example was related to the requirement for better sustainability practices and reporting. In this case, Coca Cola held a successful campaign on social media platforms to convert used plastic bottles into lamps (Doland, 2014). One of the reasons for the campaign's success was the company changing its internal environment to respond to the external environment in which the stakeholders called for sensible initiatives for plastic use.

Firms that have successfully managed their businesses according to the changing external environment changed their internal environment first.

Most studies in the existing literature used the survey instrument to analyse the BDAC implementation in developed and developing countries. Table 2.7 shows that many areas are still lacking research on the use of BDAC in the corporate setting other than in supply chain and manufacturing. Keeso (2014) highlighted that BDAC could be fundamental for improving sustainability practices. Also, the adoption of BDAC might cause a significant change in firms' reporting practices. However, literature on the link between BDAC and firms' reporting practices is still scarce, as can be seen in the aims of previous studies shown in Table 2.7.

Table 2.6: Overview of Literature on BDAC

Authors	Aim	Methodology	Sample	Theory
Bag et al. (2021)	To elucidate how automotive firms configure tangible resources and workforce skills to drive technological enablement and improve sustainable manufacturing practices and develop circular economy capabilities	Survey	219 automotive and allied manufacturing companies operating in South Africa	Institutional theory and RBV
Bertello et al. (2020)	To determine the relationship between BDA the international growth of small and medium-sized enterprises (SMEs).	questionnaire	CEOs of 266 SMEs, receiving 103 responses.	RBV
Mikalef et al. (2020)	To examine the indirect relationship between a firm's BDAC and competitive performance.	Survey	202 chief information officers and IT managers working in Norwegian firms.	RBV and DCV
Xiao et al. (2020)	To examine the effects of the different types of BDAC on service innovation	Survey	175 organisations in China	DCV
Rialti et al. (2019)	The impact of BDA capabilities on a firm's performance and mediation of organisational ambidexterity and agility	Survey	259 managers of large European organisations	DCV
Côrte-Real et al. (2016)	To explore big data analytics value chain	Survey method	500 European firms	Knowledge-based view and DCV
Dubey et al. (2017)	To examine the impact of big data and predictive analytics on the social and environmental performance of a firm	Survey method	215 Indian firms	DCV
El-Kassar & Singh (2018)	To develop and test a holistic model that depicts and examines the relationships among green innovation, its drivers, as well as factors that help overcome the technological challenges and influence the performance and competitive advantage of the firm	Correlational research design and data collection through survey method	215 respondents working in the Middle East and North Africa (MENA) region and Golf-Cooperation Countries (GCC)	RBV
Dubey et al. (2015)	To illustrate the role of BDA in world-class sustainable manufacturing	Survey sent on Facebook and LinkedIn	1130 manufacturing firms	SCM theory

Table 2.7: Continued

Authors	Aim	Methodology	Sample	Theory
Yaqoob et al. (2016)	To analyse the origins of big data applications and their current trends	Structuralism and functionalism	none	None
Alharthi et al. (2017)	Introduction of tactics to address barriers in implementation of big data	Cases	Daimler, Walt Disney, UPS, Dublin City Council, Etihad Air	None
Braganza et al. (2016)	To analyse the impact of big data on supply chain risks and uncertainty	Qualitative and qualitative methods	Taiwanese light-emitting diode companies	Grey theory
Zhang et al. (2017)	Compare the use of big data in the product life cycle	Case study	None	Data mining theory

Note: RBV: Resource based view, DCV: Dynamic capability view

2.5.4.2 BDAC: Malaysian Context

In the context of Malaysia, a few studies have examined the use of BDAC, and they demonstrated diverse applications. BDAC is increasingly being used in natural disaster management in Malaysia (Zayid et al., 2020). Since flash flooding often occurs in the country, a BDAC model has been proposed to reduce natural disaster risk. BDAC is also applied to predict carbon emissions in Malaysia. The utilisation of information on carbon emissions can be improved to curb the emissions via eco-friendly policies (Munodawafa & Johl, 2019). Morsid et al. (2019) suggested using BDAC to predict and prevent haze in Malaysia. Another study conducted by Ali et al. (2019) indicates BDAC's potential in solving the traffic problems in the country.

The studies discussed above show that the application of BDAC to promote sustainable ways of consumption and production in Malaysia is growing. However, there is a dearth of research on the BDAC implementation by firms listed on Bursa Malaysia, especially after MDEC initiated the pilot project on BDAC implementation. Moreover, social media platforms are gaining popularity in Malaysia. Social media data is part of big data, which is still lacking empirical evidence. This scenario presented a research gap that the current study aimed to fill.

2.6 Association between BDAC and Sustainability Reporting

The worldwide trend of adapting emerging technologies has resulted in firms shifting sustainability reporting from traditional to internet-based mediums. Online platforms allow firms to reach the stakeholders faster and provide them with the required information. The biggest advantage of using the internet is to ease the flow of information between the firm and its stakeholders. The advancement of internet technology has given birth to cloud platforms, which allow both firm and stakeholders to post or apply data analytics on data in text, videos, audio, and vocals. Corporate reporting in the era of the internet and mobile devices is classified as the third

generation of corporate internet reporting (Al-Htaybat & von Alberti-Alhtaybat, 2017). This third generation of corporate reporting provides stakeholders with various options to engage with firms. It has interactivity, accessibility, and data sharing capability. It also includes sustainability reporting and offers a new method of communication where stakeholders can extract and analyse data on their own. A huge proportion of the third-generation corporate internet reporting includes web 2.0 applications. The assessment of web 2.0 applications is important because they are part of the big data-creating technologies. The commonly used web 2.0 applications are Facebook, Twitter, Snapchat, Instagram, and YouTube.

In the current study's context, 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; Reilly & Hynan, 2014). Previous studies have analysed the use of social media for sustainability reporting. Lodhia et al. (2020) showed that Australian firms used social media platforms to share information and initiate dialogue on sustainability reporting indicators. The disclosures on social media platforms mainly focused on social issues rather than environmental issues. A change in firms' sustainability reporting was also reported by Al-Sartawi and Hamdan (2019). They noted that social media technologies had prompted firms to change their approaches to sharing sustainability reporting information and engagement with stakeholders. They found that 84% of the firms in Gulf Cooperation Council (GCC) countries used social media, with 70% using it for reporting purposes. Their finding also indicates that sustainability reporting on social media platforms helps firms create value.

Manetti and Bellucci (2016) examined 332 global sustainability reports that followed the GRI guidelines and conducted content analyses of firms' social media to assess the scope of communication with stakeholders. They found that few firms used

social media platforms to engage with the stakeholders to define the contents of sustainability reports. Reilly and Larya (2018) compared 11 global firms' use of formal and informal channels to communicate CSR and sustainability reporting on social media platforms. Their findings showed that high-ranked firms on Newsweek's Greenest Companies displayed more effort than low-ranked firms to communicate sustainability reporting. The use of social media platforms for sustainability reporting was also analysed by Lodhia (2018). The author inferred that these new media platforms can transform sustainability reporting. Since the traditional reporting style discourages stakeholders from communicating, new media platforms can enhance stakeholder engagement.

The dominance of social media has promoted its ability to support engagement with digital-savvy stakeholders (Men & Tsai, 2016). Trade publications reported that the public, when searching for information about a firm, tend to rely more on social media than on corporate websites (Dei Worldwide, 2008). Social media has become their primary source of information (Fuscaldo, 2011). It is the fundamental driver of media revolution (Vogt & Knapman, 2008). Media surveys have reported that internet users spend most of their time on social media platforms (Fox, 2013). With the rapid changes in media technology, social media has changed how organisations engage and communicate with their stakeholders.

Despite the growing importance of social media for organisations, some have questioned the need to use it for stakeholder engagement. A comparison between traditional and social media is necessary to address this question. Unlike the one-way communication associated with traditional media, social media allows collaboration, participation, and interaction, allowing organisations to develop meaningful relations (Men & Tsai, 2016). The popularity of social media platforms can be measured using their numbers of users. As of the fourth quarter of 2022, Facebook had 2.96 billion

active monthly users. The business community pays much attention to social media due to its growing popularity and role as one of the big data sources (Chae, 2015; Aral et al., 2013). Firms are interested in combining the use of social media platforms and BDAC to improve their insights into different domains such as early event monitoring, crisis management, brand management, public relations, information diffusion, and public opinions (Chae, 2015; Arias et al., 2014; Inauen & Schoeneborn, 2014; Williams et al., 2013). For firms in an advanced IT world, engagement with external stakeholders is vital because they are the source of firms' profitability.

The advancement in IT capabilities makes communication vital for firms. One of the various uses of technology is for stakeholder engagement (Chae, 2015). Many firms are already practising voluntary CSR and sustainability reporting (Williams, 2015). However, doing so via one-way communication is considered the weakest form of communication (Isenmann & Kim, 2006; Kaur & Lodhia, 2014). Advanced IT capabilities have provided platforms, including social media, that involve stakeholders in two-way symmetric communication (Morsing & Schultz, 2006). Social media allows organisations to influence and be influenced by the stakeholders. Chae (2015) and Arias et al. (2014) argued that providing information and receiving external stakeholders' feedback is necessary to maintain public relations. Technology can help firms make sense of the dialogic communication on social media, which is often hard to understand. BDAC has proven useful in other business domains such as supply chain, smart cities, and strategic communication. While huge and unorganised information seems useless, firms can utilise BDAC to extract it out for better decision-making.

Literature points to the existence of a gap in the communication domain and the need to implement BDAC to reap its benefits. Men and Tsai (2016) concluded that social media is just a tool, and it is up to firms how they choose to benefit from it. Further, they suggested developing big data-related competencies to acquire analytical

insights into social media platforms in order to work with digital-savvy stakeholders closely. Darwin's rule is relevant in firms' usage of social media: "It is not the strongest of the species that survive, but the most responsive to change."

Many studies have examined the use of the internet for sustainability reporting on social media platforms. Rivera-Arrubla and Zorio-Grima (2016) investigated the concept of integrated reporting and social media to connect and share reporting information with stakeholders. Similarly, Lodhia and Stone (2017) examined integrated reporting on the digital environment platform, i.e., social media. A few studies have focused on using big data as part of digital transformation to examine reporting. For example, Pei and Vasarhelyi (2020) analysed the use of big data in financial reporting. Seele (2017) analysed the predictive capability of big data to manage firms' sustainability practices. However, these studies did not explore the link between firms' analytical capabilities that are required to manage digital platforms and SRSM specifically. Therefore, the current study explored the link between BDAC and SRSM to fill this literature gap.

2.7 BDAC and Sustainability Reporting: Moderation by Tone at the top

In order to capture top management's persona, Hart (2000) formulated a set of attributes known as "tone at the top" to determine the top management's tone. Hart (2000) defined tone at the top as "the shared set of values that an organisation has channelling from the most senior executives". Top management's tone has been analysed from various perspectives. For example, Latan et al. (2018) examined the impact of top management's commitment on environmental performance. The moderating role of top management support in implementing innovative green technologies was also examined. A limitation of the study is that a limited number of questionnaire items were used to examine top management support. Moreover, apart

from top management support, many other factors constituting top management's persona also affect firms.

From the perspective of accounting firms, International Federation of Accountants (IFAC, 2007, p. 8) explains tone at the top as:

> "...the standard set by the organisation's leadership whereby performance is measured; the culture within which the members of the organisation operate; the tone set by senior management; irrespective of management's documented strategy and policies, it is the force that drives individual professionals; the "unseen hand" that directs activities regardless of management's proximity to the action; and a commitment to the quality of care clients receive."

The Oxford English Dictionary (1989) defines tone at the top as "the state of morals or manners prevailing among members of a community, or a society". Mahadeo (2006) concluded that tone at the top is created by an ethical or an unethical atmosphere. Additionally, the author mentioned that managers set the tone regarding ethics and integrity for employees. Hence, when employees see managers disregarding the rules, they will follow suit (Cutler, 2004). A senior manager can promote fiscal prudence to their staff by setting a good example, such as adhering to the same budget allowances and privileges. In other words, senior management can influence employees' ethics by embedding their beliefs, values, and assumptions to create a healthy organisational culture.

Tone at the top also refers to a set of cues guiding a firm's functions in management control, ethics, and pressure. It means that the top management leads by example through their practices encompassing work ethics, actions, words, and general behaviour with the employees. The cues or signals can be positive or negative. Positive cues include a commitment to ethical values, nontolerance to fraud, transparency, and openness in reporting practices. Negative cues include a pessimistic attitude towards employees, promotion of a deceptive culture, and intolerance for openness in the firm.

2.7.1 Literature on Tone at the Top

Hart (2000) categorises tone at the top into five master variables: activity, certainty, commonality, optimism, and realism. Some previous studies examined only one tone at the top variable, and some analysed tone at the top as one variable consisting of all five variables. Tone at the top in the literature has been analysed through various perspectives. Many scholars have associated it with earnings management, risk management, impression management and accountability. Whereas others have examined traces of ethical practices of the top management through their non-verbal communication.

Beretta et al. (2019) analysed the impact of tone at the top on intellectual capital disclosures. They found an overall positive tone of intellectual capital disclosures. Moreover, their findings showed that firms with an optimistic tone had better environmental, social, and governance performance. Overall, the study added to the empirical evidence on integrated reporting by testing the link between tone at the top and impression management. An empirical investigation by Patelli and Pedrini (2015) examined the connection between tone at the top and leadership style. They found that the tone in CEOs' annual letters to shareholders tended to be linked to financial reporting aggressiveness. Moreover, the CEOs who made an aggressive case for their firms were more likely to write in a firm language.

Marshall and Cali (2015) evaluated the identification of fraudulent reporting through tone at the top, primarily focusing on the chief operating officer. Identifying fraudulent tones by analysing the master variables of tone at the top helped accountants make rational decisions and follow the ethical code of conduct. Rose et al. (2021) conducted a similar study, focusing on the link between financial wrongdoings and managerial tone. The result showed that executives were willing to commit misreporting when the chief financial officer set a positive tone. A negative tone did not encourage

executives to transition from a minor offence to financial misreporting. The study did not find executives' decisions to be "slippery" but assumed a great risk of fraud. Overall, the findings indicate that firms with a pro-organisational orientation and incremental behaviour are predictive of unethical behaviour, financial misrepresentation, and corporate failure.

In the previously available literature, the scholars examined tone at the top concerning earnings management. Plöckinger et al. (2016) reviewed individual executives' role in corporate financial reporting underpinning upper echelon theory. Their analysis of 60 studies showed the top management executives' influence on disclosure decisions and their quality. Empirical studies developed methods to examine the psychological characteristics and character traits of the executives. However, the results of research on corporate executives' demographic characteristics are sometimes contradictory and ambiguous. Although the overall empirical results are supportive of the upper echelons' predictions, there is some dissent. More research is needed before determinations can be made regarding the effect of upper echelon characteristics, important moderating variables, and adverse selection effects. The authors suggest that future research investigates the magnitudes of managerial influence more closely and takes a more holistic view of financial reporting results.

In line with the financial reporting communication, Arslan-Ayaydin et al. (2016) analysed that managers can use earnings press releases to communicate a firm's performance to third parties to influence the firm's perception achievements. Using the tone of the earnings press release as a proxy for tone inflation, they claim equity-based incentives cause managers to overstate earnings. They further suggest that the impact of tone on abnormal returns is dependent on the magnitude of equity-based incentives. The finding showed that earnings press releases had positive tone when the manager's portfolio value is closely linked to stock price.

Not only earnings management but the empirical studies in the literature have also focused on the reflection of ethics in the tone of top management. Ahluwalia et al. (2018) ascertained the degree to which the presence of a code of ethics affects firm behaviour. They studied how firms adopt a financial code of ethics by financial statement restatements as a dependent variable to measure accounting standards' effectiveness. The results support that adopting a financial code of ethics improves the integrity, quality, and transparency of financial reporting. Another study conducted by Wang and Fargher (2017) investigated whether expression, tone and coordination between internal and external auditors influence fraud risk assessments. The experiment's result involved 64 internal auditors. The findings indicated that poor tone at the top increases the chances of intentional misstatements, and coordination with external auditors further reduces the incidence of intentional misstatements.

In contrast to the literature on ethical tone, the studies in the literature also investigated the role of unethical tone at the top. Remišová and Lašáková (2019) uncovered the systematic differences in the manager's perception of unethical tone at the top based on their demographic characteristics. The sample included 772 management professionals working in diverse industries. The top-level managers tended to ascribe less impact to the unethical tone at the top than middle and lower-level managers. Managers with greater tenure (10+ years) considered unethical tone at the top to be more harmful to unethical leadership decisions and workplace culture than bosses with less tenure. The business-oriented students perceived the unethical tone at the top to be less harmful to the company compared to its counterparts. Education, age, the span of control, and experience were found to be only marginally relevant as predictors of unethical behaviour. The authors contributed to understanding how unethical tone at the top helps in organisational practice to improve managers' awareness of the damaging

effects of unethical tone at the top and thus minimise threats to ethical workplace culture.

In the dissemination of unethical practices, the Chief Executive Officer (CEO) characteristics are also vital in determining tone at the top. Liu and Nguyen (2020) argued that CEO letters to shareholders have a positive tone when describing the firm performance. The letter provides incremental information to the numerical data in the financial statements, but the language is mainly inconsistent with current firm performance and is influenced by the level of positive words. This inconsistency is commonly attributed to overly optimistic management, who tend to have an overly positive view of their case and firm prospects while underestimating firm risk. The analysis conducted by Liu and Nguyen (2020) reveals that CEO gender affects the tone of the letter more, with female executives using less direct language. The evidence shows that CEO letters are an important source of corporate disclosure, and CEO characteristics largely shape the information.

Similarly, Buchholz et al. (2018) present evidence that there are distinct positions in various corporate disclosures and that the CEO's attributes affect language choices. They recorded that, when describing the same company results, CEO letters to shareholders have a more optimistic tone than the Management Discussion and Analysis (MD&A). Although the MD&A provides the numerical details in the financial statement with incremental detail, the CEO's letter's language is mostly inconsistent with actual company results and is primarily affected by the level of positive terms. This discrepancy is due to over-confident CEOs, who seem to have an excessively optimistic view of their potential and firm prospects. Further research by Buchholz et al. (2018) reveals that CEO gender also influences CEO letter language style, using a more neutral tone by female CEOs. Overall, the evidence presented by Buchholz et al. (2018)

indicates that CEO letters, which are influenced by CEO characteristics, are an important source of corporate disclosure.

2.7.2 Tone at the Top and Sustainability Reporting

Few studies have focused on the relationship between tone at the top and sustainability. Hassan (2019) analysed how sustainability assurors used optimism and certainty in persuasion attempts and found that they used certainty and optimism with caution. The author identified praise, assurance level, legal system, and report location as the possible significant determinants of optimism. The use of certainty seemed to be explained by sustainability management control, certification of assurance providers, praise, legal system, and financial performance. The study implies that assurors use certainty in their tone to signal flexibility and optimism to signal discreetness. Meanwhile, in the study by Kim and Kim (2017), listed firms' CEO letters were found to exhibit low realism and high commonality, with North American firms showing higher commonality and European firms demonstrating higher realism.

Tone at the top has also been associated with ethics. Feng and Gao (2020) analysed the role of the non-verbal tone of environmental disclosures in annual reports and how these disclosures were interpreted. In both environmentally sensitive and non-environmentally sensitive industries, the findings showed an increase in the overall level of detail provided in environmental disclosures following the issuance of US Securities and Exchange Commission (SEC) guidance. No change in the size and non-verbal tone of voluntary environmental disclosures was noted over time, suggesting that the changes in the annual reports filed with the SEC resulted from firms simply updating their reports based on the new interpretive guidance.

Cho et al. (2010) predicted that the non-verbal tone in the disclosures by worse performers would be less certain than that of better performers. The sample included US 10K annual reports. The study used the content analysis software DICTION and

reported positive findings. The research is significant because it provides empirical support regarding the roles of language and non-verbal tone in managing stakeholder impressions in an environmental disclosure situation. Since these additional environmental disclosures (such as formality and content) are also important, their relationship with corporate performance warrants thorough investigations. A limitation of the study is that it only looked at certainty and optimism and ignored other variables of tone at the top. Du and Yu (2020) examined the effects of CSR reports' readability and tone on CSR performance and market reaction to the CSR reports among Fortune 500 firms. The analyses suggest that CSR reports are easier to understand when they have a more readable tone and that market reaction to CSR reports' readability is more pronounced for firms with lower analyst following and higher financial opacity. The results demonstrate the importance of clear communication and tone in conveying CSR information to investors.

Fisher et al. (2019) measured tone across multiple narrative types within annual reports and standalone CSR reports. They found that tone dimensions varied significantly across narrative types (genres) and that tone was a significant determinant of readability. Disclosure type was found to be an important tone determinant. The study did not find significant evidence of firms using tone to conceal information. The study provides insights into the underlying disclosure norms that can help firms identify exceptional cases that do not conform with the expected tonal patterns of a particular narrative type and may warrant closer inspection by preparers, auditors, or regulators. The issues raised regarding the clarity and balance of textual disclosures highlight the challenges in regulating corporate narratives.

The above discussion shows that the previous studies on tone at the top investigated the relationships of tone at the top with sustainability, environmental disclosures, corporate governance, and ethics. Most of the studies focused on optimism

and certainty in measuring tone at the top. A few studies explored the whole five master variable's impact on other explanatory factors. Despite the growing focus on the relationship between sustainability reporting and social media platforms, none of the studies explored this relationship. The master variables of tone at the top aim to analyse the essential components of leadership, including flexibility and the ability to change daily routines in response to changes in the external environment. The growing use of social media for sustainability reporting disclosure requires firms to change their daily activities. This scenario presented a gap in the literature that the current study aimed to fill by including tone at the top as a moderator.

The introduction of new technologies, along with a dynamic external environment, requires firms' leaders to be versatile (Dartey-Baah, 2015). Herremans and Nazari (2016) analysed the roles of internal factors in firms' sustainability reporting. They found that managerial attitudes influenced the relationship between stakeholders and sustainability reporting. Managerial attitudes are highly dependent on the top management's tone (Graves et al., 2019). Cho et al. (2010) examined the impact of optimism and certainty in the top management's tone on sustainability reporting, and Fisher et al. (2019) analysed tone at the top in standalone annual reports and CSR reports from the perspective of readability. Other studies analysed a certain tone at the top variable as defined by Hart (2000). For example, Nakao et al. (2019) analysed optimism and certainty. A few studies analysed all five tone at the top variables (e.g., Fisher et al., 2019; Tailab & Burak, 2018). A limitation of these studies is that while they analysed tone at the top concerning ethics, fraud, and financial reporting, they did not examine the impact of top management's tone on sustainability reporting when the reporting medium changed from traditional to social media platforms. Therefore, the current study examines the role of tone at the top as a moderator to fill this literature gap.

2.7.3 CEO Letters and Tone at the top Assessment

CEO letters, which have a non-verbal tone, play a significant role in determining tone at the top. CEO discourse, whether formal (in speeches, press releases, interviews, narrative parts of annual reports) or informal (in meetings or corridor conversations), is a set of complex communicative acts with symbolic, emotional, cultural, and political overtones. There is growing support to the notion that leadership is a discursive, language-based phenomenon (Fairhurst, 2008; Tourish, 2008). In particular, charismatic and inspirational leaders are assumed to communicate their visions energetically. This notion enables leaders to use language as part of their communication, encouraging charismatic or would-be charismatic leaders to exploit language's dramatic possibilities. Emerging communication theories suggest that textually mediated practice is central to how companies and their leaders are constituted and secure consent and mobilise capital (Kuhn, 2008).

Among the various formal and informal forms of corporate discourse, the CEO letter is particularly important. A firm's CEO letter to investors is an example of how language is used in the discourse by senior corporate leaders. Business letters offer an important insight into the motives, attitudes, and mental models of management. Labels such as "fair employer", "good corporate citizen", and "innovative manufacturer" are used to "summarise what the organisation does or stands for – or is claimed to stand for – to individuals and groups" (Ashforth & Humphrey, 1997).

The CEO's letter to investors reveals practical and theoretical knowledge about the firm. If the CEO's narrative in the annual letter to shareholders is examined closely in terms of content, meaning, and ideology and with regard to cognitive-linguistic indicators (e.g., metaphor), then the cognitive world of CEO-level executives at large can be understood. The CEO's letter is also important because it helps readers understand the leader's vision of the world and attempt to engage employees and other

key stakeholders (Amernic et al., 2007). Research shows that CEO letters are not merely "mundane, popular discourses of seemingly minor significance, possessing a narrow, 'captured' audience of stockholders" (Amernic et al., 2007) but that they are also valuable documents for scrutiny. "This is because they are official records signed by a firm's CEO, released annually as an integral part of its Annual Report, and offer a personal accountability narrative" (Amernic et al., 2007). The value of the CEO's letter and the perspective it provides have also been demonstrated by Palmer et al. (2004) and Fanelli and Grasselli (2005).

Five main reasons are identified by Amernic et al. (2010) to analyse CEO letters to assess TAT. First, they are the public representative of a firm (Cha et al., 2019). The CEO's signature reflects that the CEO is personally responsible for the letter and clarifies that they stand behind their writing. There is no confusion about the claim. Even though others assisted, it is the CEO's work that is ultimately attributed. The fact that the letter is written, and not improvised, increases the affective and cognitive force of the communication.

Secondly, they are associated with the other contents of the annual report in such a way as to give an overall idea of management's financial integrity. The dissemination of corporate annual reports is an established annual event. The annual report is an account-giving and an explanation to interested shareholders about the year just past and expectations for the future. And such narratives play an important role in the functioning of society (Franzosi, 1998).

Third, they provide insight to top management as to what they consider to be important. For example, analysis of the metaphors used in the CEO's letter exposes implicit ideologies (Craig & Amernic, 2004). Fourth, they often highlight key performance measurements by which CEOs hope to achieve a high accountability level. In their 2000 annual report, Enron's top executives, Skilling and Lay, described Enron

as a company that was ‘laser-focused on earnings per share. A single-minded fixation on one measure of financial performance has been acknowledged to be one of the key reasons for Enron's failure (Stewart, 2006). In summary, the CEO's letter in an annual report provides insight into what the organisation's TAT is like. This is because leadership is enacted through how people speak to one another. The document shows the CEO's priorities, mindset, ideologies, and perceived charisma and greatness level.

There are distinct positions in corporate disclosures, and the CEO’s attributes affect the language choice (Buchholz et al., 2018). Buchholz et al. (2018) reported that CEO letters to shareholders had a more optimistic tone when describing the same company results as the Management Discussion and Analysis (MD&A), which provides incremental details of the numerical information in the financial statements. The language in the CEO letters was mostly inconsistent with actual company results and was primarily affected by the level of positive terms. This discrepancy was due to over-confident CEOs who seemed excessively optimistic of their potential and firms’ prospects. Further, Buchholz et al. (2018) found that CEO gender also influenced the CEO letter’s language style, with female CEOs using a more neutral tone. The authors presented evidence supporting the notion that CEO letters, which are influenced by CEO characteristics, are an important source of firms’ financial and nonfinancial disclosures.

2.8 Literature Overview on Competitive Advantage

Competitive advantage is defined based on two widely used concepts, namely, performance (Schoemaker, 1990) and sources or determinants (Porter, 1985). It can be assessed by analysing the sources of advantage, such as the firm’s market position (Porter, 1980) and resources (Barney, 1991), or by measuring the outcome of competitive efforts using firm performance (e.g., profitability) or market share stability. Literature shows that quality of products or services, corporate image, market position,

differentiation and diversity, company growth, cost of manufacturing, and market leadership are the most commonly used dimensions for measuring competitive advantage (Saeidi et al., 2015).

Any source that provides an edge to a firm over its competitors is viewed as a determinant of competitive advantage. These sources can emanate from internal as well as external sources of a firm. One of the examples of external sources is technology and innovation. Adopting the technology enables a firm to generate value through the up grading of a firm's internal capabilities. Human capital is one of the examples of internal capability up-gradation. The workforce of an organisation is identified as a human capital of a firm. In line with the resource-based view (RBV) theory, firms can create value through their human capital. RBV proposes internal and external resources, but other firms can easily imitate these resources if not dynamic in nature. This is against the concept of competitive advantage.

In contrast to RBV, the DCV proposed that a firm need to focus on the resources that can be transformed considering the changing external environment. A firm's dynamic capability helps develop resources that are not accessible readily and easy to imitate. Innovation is considered a key component of business competitiveness. In order to highlight the main concepts of innovation as a source of competitive advantage, a systematic literature review carried out by Torres et al. (2017) highlights concepts of innovation as a source of competitive advantage. The results highlight that innovation should be one of the organisation’s strategies to generate competitive advantage, enabling their differentiation or approximation to their competitors, assisting in their sustainability over time.

In contrast to traditional sources of competitive advantage, Arend and Bromiley (2009) identified some of the characteristics of dynamic capabilities that lead to competitive advantage. One of the dynamic capabilities is stakeholder engagement. In a

recent study, Panda and Sangle (2020) explain how stakeholder engagement is a competitive advantage source for a firm, what capabilities are required to develop this source and suggest stakeholder engagement strategies. Stakeholder engagement is an emerging source of competitive advantage. This also highlighted by Dagnino et al. (2021). They are of the view that since historical sources of competitive advantage are losing their relevance, the managers need to re-evaluate and adjust their strategies continually. In addition, scholars have felt compelled to shift away from a traditional focus on sustainable competitive advantage to a focus on how firms compete by achieving a series of short-term advantages. Dagino et al. (2021) provide a conceptual map of the current inquiry into a temporary competitive advantage, discussing the antecedents, consequences, and temporary competitive advantage management.

Çalli and Clark (2015) are of the view that given the significant role of SMEs in modern economies, more needs to be done to understand the various strategies SMEs can adopt and how they can overcome the factors that limit their ability to deploy these strategies. In order to succeed, it is important to understand that SMEs are highly heterogeneous in nature, with business practises dependent on their size and industry. While a five-person software company headed by a young entrepreneur and a family-run furniture manufacturer are both considered small to medium enterprises (SMEs), their approach to utilising social media in order to gain competitive advantage will likely vary. Despite being similar in many ways, both types of enterprises still face barriers such as management, finance, technology, staff, and the environment. The study investigated SME use of social media and identified the common factors that successful businesses use in social media.

Social media is identified as a potential source of competitive advantage. Özeltürkay and Mucan (2014) examined how Turkish banks use social media tools like Facebook and Twitter to gain competitive advantages in Turkey. They carried out a

content analysis to investigate the Turkish bank's social media platforms usage to connect with the stakeholder. The findings confirm that forty per cent of Turkish banks use Facebook and Twitter more than other available communication tools. It means that social media platforms have the potential to become competitive advantage for a firm. These findings are also confirmed by Popescu and Alecsa (2015). They also identified social media as a source of competitive advantage. Not only social media generates competitive advantage for a firm, but it also acts as a marketing tool for small businesses to engage with the stakeholders. The findings of their study confirm social media as a source of competitive advantage.

In the emerging literature, social media data is often categorised as big data (She & Michelon, 2019). Big data analytics is receiving increasing attention in business, government, and educational organisations. Ribarsky, Wang, and Dou (2014) are of the view that big data analytics, when used as social media analytics, can be a source of competitive advantage for a firm. The findings presented by Agung and Darma (2019) confirm that the big data algorithm can be imperative for competitive advantage's achievement for a firm. They studied the function of the Instagram algorithm in determining the performance and relationship with the stakeholders. Further, they suggest that firms need to actively develop this capability to strengthen the relationship with the stakeholders, resulting in competitive advantage.

Singla and Durga (2015) argued that today's younger employees have a more positive social media view and bring that knowledge into the workplace. However, the best strategy for utilising this trend is still unclear. There are many expectations, and on the other hand, there are numerous social media initiatives that have failed. The executives, in general, lack an understanding of how to handle social media. In order to comprehend the determinants of competitive advantage, Singla and Durga (2015) underpin Porter’s systematic analysis of social media and suggests that social media’s

use in an organisation is the combination of strategies channelling from top management.

2.8.1 Sustainability Reporting and Competitive Advantage

There are abundant prior studies in the literature that analysed the relationship between CSR/sustainability reporting and competitive advantage. For example, a contrasting view is provided by (Treviño, 2016) that CSR marketing is aimed at greenwashing and green marketing. They investigated the theoretical factors influencing customers' decisions to become brand ambassadors on Facebook, what this item conveys about the firm's information; what type of information it includes about the company; if it is concerned about their involvement in the cause; if peers and co-workers perceive the CSR initiatives as being invasive, if the cause affects the person's brand image. Treviño (2016) findings showed that all of the aforementioned factors are predicted to positively influence the CSR campaign, except for the concern of being seen as intrusive and having privacy concerns.

Arend and Bromiley (2009) identified dynamic capabilities as a source of competitive advantage that is unlike the traditional sources of competitive advantage. Dynamic capabilities may include firms' tangible and intangible sources. One of the dynamic capabilities of a firm is stakeholder engagement. Panda and Sangle (2020) explained how stakeholder engagement is a source of competitive advantage for firms and the capabilities required to develop this source. They also suggested developing further stakeholder engagement strategies to increase firms' competitive advantage. Stakeholder engagement as an emerging source of competitive advantage was also highlighted by Dagnino et al. (2021). The authors emphasised that since historical sources of competitive advantage are losing relevance, managers must continually re-evaluate and adjust their strategies. In addition, scholars have felt compelled to shift

away from a traditional focus on sustainable competitive advantage to focusing on how firms compete by achieving a series of short-term advantages (Dagino et al., 2021).

With the change in focus on the sources of competitive advantage, social media has also been identified as a potential source. Özeltürkay and Mucan (2014) examined how Turkish banks used social media tools like Facebook and Twitter to gain a competitive advantage. The finding showed that 40 per cent of Turkish banks used Facebook and Twitter more than other communication tools. The finding indicates that social media platforms can become a competitive advantage for firms (Popescu & Alecsa, 2015). Singla and Durga (2015) argued that today's younger employees have a more positive social media view, and they bring that perception to the workplace. However, the best strategy for how to benefit from this trend is still unclear. There are various expectations, but numerous social media initiatives have failed. Executives, in general, lack an understanding of how to handle social media. Singla and Durga (2015) attempted to discover the determinants of competitive advantage, and they suggested that social media use in a firm is a combination of strategies channelling from the top management.

Many scholars have examined the link between CSR and competitive advantage. Yu et al. (2017) analysed whether CSR disclosure can persuade stakeholders to influence China's corporate operations. The study found a significant competitive advantage gap between environmentally and non-environmentally sensitive industries. For state-owned enterprises, privately owned enterprises, environmentally sensitive enterprises, and non-environmentally sensitive enterprises, a negative relationship was found between the overall CSR disclosure and competitive advantage. Fifka and Adaui (2015) argued that firms, regardless of size, could use CSR reporting to create competitive advantage. The authors highlighted that small and medium-sized enterprises (SME) considered mandatory CSR reporting a burden. Considering this, the European

Union (EU) has confined the reporting requirement to large firms. This scenario demonstrates the widespread belief that CSR reporting is an administrative and financial burden and that there is a need for legally mandatory CSR reporting. The authors highlighted that CSR reporting can result in potential business benefits such as improved stakeholder communication, a better understanding of the firm's value chain, and enhanced risk management that ultimately converts to competitive advantage for the firm.

Some studies investigated competitive advantage in developing countries. For example, Eyasu and Arefayne (2020) examined the impacts of different customer, employee, community, and environmental CSR engagements on the banking industry's competitive advantage. The findings showed a positive influence on banks' competitive advantage. The banks were more interested in customer-based CSR, which is the most important aspect for competitiveness. They also paid the least attention to environmental sustainability. Hence, bank managers should emphasise the importance of environmental CSR and its integration into banks' operations that may profoundly impact the banks' competitive advantage.

Sun (2020) distributed 600 questionnaires to examine the competitive advantage of China's high-tech industry. The findings showed that good customer relationship had significant positive effects on social responsibility, and excellent customer relations enhanced competitive advantage. Based on the results, various recommendations were made, including enabling domestic high-tech firms to serve customers better, boosting firms' social responsibility, positioning to gain an advantage, and adapting to the changing market.

A parallel stream of literature has focused on the impact of corporate sustainability practices on competitive advantage. Zameer et al. (2020) explored the green competitiveness of Chinese manufacturing firms by collecting primary data from

managers and customers of the sample industry. The findings showed that a green brand led the process of green advantage. It was observed that customer demand, regulatory demand, and growing consumer preference influence led to the green movement. Consequently, the customer pressure on decision-makers also increased. The findings indicate that green production and green creativity help enhance green competitive advantage. The role becomes critical when it contributes to green competitiveness through green branding. Firms benefit from customer input in the use of green strategies, as well as from adopting them. Similar findings were reported by Singh et al. (2019), which investigated the relationships between environmental ethics, training, and performance. The findings showed a connection between environmental ethics training, environmental performance, and competitive advantage.

In Malaysia, Haseeb et al. (2019) examined the technological problems faced by Malaysian SMEs. Their study explored the strategies to establish sustainable performance in the context of social and technological challenges. The sample included 500 SME business owners. The SMEs' employees concurred on the roles of social and technological challenges in gaining a competitive and long-term business advantage. The findings showed that social and technological challenges had substantial impacts on sustainable business performance. Strategic alignment was necessary to obtain the impacts of social and technological factors on long-term sustainable advantage.

Competition is fierce in the contemporary and constantly changing business world. The adoption of sustainability practices by firms has led to rising competition for better sustainability performance. Many studies have explored the link between sustainability performance, reporting, and competitive advantage (e.g., Cantele & Zardini, 2018; Danso et al., 2019; Haseeb et al., 2019; Papadas et al., 2018; Taliento et al., 2019). The links between sustainability reporting, engagement with stakeholders on social media, and competitive advantage have also been investigated (e.g., Zhao et al.,

2019; Strand & Freeman, 2015; Kumar & Pansari, 2016; Leonidou et al., 2018). However, these studies did not examine SRSM as a source of competitive advantage. Moreover, the relationship has not been explored in developing countries such as Malaysia. Hence, the current study aimed to examine the impact of SRSM on competitive advantage to fill the gap in literature.

2.9 Research Gap

Based on the literature review presented in the prior sections of this chapter, the following research gaps are identified:

1. A handful of studies have analysed the link between digital technological transformation and sustainability reporting practices. Most studies examined the use of the internet for sustainability reporting on social media platforms. For example, Rivera-Arrubla and Zorio-Grima (2017) investigated the concept of integrated reporting and social media to connect and share reporting information with the stakeholders. Similarly, Lodhia and Stone (2017) examined integrated reporting in the digital environment platform, namely social media. A small number of studies focused on using big data as part of digital transformation to examine reporting. For example, Pei and Vasarhelyi (2020) analysed big data's use in financial reporting. Whereas Seele (2017) analysed the predictive capability of big data to manage the firms' sustainability practices. A limitation of these studies is that they did not explore the link between a firm's analytical capabilities required to manage digital platforms and sustainability reporting on social media specifically. Moreover, Rosário and Dias (2022) analysed the literature on the link between digital technologies including big data and sustainability practices of the firms. The literature reviews showed the importance of BDA for sustainability which includes sustainability reporting.

Therefore, to fill the existing literature gap, the current study aims to explore the link between BDAC and SRSM.

2. The introduction of new technologies and a dynamic external environment requires the firm's leadership to be versatile (Dartey-Baah, 2015). Herremans and Nazari (2016) analysed the role of a firm's internal factors to motivate sustainability reporting. They found that managerial attitudes and role-play an imperative role in the relationship with the stakeholders and sustainability reporting. The managerial attitudes are vastly dependent upon the top management's tone (Graves et al., 2019). Cho et al. (2010) examined the impact of optimism and certainty in the top management's tone on sustainability reporting. They found that firms with better sustainability reporting disclosures have a more certain tone in their sustainability reports than those with less disclosure of sustainability reporting. Fisher et al. (2019) analysed tone at the top in the standalone annual reports and CSR reports in the perspective of readability. Other studies in the literature analysed a certain tone at the top variable as defined by Hart (2000). For example, Nakao et al. (2019) analysed optimism and certainty. A few studies analysed all the five 'tone at the top' variables, namely, Fisher et al. (2019) and Tailab and Burak (2018). A limitation of these studies is that they analysed tone at the top concerning the corporate reports. They did not examine its role when sustainability reporting is disclosed on other than traditional platforms such as social media. Furthermore, Bahuguna et al. (2023) emphasised the importance of top management in implementing sustainability related strategies, hence, the current study examines the role of tone at the top as a moderator between BDAC and SRSM.
3. In the contemporary changing business world, competition is fierce. Since the adoption of sustainability practices in the firms, the competition for better

sustainability performance is rising. Many studies in the existing literature explored the link between sustainability performance, reporting and competitive advantage (e.g., Cantele & Zardini, 2018; Danso et al., 2019; Haseeb et al., 2019; Papadas et al., 2018; Taliento et al., 2019). Some studies also explored sustainability reporting and engagement with stakeholders on social media having a positive influence on competitive advantage (e.g., Zhao et al., 2019; Strand & Freeman, 2015; Kumar & Pansari, 2016; Leonidou et al., 2018). However, these prior studies have not examined SRSM as a source of competitive advantage. Xu et al. (2023) also suggested to expand the research on non-mandatory sustainability reporting disclosures. Moreover, the relationship has not been explored in the context of developing country such as Malaysia. Hence, the current study aims to explore the impact of SRSM on competitive advantage.

2.10 Summary

This chapter discussed the literature review and identified the research gap that serves as the foundation for the current study's research model. The literature was explored on the variables used in the current study, namely BDAC, SRSM, tone at the top, and competitive advantage.

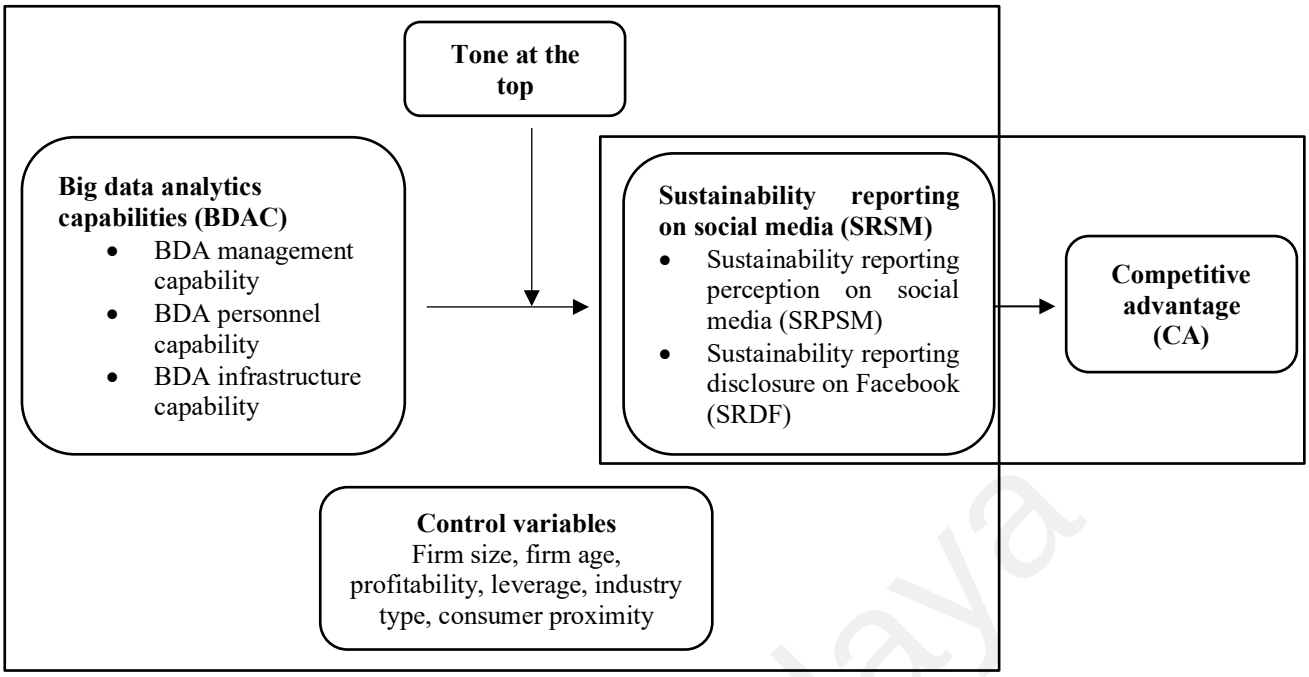
CHAPTER 3: THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

3.1 Introduction

This chapter discusses the theory used and the construction of hypotheses for the current study. It contains four sections. Section 3.2 provides an overview of the overall research model. Section 3.3 explains the use of dynamic capability view (DCV) as a theoretical foundation for the hypothesis development. Section 3.4 discusses the relevant literature leading to the development of hypotheses for the relationships between the proposed variables of the current study. The chapter summary is provided in the last section.

3.2 Research Model

The current study examines the relationships between big data analytics capabilities (BDAC), sustainability reporting through social media (SRSM), tone at the top, and competitive advantage. The independent variable in the current study is BDAC, which is represented by three dimensions: big data analytics (BDA) management, infrastructure, and personnel capabilities. The dependent variable of the current study is SRSM, which is measured using sustainability reporting perception on social media (SRPSM) and sustainability reporting disclosure on Facebook (SRDF). Tone at the top is included as a moderator between BDAC and SRSM. Competitive advantage is analysed as an outcome variable, with SRSM acting as the independent variable and competitive advantage as the dependent variable. Six control variables are also incorporated in the current study namely, industry type, consumer proximity, profitability, firm age, firm size, and leverage. The relationship between the current study's variables is explained using DCV as the theoretical foundation. The current study's research model is presented in Figure 3.1.



Note:
Independent variable: Big data analytics capabilities (BDAC)
Dependent variable: Sustainability reporting on social media (SRSM)
Moderator: Tone at the top
Outcome variable: Competitive advantage (CA)

Figure 0.1: Research Model

3.3 Theoretical Framework

Resource-based view (RBV) theory is the foundation of DCV (Ambrosini & Bowman, 2009). RBV is defined as the firm's resources and capabilities that result in a competitive advantage (Barney, 2001). There are several criticisms of RBV. First, RBV does not explain why and how certain firms build competitive advantage in changing environments (Cavusgil et al., 2007). Second, RBV does not elaborate on the addition of new capabilities in a firm, whereas DCV focuses not only on the competitive advantage gained due to dynamic resources in nature but also on how it is configured by the managers of a firm (Cavusgil et al., 2007). In other words, the fundamental question of how firms sustain their competitive advantage is not addressed by RBV but answered by DCV (Teece et al., 1997). Further, Teece et al. (1997) argued that RBV stresses on firm's tangible assets, intangible assets, and operational capability (ordinary capability), whereas DCV emphasises purposeful modification of these assets (Schilke et al., 2018). Resultantly, DCV emerged as an alternative theory to explain the firm's resources.

There is a broad spectrum of DCV definitions in the existing literature, but they are all built upon three basic definitions provided by Teece et al. (1997), Eisenhardt and Martin (2000) and Helfat et al. (2007). It is defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments." Dynamic capabilities thus reflect a firm's ability to achieve new and innovative forms of the competitive advantage given path dependencies and market positions (...)." (Døving & Gooderham, 2008; Witcher & Chau, 2012).

There are various antecedents of DCV. Organisational structure (Felin & Powell, 2016), organisational culture (Song et al., 2016), tangible and intangible resources (Salge & Vera, 2013), information technology (Pavlou & El Sawy, 2010), and leadership (Day & Schoemaker, 2016) are one of the commonly identified antecedents of DCV. The underlying assumptions of DCV are based on its antecedents. First, a firm 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 maintain through reconfiguration of 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 the firms are associated with ordinary capabilities, whereas transformation, seizing and sensing the capabilities are known as dynamic capabilities (Teece et al., 1997). Furthermore, Teece et al. (1997) argue that dynamic capabilities are superior to ordinary capabilities, involving experimentation, evolution, and growth of existing resources. Some scholars also add agility as a firm's dynamic capability (e.g., Blome et al., 2013). Teece (2007) defined agility as a capability through which firms can adjust their behaviours according to opportunities and threats in the environment.

Sustainability practices can be viewed as a dynamic capability (Cantrell et al., 2015). Firms started to report their sustainability practices due to increasing

environmental problems and stakeholder pressure. Initially, firms included sustainability performance in the annual reports, but they proceeded to use social media due to the rapidly changing technology globally. Social media platforms present threats as well as opportunities to firms. Threats exist in the sense that stakeholders can voice their concerns openly and firms cannot control them. Opportunities arise for firms that can manage their relationships with stakeholders according to the stakeholders' informational needs. The threats and opportunities related to expanding social media usage among stakeholders and firms need to be managed to improve sustainability reporting. For this purpose, IT support systems such as BDAC is vital. Chen et al. (2014) view agility as the operational flexibility of IT support systems and organisational processes. Agility can be achieved by processing large and diverse information, which is possible with BDAC (Côrte-Real et al., 2017). Based on the DCV proposition that "firms need to have the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments", the current study proposes that BDAC has a positive impact on SRSM.

Achieving SRSM as a capability requires top management support for firms to reconfigure resources and capabilities according to the environment (Hermano & Martín-Cruz, 2016). Hart (2000) identified five important traits in the non-verbal tone of top management, termed as tone at the top, that may influence the implementation of a certain phenomenon. Previous studies have mostly analysed tone at the top concerning earnings management, ethics, and financial reporting (e.g., Cai et al., 2019; Rose et al., 2021; Gramling & Schneider, 2018). Some studies have analysed the impact of tone at the top on sustainability performance or reporting. For example, Cho et al. (2010) analysed the impact of certainty and optimism in the non-verbal tone of CEOs of American firms on environmental disclosures. The study found a significant impact. Cong et al. (2014) examined the impact of the CEO's tone on environmental

performance. A limitation of these studies is that they did not analyse tone at the top with all dimensions of sustainability in stand-alone reports or on social media. Given the DCV proposition that SRSM can be a capability, it requires support from the top management. Thus, the current study investigates tone at the top as a moderator between BDAC and SRSM.

DCV states that the external or internal capabilities of a firm result in a competitive advantage. Eikelenboom and Jong (2019) believe that dynamic capabilities are important for economic, social, and environmental performance. Other studies have also highlighted that CSR practices and fulfilment of stakeholders' needs transform into an asset for firms and contribute to achieving competitive advantage (e.g., Khan et al., 2019). A parallel stream of the literature shows that social media leads to better communication and relationships with stakeholders (Bakri, 2017). It can also be a source of competitive advantage (Singla & Durga, 2015). However, research exploring sustainability reporting on social media platforms as a source of competitive advantage for firms is lacking. Since sustainability performance and reporting are interlinked, the current study proposes SRSM as a firm's capability that may be a source of competitive advantage.

Based on the discussion on DCV, it is adopted in the current study to examine the impact of BDAC on SRSM, moderated by the tone at the top. in operationalising DCV, first, the current study considers BDA infrastructure, management, and personnel capabilities to measure BDAC. Second, tone at the top is measured via content analysis of CEO statements in the annual/sustainability reports using DICTION, developed by Hart (2000). Lastly, competitive advantage is measured by evaluating its various sources such as research and development (R&D), sustainability image, competition, sustainability communication capability, and quality.

3.4 Hypothesis Development

The sub-sections below discuss the hypotheses developed in the current study based on the research framework developed in section 3.2 and theoretical support from DCV.

3.4.1 BDAC and Sustainability Reporting

Dynamic capabilities result from the purposeful adoption of resources (Teece et al., 1997). Further, dynamic capabilities allow a firm to react timely to external environmental changes. Over the period, IT capabilities have changed rapidly and those firms that could not manage to transform their abilities, accordingly, faced major problems. One of the examples is Nokia. They failed to survive in the market because they did not change their internal environment in accordance with changing competition in the market (Bhalodiya & Sagotia, 2018). Another example of changing the external environment is the requirements for better sustainability practices and reporting. For instance, Coca Cola started a campaign on social media platforms to convert used plastic bottles into lamps. The campaign went successful (Doland, 2014). One of the reasons for the campaign's success was the change in the internal environment of Coca Cola according to the external environment. In the external environment, the stakeholders called for sensible initiatives for plastic use. It is important to note here that those firms that successfully manage their businesses according to the changing external environment change their internal environment first.

DCV is of the view that firms need to have dynamic capabilities in order to compete with the changing internal and external environment. BDAC is also a contributing factor to the dynamic internal and external environment for the firms. Since social media is part of BDAC, a purposeful adoption of BDAC by firms can help manage SRSM. The change in firms' IT capabilities has played a major role in managing changes in the external environment. Given the Industrial Revolution 4.0,

Gupta and George (2016) have identified BDAC as an advanced form of IT capability. The implementation of BDAC has a positive relationship with CSR management practices towards external stakeholders (Wang et al., 2020; Marsden & Wilkinson, 2018). Wang et al. (2020) suggest integrating BDA in the triple bottom line (TBL)—people, planet, and profit—in businesses and all other relevant organisations to make decisions that support and benefit TBL in the short and long run. McAfee and Brynjolfsson (2012) found that firms achieved better financial and operational results when they made data-driven decisions in terms of firm performance. The impact could be seen financially. For instance, in 2016, Facebook's market capitalisation rose from $40 billion to $340 billion (Arnaboldi et al., 2017).

In the context of reporting, evidence from the literature indicates a gradual adoption of BDA in financial reporting practices (Kaya & Akbulut, 2018). Wiencierz and Röttger (2017) reviewed the literature on how BDAC had shaped corporate communication strategies. They found that since adopting BDAC, firms had been more active in sharing corporate reports on social media platforms. Al-Htaybat and von Alberti-Alhtaybat (2017) conducted a qualitative study to determine the relationship between BDA and corporate reporting. The study suggested adopting new norms for corporate reporting. One of the study's interviewees suggested using Snapchat for corporate reporting communication with the stakeholders to reduce the limitation of annual reports and enable firms to report progress and share information at any time of the year. Given the benefits of BDAC implementation, Al-Htaybat and von Alberti-Alhtaybat (2017) further suggested utilising big data in corporate reporting to transform reporting from the traditional style into new interactive reporting. The study's findings indicate that the traditional modes of corporate reporting including sustainability reporting are transitioning towards digitalisation. BDAC allows firms that use social

media platforms to communicate timely with the stakeholders about their sustainability performance.

Firms worldwide place high importance on addressing sustainability issues, resulting in improved reporting quality in stand-alone sustainability reports and on social media platforms (Boiral et al., 2019). There is sufficient evidence of how firms in developed countries manage sustainability reporting and how the latest technologies help improve the reporting (Bellucci & Manetti, 2017; Bonsón & Ratkai, 2013). For example, Deloitte (2018) reports that in future reporting will be interactive, intelligent, and real-time. The social media platforms can facilitate an interactive reporting with the assistance of BDAC. However, little is known regarding how BDAC facilitates SRSM in the developing country context. For example, sustainability reporting has been made mandatory in Malaysia. Social media has helped in the identification of sustainability issues (Ballew et al., 2015). Although Malaysia is one of the countries that are moderately affected by environmental disasters (Rahman, 2014) still there is a need to balance profits, competition, and natural resources (Rahman, 2014). All stakeholders need to be involved to achieve sustainable development goals. GRI (2015) suggests that firms should include and engage with stakeholders on their chosen platforms i.e., social media. However, their management requires latest technological implementation (Pranjić & Rekettye, 2019).

In Malaysia, Yeo and Carter (2017) and Wong et al. (2015) provided evidence of BDAC implementation. Wong et al. (2015) used data from 132 Malaysian firms to evaluate the BDAC implementation. They found that Malaysian firms were in a position to leverage the big data economy. About 82% of the firms surveyed achieved the specified level of maturity but exhibited a modest level of capability in data analytics. Malaysia is also among the top 25 countries where Facebook is used widely, with almost 77% the population being Facebook users . This indicates that Facebook is

among the top social media platforms that generate big data in Malaysia. Since social media is one of the big data sources (She & Michelon, 2019), firms with BDAC competency in Malaysia need to improve SRSM.

The literature is limited on the relationship between BDAC and SRSM. Most of the studies were conducted in developed countries, leaving the use of BDAC and SRSM in developing countries largely unknown. In order to explore the impact of BDAC on SRSM in the Malaysian context, the current study underpins the DCV assumptions and follows Arnaboldi et al. (2017) and Al-Htaybat and von Alberti-Alhtaybat (2017) in developing the following hypotheses:

H1: There is a positive association between big data analytics capabilities and sustainability reporting through social media.

H1a: There is a positive association between big data analytics capabilities and sustainability reporting perception on social media.

H1b: There is a positive association between big data analytics capabilities and sustainability reporting on Facebook.

3.4.2 BDAC and Sustainability Reporting: Moderation by Tone at the top

DCV emphasises flexible internal and external organisational processes. Flexibility in the organisational processes is channelled from the top management. Top management plays a crucial role in determining firms' policies and strategies (Makhdoomi, 2018). The non-verbal tone of the top management is known as the tone at the top (Patelli & Pedrini, 2015). It can be assessed by reviewing the CEO's letter in the annual or sustainability report. The CEO's letter is important because it provides information on the firm's important policies. It is a central part of the annual report. It reflects the important issues confronting the firm and highlights the steps that leadership will take to counter them; hence, the letter is a reflection and depicter of CEO leadership (Cong et al., 2014).

The CEO can set a firm's tone by guiding it on multiple domains (Cong et al., 2014). For instance, the CEO plays a major role in taking the steps to reduce a firm's environmental impacts. Prior studies have assessed the role of CEO's tone in influencing firms to take steps for sustainable practices, reduce firms' environmental impact, and improve firms' reputation (Cong et al., 2014). The CEO's tone is a measure of leadership. DICTION, an automated content analysis software, provides five attributes of the non-verbal tone of CEO leadership. These attributes are activity, certainty, optimism, realism, and commonality (Amernic et al., 2010). The purpose of assessing activity in the CEO's tone in the current study is that it reflects the implementation of ideas. Commonality indicates cooperation and agreed-upon values in a firm. Realism measures the tangible and immediate matters that affect the people in a firm. Certainty shows resoluteness and completeness, and optimism entails the positivity of a person, group, concept, or event in a firm. Fisher et al. (2019) examined the impact of each tone at the top attribute on corporate accountability disclosures. Tailab and Burak (2018) measured activity from the management discussion and analysis of financial conditions and results section in the annual report. They investigated its impact on the financial performance of the Fortune 500 firms. While the aforementioned studies analysed all five attributes of tone at the top, other previous studies analysed selected tone at the top attributes.

Cho et al. (2010) analysed how certainty and optimism affected US firms' environmental disclosures. The results showed that firms with certainty in their tone tended to be proactive in disclosing their environmental performance, whereas firms with more optimistic non-verbal tone disclosed less about their environmental performance. Arena et al. (2015) analysed the impact of optimism on environmental disclosures. They found a negative link between optimism and future environmental concerns of the firms with a low stakeholder orientation. Both studies focused on

environmental disclosures in the annual reports of firms in developed countries, where firms are proactive in sustainability reporting. In Malaysia, firms tend to focus on improving sustainability reporting through various mediums such as websites, annual reports, and social media platforms (Amran et al., 2015; Ahmad, 2016). Although tone at the top has been analysed in reporting and environmental disclosures, it has not been analysed in the context of sustainability reporting inclusive of social and economic dimensions in Malaysia. In the current study, the CEO's letter is used to determine tone at the top. The current study includes all the attributes of tone at the top to examine tone at the top's holistic impact on sustainability reporting. The current study assumes that tone at the top's attributes moderates the link between BDAC and SRSM. Since sustainability reporting in the current study is determined via sustainability reporting perception on social media (SRPSM) and sustainability reporting disclosure on Facebook (SRDF), it is predicted that tone at the top strengthens the relationship between BDAC and SRSM. Thus, the following hypotheses have been formulated:

H2: Tone at the top strengthens the relationship between big data analytics capabilities and sustainability reporting through social media.

H2a: Tone at the top strengthens the relationship between big data analytics capabilities and sustainability reporting perception on social media.

H2b: Tone at the top strengthens the relationship between big data analytics capabilities and sustainability reporting disclosure on Facebook.

3.4.3 Sustainability Reporting and Competitive Advantage

According to DCV, firms' tangible or intangible resources ultimately lead to competitive advantage. Literature classifies many types of competitive advantage sources. For example, IT-based resources and a firm's flexibility to adapt to internal and external environmental changes are sources of competitive advantage (Urbancova, 2013). Over time, a firm's sustainability practices, including the relationship with

stakeholders, have also become a source of competitive advantage. However, firms cannot build the relationship with stakeholders in the traditional setting, i.e., employee/organisation or supplier/organisation (Viglia et al., 2018) and annual or sustainability reports. This is because these traditional settings do not allow two-way communication or provide a platform where firms can also receive instant feedback from the stakeholders.

Studies have shown that social media platforms strengthen the relationship between a firm and its stakeholders. Consequently, the ability of a firm to communicate with its stakeholders becomes a competitive advantage (Surroca et al., 2010). A robust relationship with stakeholders offers many benefits, such as profit, protection against hostility, better CSR, and increased chances of firm survival (Choi & Wang, 2009; Martínez et al., 2016). Firms need to incorporate sustainability practices and communicate these practices to their stakeholders. According to Reilly and Hynan (2014), firms that communicate sustainability practices on social media platforms are able to establish a strong market position and gain competitive advantage. Lodhia and Stone (2017) explained the richness of media platforms for stakeholder engagement, emphasising attributes like concurrency, multiple addressability, language variety, and multiple cues. Timely communication of current and future-oriented information for stakeholders' decision-making; improved presentation, organisation, and connectivity of information; enriched communication formats that convey multiple cues to increase stakeholders' understanding; and personalised information to match different stakeholders' information needs are among the benefits that media platforms offer.

Digital media platforms offer an efficient way to communicate with stakeholders (Olsen, 2011). These platforms allow firms to extract the solutions to various problems they might encounter by critically analysing tweets, reviews, posts, and comments. Singla and Durga (2015) indicated that social media impacts Porter's five forces of

competitive advantage. One of Porter's five forces is the threat of substitutes (Grundy, 2006). Since all firms have equal access to social media, there is a threat that other firms might develop a better relationship with the stakeholders, leading to increased rivalry among firms to develop a strong relationship with the stakeholders. Firms that are successful in utilising social media platforms for stakeholder relationship tend to gain competitive advantage. The studies in Malaysia also provide this evidence.

Competitive advantage was found to strengthen the relationships between environmental, social, and governance disclosures and firm performance in Malaysia (Mohammad & Wasiuzzaman, 2021). Thaker et al. (2020) investigated environment-related CSR practices and their impact on social media engagement. The results showed that stakeholder engagement on social media led to customer loyalty. The study further suggests that this may become a source of competitive advantage. Hanaysha (2017) found that social media combined with CSR resulted in customer satisfaction. Yeo and Carter (2020) view stakeholder awareness as critical to CSR. This shows that social media plays an important role in disseminating CSR information in Malaysia. CSR information shared on social media platforms helps firms gain competitive advantage. There is evidence regarding CSR on social media and competitive advantage in Malaysia, but empirical evidence on the relationship between SRSM and competitive advantage is lacking. Deriving from Llorente and Cuenca (2016) that firms' strong communication capabilities with their stakeholders on social media platforms are a source of competitive advantage and the fact that Facebook is used by 77% of Malaysians, the current study is motivated to examine the impact of SRSM on the competitive advantage of Malaysian firms. Hence, the following hypotheses have been formulated:

H3: There is a positive association between sustainability reporting through social media and the competitive advantage of firms.

H3a: There is a positive association between sustainability reporting perception on social media and the competitive advantage of firms.

H3b: There is a positive association between sustainability reporting disclosure on Facebook and the competitive advantage of firms.

3.5 Summary

This chapter discussed the theoretical background of the current study. It developed a research model of BDAC, tone at the top, SRSM, and competitive advantage with DCV as the underpinning theory. This model postulates that firms that have BDAC have better SRSM. The model further includes tone at the top as the moderator between BDAC and SRSM to examine the strength of the proposed relationship. Lastly, the model posits that SRSM impacts the competitive advantage of firms. Six hypotheses were developed to test the model, with the addition of six control variables.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

This chapter discusses the research methodology used for the current study. The research paradigm and design are explained in sections 4.2 and 4.3, respectively. The sampling procedure is discussed in section 4.4, and the variables' definitions and measurements are provided in section 4.5. The questionnaire and content analysis design are discussed in sections 4.6 and 4.7, respectively. Data collection is explained in section 4.8. Section 4.9 elaborates on the response rate of the current study. Data analysis is discussed in section 4.10. Section 4.11 provides the chapter summary.

4.2 Research Paradigm

The proposed theoretical or philosophical assumptions in academic research are known as the research paradigm. Three sociological research paradigms are prevalent in accounting research: mainstream positivism, interpretivism, and critical paradigm (Burell & Morgan, 1979). The positivist paradigm consists of research questions and hypotheses based on a research problem to investigate the relationships among variables with statistical assistance (Baker, 2011). This paradigm is dominant in accounting research due to several reasons (Chua, 2019; Gill & Johnson, 2002). First, the large sample size allows generalisation of the study's findings (Bryman & Bell, 2007a). Second, the findings are reliable because they are based on the objective epistemology (Johnson & Duberley, 2000) and they can be validated using statistical tests such as internal consistency, correlation, and Cronbach's alpha (Dörnyei, 2007). Despite the advantages of the positivist paradigm, subjective phenomena such as attitudes, thoughts, and emotions cannot be studied. Nevertheless, the positivist paradigm dominates other research paradigms. Commonly used quantitative research methods in the positivist paradigm include survey and content analysis (Mackenzie & Knipe, 2006).

Next, interpretivism is linked with the phenomena associated with human behaviour. This approach implies that social components and perceptions craft reality based on the subjective assumptions of an individual's previous understanding of reality (Creswell & Clark, 2019). The research process mainly entails formulating open-ended questions. Qualitative research approaches, such as text and image analysis, are commonly associated with interpretivism. Interpretivism has several limitations. First, the findings cannot be generalised to other contexts due to the aim to obtain a deeper understanding of the phenomenon under study (Cohen et al., 2013). Second, since the views of interpretivism are subjective in nature, the chances of human biases are high. Lastly, this paradigm focuses on studying current phenomena rather than problems that aim to improve society (Mack, 2010).

Finally, the critical paradigm evaluates scientific knowledge through a political lens. It investigates false consciousness, power relations, and prejudiced communications (Johnson & Duberley, 2000). This approach helps develop connections in interdisciplinary topics such as social, politics, culture, and economics. It employs dialogic methodology to pursue scientific truth (Creswell & Clark, 2019). While the critical paradigm helps answer society's problems, it has a limitation. The results produced are subjective, rendering generalisation impossible (Creswell & Creswell, 2017).

While each research paradigm has advantages and disadvantages, the current study adopted the mainstream positivist paradigm. This paradigm is consistent with the current study's research objective to investigate the associations between big data analytics capabilities (BDAC), sustainability reporting on social media (SRSM), tone at the top, and competitive advantage. The relationships among the variables were tested using the hypotheses developed for the current study. The variables were operationalised via quantitative data collection (web-based questionnaire and content

analysis) and data analysis. This approach allows checking the validity and reliability of the results before possibly generalising them (Chua, 1986). Moreover, this approach has also been used in other studies with similar research objectives (Babu et al., 2018; Beier et al., 2018; Ismail et al., 2014; Mohd Fuzi et al., 2019).

4.3 Research Design

The research design or method is a process used to answer the research questions and solve the problem (Welman et al., 2005). Similarly, in research, systematically, data is collected to find the answer to the research questions (Kumar, 2008). The research design highlights the phases of the study and presents the whole process of study. The selection of research design is determined by the area of study (Hall & Howard, 2008). In other words, a research design is an appropriate way for investigating the answers to research questions (Cooper & Schindler, 2001). There are three types of research designs: 1) exploratory, (2) descriptive and (3) causal or explanatory design.

The exploratory research design is used to understand a particular phenomenon in depth. In other words, it means laying out the groundwork for future research. Whereas in descriptive research design, the variable under study is supported by more information. The explanatory research design examines the cause and effect of the relationship between variables, and it helps answer the questions concerning “what” and “how”. It seeks to establish a relationship between variables, that is, to identify how one variable affects the other; it also seeks to explain the causes and/or effects of one or more variables.

Further, the research design is classified as quantitative and qualitative research. Qualitative and quantitative research designs are both used widely (Yin, 2013). The qualitative research design is used to gather information about people’s attitudes, behaviour, and experience. It consists of a set of interpretive, material practices that

make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos of the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural setting, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them (Charmaz, 2008, pp.399). Qualitative research design involves identifying the appropriate sample that represents the population, the research instrument design (including testing the validity and reliability), data collection procedure, and data analysis methods.

The quantitative research method deals with measures and ends with a confirmation or disconfirmation of formulated hypotheses. By following the quantitative method, the researchers identify a suitable design to find answers to research questions and support\reject hypotheses. According to Sukamolson (2007), the quantitative method is classified in several research designs and types; however, mainly, it includes, 1) descriptive design, 2) correlational design, 3) experimental design, and 4) causal-comparative or quasi-experimental design. Quantitative research designs such as questionnaires and content analysis provide statistical evidence on proposed relationships (Dawson, 2002).

The questionnaire is widely used in various research designs due to its many advantages. It is easy to administer and can be distributed physically or through emails, whichever suits the study. A questionnaire sent through emails can reach a geographically diverse sample, thus saving time, energy, and the cost of a study (Sekaran & Bougie, 2016). It is user-oriented because the respondents can complete the questionnaire according to their convenience. The questionnaire is suitable to be used in a study in which it is known what to investigate and how to measure the variables (Sekaran & Bougie, 2016).

Another type of research method is content analysis. It is defined as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff, 2004a). It is a quantitative process that follows a specific procedure for analysing communicative messages (Allen, 2017). Qualitative data is converted into quantitative data for interpretation and statistical analysis. The main advantage of content analysis is direct access to the data (text or transcripts), which can provide valuable insights into the phenomena under study. The data collected for content analysis is often in the form of text that can be coded efficiently for statistical analysis. Content analysis is the most used technique when a study aims to examine and analyse an informative text (Drisko & Maschi, 2015).

A multi-method research design helps to address the shortcomings of each research method used in a study (Hesse-Biber & Johnson, 2015). The multi-method research design utilises multiple types of quantitative or qualitative methods of data collection techniques in a single study (Morse, 2003). Hesse-Biber and Johnson (2015) regarded the use of primary and secondary data for a research design as a multi-method research approach. The multi-method approach enhances data credibility and reliability. For example, when a questionnaire does not allow the researcher to examine a variable through multiple dimensions, secondary data can be used to examine the variable (Allen, 2017). If the results obtained from both methods are similar, they can be used with confidence. If the results vary from each other, it allows further investigation and contribution to the academic literature by identifying other factors affecting the variable under study. Prior studies have also used the multi-method research design (De Hoogh & Den Hartog, 2008; Mokhtar, 2015).

In the current study, underpinning the positivist research paradigm, a multi-method research design consisting of a web-based questionnaire and content analysis was used to collect data. Web-based questionnaires are commonly used to measure

BDAC, SRSM, and competitive advantage (Dubey et al., 2017; Papadas et al., 2018; Wamba et al., 2017). Along with the questionnaire, content analysis has also been widely employed in SRSM research (Amran et al., 2014; Cortado & Chalmeta, 2016; Hussain et al., 2018; Lee et al., 2013; Viglia et al., 2018). Table 4.1 provides a summary of the justifications for the research paradigm and design used in the current study.

Table 4.1: Research Outlook

Research approach		Justification	Source
Paradigm	Positivism	Empirical generalisation	Smith (2019)
Design/ Method	Multi-method: web-based questionnaire and content analysis	Cost-effective measurement of multiple dimensions simultaneously	Allen (2017); Sekaran & Bougie (2016)

4.4 Sampling Procedures

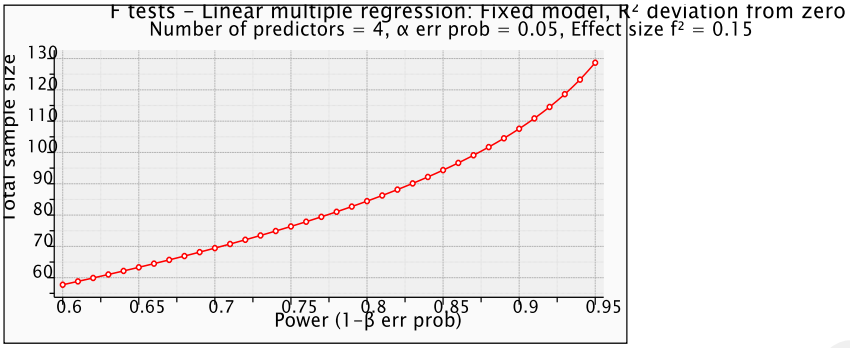
A population refers to the entire group of people, events, or things of interest under investigation in a study. The current study's population is Bursa Malaysia-listed firms that used social media platforms. Malaysia is an emerging economy that is rapidly adopting Industry 4.0 technologies (Luthra & Mangla, 2018). Hence, it presents a favourable case to investigate social media use for sustainability reporting since social media is one of the sources of and a part of Industry 4.0 technologies. As of January 2021, 86% of Malaysians were active users of social media platforms, and about 24.81 million were active Facebook users (Müller, 2021). The World Bank Group (2017) reported that two-thirds of Malaysians were active Facebook users. Thus, Facebook seems to be the most popular social media platform in Malaysia (Moorthy et al., 2019). The popularity of social media platforms in Malaysia drove the current study to choose Malaysian firms listed on the Main Market of Bursa Malaysia as a population of interest. Based on the list provided by Bursa Malaysia as of June 2019 (the latest available at that time), the current study identified a total population of 791 firms. Bursa Malaysia classifies public listed firms into 13 sectors: Technology, Construction, Utilities, Energy, Telecommunication & Media, Consumers Products & Services,

Transportation & Logistics, Health Care, REIT, Finance Services, Property, Plantation, and Industrial Products & Services.

The sample of a study is drawn from the population; it represents the population's characteristics, and the sample size should be adequate to allow generalisation of the study's findings (Sekaran & Bougie, 2016). It is a subset of the population, and it offers an equal opportunity for each member to be included in the study. According to Hair et al. (2016), the sample should be reflective of the population and diverse enough to encompass the similarities and differences of the population. The diversity of the sample, eventually, helps the researcher make inferences and recommend further studies.

The sample size was calculated using G*Power 3.1 in the current study. This analytical software program is widely used in social sciences for the sample size determination (Abt et al., 2020; Faul et al., 2009; Hair et al., 2016). Prior studies have also used this sampling approach to determine their sample size (e.g., Charan & Kantharia, 2013; Caniëls & Bakens, 2012; Wilden et al., 2013). The software generates the minimum sample size requirement based on the research model of the study (Memon et al., 2020). Following the software settings recommended by Hair et al. (2017), "F test" was chosen from the test options in the first step, followed with "Linear multiple regression: fixed model, R2 deviation from zero" from the list of tests. For the type of power analysis, "A-priori: Compute required sample size – given α, power and effect size" was chosen. The input parameters were set at 0.15 for the effect size, 0.05 for the alpha error probability, and 0.80 for the power (1 − □ error probability). The number of predictors was decided based on the maximum number of arrows pointing towards the dependent variable. Memon et al. (2020) recommended counting the interaction term as an additional arrow for a model that includes moderation. The

number of predictors for the current study is 4. Hence, the minimum sample size was set at 85 (see Figure 4.1).



0.1: G*power Graph for Sample Size

The sampling technique is defined as "the name or identification of the specific process by which the sample entities are selected" (United States Bureau of the Census, 1998). Sampling techniques are categorised into probability and non-probability sampling. In probability sampling, every element of a population has an equal chance of being selected (Lavrakas, 2008). Probability sampling techniques are convenient and easy to use but time-consuming and expensive compared to non-probability sampling techniques.

In non-probability sampling, the chances of selecting each population element cannot be calculated (Lavrakas, 2008). Non-probability sampling is suggested for exploratory research (Ben-Shlomo et al., 2013). The objective of this technique is to specify a sampling design that follows the research objectives (Teddlie & Yu, 2007). One of the non-probability sampling techniques is purposive sampling. This technique allows the participants to be selected based on the research needs of the study (Dodge, 2008). The current study used the purposive sampling technique because it is in line

with the research objective of analysing BDAC's impact on SRSM and SRSM's impact on competitive advantage.

Among the 791 firms listed on Bursa Malaysia, only 320 mentioned using social media in their annual reports or sustainability reports and on their websites. Firms that used social media were selected for several reasons. First, social media is one of the sources of big data. Firms continually monitor their social media platforms to extract information that can facilitate decision-making to improve business performance (Bello-Orgaz et al., 2016; Côrte-Real et al., 2017; Ghani et al., 2019; Sivarajah et al., 2017; Tsai et al., 2015). This is in line with the current study's research objective of examining the impact of BDAC on SRSM. Second, the presence of stakeholders on social media platforms creates enormous pressure on firms to communicate their sustainability performance on these platforms, resultantly firms tend to use social media platforms (Lyon & Montgomery, 2013; Nwagbara & Reid, 2013). Last, purposive sampling has been proven beneficial in analysing CSR or sustainability reporting in prior studies (Kamatra & Kartikaningdyah, 2015; Wardayati & Wulandari, 2014). Therefore, 320 firms were included as the sample of the current study (see Table 4.2).

Table 4.2: Study Sample

Total firms listed on Bursa Malaysia (June 2019)	791
Social media use mention:	
Website	188
Annual/sustainability report	132
Total sample firms that use social media	320
Firms that responded	114
Firms deleted due unavailability of data	(14)
Total response rate	100

Based on the research objectives of the current study, its unit of analysis is the individual Bursa Malaysia-listed firm. Using public listed firms as a unit of analysis is also in line with the previous studies on BDAC (e.g., Amin et al., 2020; Aydiner et al., 2019; Shamim et al., 2s019), sustainability reporting (e.g., Diouf & Boiral, 2017; Ioannou & Serafeim, 2012; Wijethilake, 2017), and competitive advantage (e.g.,

Ferreira et al., 2018; Ramirez & Hachiya, 2008). The mandatory disclosure of sustainability in the annual reports of public listed firms in Malaysia adds to the justification of using public listed firms as units of analysis (Malaysia, 2015). Moreover, MDEC has been tasked with implementing Industry 4.0 technologies to drive the Malaysian digital economy. Public listed firms, an integral part of the Malaysian economic sector, are the forerunners in adopting Industry 4.0-related technologies such as BDAC (MDEC, 2015). Since social media data is an important part of BDAC, public listed firms in Malaysia present an appropriate unit of analysis for the current study.

4.5 Variable Measurements

The variables of the current study consist of BDAC, SRSM, tone at the top, and competitive advantage. BDAC is the independent variable, SRSM is the dependent variable, tone at the top moderates the association between BDAC and SRSM, and competitive advantage is the outcome variable. A multi-method research design is used to measure variables through web-based questionnaire and content analysis of Facebook posts of the sample firms as well as content analysis of CEO/Chairman's message to the stakeholders. The sub-sections below provide the measurement detail for each variable of the current study.

4.5.1 Sustainability Reporting on Social Media (SRSM)

Sustainability reporting refers to a "public report by companies to provide internal and external stakeholders with a picture of the corporate position and activities on economic, environmental and social dimensions" (Amran & Haniffa, 2011). In the current study, sustainability reporting is known as sustainability reporting on social media (SRSM). It is defined as "the use of social media for external and internal corporate communication about sustainability, allowing a two-way interaction between organisation and stakeholders" (Kaplan & Haenlein, 2010; Reilly & Hynan, 2014). SRSM was measured using a web-based questionnaire and content analysis. The web-

based questionnaire contained three items to measure sustainability reporting perception on social media (SRPSM). The content analysis consisted of the sustainability reporting disclosure index for Facebook (SRDF) to analyse the posts made by Malaysian public listed firms related to sustainability reporting.

Sustainability reporting has three dimensions: economic, social, and environment. The current study adopted the definitions provided by Bradford et al. (2017) and Hutchins et al. (2019) for sustainability reporting dimensions (see Table 4.3). According to Marsh et al. (1998), a minimum of three items in a scale is needed to produce reliable results. Since a firm's sustainability performance is reflected in its sustainability reporting (Papoutsi & Sodhi, 2020), the current study adapted the questionnaire measurement for SRPSM from Dubey et al. (2017) and Annunziata et al. (2018) because they analysed the impact of BDAC on sustainability performance, where sustainability performance was measured using social, economic, and environmental performance indicators in the questionnaire. Sustainability performance and reporting are interrelated concepts; hence, the purpose of adapting three items of SRPSM was to explore the impact of BDAC on SRSM. The operational definitions of the SRSM dimensions and items for SRPSM are shown in Table 4.3 below.

Table 4.3: Items for Sustainability Reporting Perception on Social Media

SRSM dimensions	**Definition**	**Sources**
Economic	Activities that describe how a company affects the economic conditions of its stakeholders and systems locally, nationally, and globally.	Bradford et al. (2017); Hutchins et al. (2019)
Social	Activities of improving labour practices, human rights, society and being responsible for the products developed.	
Environment	Activities that affect both living and non-living systems of nature.	
Items label	**SRPSM**	
Big data analytics improves communication about the following on social media platforms:		Dubey et al. (2017); Annunziata et al. (2018)
SRPSM1	Environmental performance	
SRPSM2	Social performance	
SRPSM3	Economic performance	

Content analysis of the firms' Facebook posts was carried out after receiving the questionnaire responses. The purpose of employing content analysis for the SRSM measurement in the current study was to investigate further each dimension of SRSM, i.e., economic, social, and environment, on Facebook. Facebook was selected because it is a commonly used social media platform in Malaysia. Moreover, among several social media platforms, Facebook was commonly used by all the sample firms.

Prior studies identified sustainability-related Facebook posts based on the themes provided by the GRI guidelines (Manetti & Bellucci, 2016; Cortado & Chalmeta, 2016; Ramananda & Atahau, 2019). Since the GRI guidelines are accepted worldwide (Bradford et al., 2017; Fuente et al., 2017), Bursa Malaysia's sustainability reporting guidelines are also based on the GRI dimensions consisting of economic, social, and environment (Amran et al., 2015). Facebook is an informal medium of communication (Alm, 2015). Many previous studies that investigated Facebook pertaining to sustainability reporting adapted general themes of the GRI rather than an exact imitation. Hence, in line with the existing literature, GRI (2015), and Bursa Malaysia reporting guidelines, a checklist (see Table 4.4) was adapted to identify Facebook posts pertaining to sustainability reporting (GRI, 2015; Sustainability Reporting Guide, 2018).

Table 4.4: Checklist for SRDF Dimensions

Labels	Keywords
	Economic
E1	Procurement, spending on local suppliers at operation's location
E2.1	Any projects or investments to boost local community, efforts for positive social impacts
E2.2	Voluntary contributions, social and economic benefits
E3.1	Any indication towards money flow from organisation to the stakeholders
E3.2	Impact, outcome, or consequence of the financial transactions performed by the firm
E4	Climate-related financial risks and opportunity, positive or negative impact of climate on the firm
E5.1	Management trainee programs for youth or fresh graduates
E5.2	Career booths for internships or jobs
	Social
S1.1-1.4	Diversity in terms of race, gender, age, disability, ethnicity, and efforts made to be inclusive of the diversity in the firm's workforce
S2.1	Protection and efforts for the right to express and provide an opinion to the workforce
S2.2	Humane working conditions, right to rest, right for vacation
S3.1	Number of accidents, prevention, and efforts to curb the possible accidents at the worksites/workplace
S3.2	Safety protocols for the workers, steps taken to ensure safety, training for workers to avoid accidents
S4	Ethical behaviour without affecting consumer choice, pricing, and market efficiency
	Social
S5.1	Encouragement and steps are taken to promote transparency through the firm's environment
S5.2	Whistleblowing, all other forms of corruption
S6.1	Equality and fair treatment to all the workers
S6.2	Programs, efforts or events to improve the employee's skill, any access provided to the specified program to improve knowledge
S6.3	Perks, memberships, salary raise, medical, transport or accommodation
S7.1	Impact of the firm on society values, practices, and norms
S7.2	Community values, practices, and norms affected by the firms
S8.1	Safeguard of the society's wellbeing from possible harms of products and services
S8.2	Data privacy, awareness from possible threats to the consumer's online and offline privacy
S8.3	Protection of health from firm's products and services
S9	Supply chain
S10.1	Evaluation and prediction of the possible impact of a firm's overall activities
S10.2	Compliance with related laws and guidelines
S11.1	Gifts, contributions, donations for a specific cause
S11.2	Aid, welfare, relief, funding any cause
S12	Education, schooling, college funds, training

Source: GRI (2015); Sustainability Reporting Guide (2018)

Table 4.4: Continued.

Environment	
ENV1	Carbon dioxide, nitrogen oxides, sulphur dioxides and particle emissions
ENV2.1	Hazardous waste generated and treated, method of disposal, effluents
ENV2.2	General waste, paper, and plastic
ENV3	recycling, reuse, water usage products and general usage
ENV4.1-4.4	consumption, intensity, conservation/solar and wind
ENV5.1	Biodiversity risks in operating sites, impacts, high conservation value
ENV5.2	Habitat protection on terrestrial, freshwater, and marine environment
ENV6	New suppliers and environmental impacts related to products and services
ENV7	Materials used in goods production
ENV8.1	Human activities that contaminate land, natural contaminants such as solid, liquid or gas, degradation
ENV8.2	Efforts to reduce contaminants

Source: GRI (2015); Sustainability Reporting Guide (2018)

The checklist themes were also cross-checked against Bursa Malaysia Sustainability Reporting Guide to avoid any errors in identifying sustainability reporting-related posts on the Facebook pages of public firms in Malaysia. The Facebooks posts were screened from January 2019 to December 2019 using the checklist shown in Table 4.4 above for each firm included in the current study. The names of the firms or any related words that could reveal their identity were removed to preserve their anonymity, in line with ethical guidelines.

All the Facebook posts identified based on the checklist were organised into categories of the SRDF index (see Table 4.5). The Facebook posts of those firms were analysed that returned the web-questionnaire. From January 2019 to December 2019 each Facebook post of the respective firm's Facebook page were analysed to identify if it is sustainability reporting post. For example, in the economic indicators, E1 was related to procurement practices, based on the checklist keywords provided in Table 4.4, the following Facebook post was identified as E1:

> "Distinct preferences for local suppliers in surrounding of 50KM of our operations in all over the country for things of general use for inputs of non specialized nature."

The examples of all the other economic indicators are provided in Table 4.5.

Table 4.5: Facebook Posts Examples- Economic indicators

Economic	
E2.1	A new medical facility is established that will offer free or subsidised medical facilities to employees as well as local community.
E2.2	Renewable energy exhaust lower level of emission, carbon dioxide and other poisonous gases and is an environmental friendly. This can reduce health problems, improves local employment and life standard.
E3.1	We take pride in maintaining a reasonable ratio between its earning per share and dividend per share.
E3.2	"We're proud to announce nine consecutive years of strong growth in FY19 with record combined global revenues of US$36.4 billion. Over the last 6 years we've added nearly US$15b in revenue and 100,000 (…) people."
E4	Seasonal variations of Malaysia are not a significant factor in the demand for our product.
E5.1	The company is pleased to report the continued success of its well established management trainee program. This year a total of 24 trainees were inducted in various fields of operation.
E5.2	Grow your career with us and embark on a journey with our dynamic team with vast opportunities that are ready for you tomorrow… will be at booth G09, Hall 4. Come and drop by!

The social indicators of sustainability reporting were also identified based on the checklist provided in Table 4.4. Each Facebook post was analysed to identify which post falls under the category of social indicators of sustainability reporting. For instance, S11.1 is related to the donations of a firm. The following Facebook post was identified as S11.1:

"Calling all book lovers! This World Book Day, why not donate your pre-loved books for a good cause? We've recently opened our second BukuHub in Publika, a space that encourages more reading in our community. Give your books a second life today, drop off your pre-loved books at BukuHub!"

Similarly, other social indicators were also identified based on the checklist shown in Table 4.4, the example of each post is illustrated in Table 4.6 below.

Table 4.6: Facebook Posts Examples-Social indicators

Social	
S1.1	Even though things can be quite challenging at times, we must stay resilient and constantly motivate not only ourselves, but those around us to achieve a true balance, not only in numbers but also a balance in rights... I'm very much satisfied with the working environment. Even though construction is often perceived as a male-dominated industry, key roles such as project managers are largely held by the ladies. Like my team that consists of a very balanced number in gender ratio, where the capabilities of each individual decides everything. My advice to the ladies? Love and be passionate about what we are doing, that is how one stay motivated. Happy International Women's Day!
S1.2	A prescribed retirement date will keep the path for induction of young internees open.
S1.3	Organizations should abide by the national labour policy on adhering to quota for disabled employees wherever practicable.
S1.4	We strictly follow a non-discrimination policy on grounds of religion, language, ethnicity, and gender.
S2.1	An annual picnic was held last week, where all the participants freely exchanged their views and opinions.
S2.2	HR policies are consistent with well established principals of providing due rest and leisure time to all its employees.
S3.1	Shareholders are informed that there were no serious industrial accident recorded on the year under review.
S3.2	A very big thank you to CERT Academy for coming to (…) and giving our employees the 2-days interactive Safety & Health Compliance Training!
S4	A firm believer in free market and desists from any anti completive behaviour.
S5.1	Is website a toll to aid its policy on transparency?
S5.2	A well designed whistle blowing policy among other acts is an effective guard against all forms of corruption.
S6.1	A fair treatment to all employees will improve organizational image.
S6.2	A consistent, effective and comprehensive policy of employees' skill development can bring a competitive edge.
S6.3	In addition to statutory benefits, the company is pleased to offer a number of non-negotiated benefits to its star employees.
S7.1	…always pay key attention in the side of making quality people's capital as one of its social responsibility to society.
S7.2	Harmful emissions or water affluents significantly harm to the community and environment.
S8.1	Discounted prices for low-income people will significantly contribute in improving their social status.
S8.2	all data received is strictly confidential and is not disclosed.
S8.3	…our barge-type tender assisted drilling #rig bagged five awards for high safety record and outstanding performances through its operations in the Gulf of Thailand. The achievements reflect our continued commitment to Quality, Health, Safety and Environment standards in all our services and operations. #drilling #oilandgas #safetyfirst
S9	Creating and maintaining a sustainable supply chain, helping companies build resilience and safeguard reputations.

Table 4.6: Continued

Social	
S10.1	The products are carefully crafted to minimize their environmental impact
S10.2	Our values are aligned with the sustainability guidelines provided by 'Bursa Malaysia'
S11.1	Calling all book lovers! This World Book Day, why not donate your pre-loved books for a good cause? We've recently opened our second BukuHub in Publika, a space that encourages more reading in our community. Give your books a second life today, drop off your pre-loved books at BukuHub!
S11.2	On 14 November (Thursday), we attended the Annual Bursa Bull Charge organised by Bursa Malaysia. Since incepted in 2014, the charity run has collected some RM9.7 million."
S12	Bring your kids along for a day full of fun educational activities on arts and technology to engage and educate…

The environment related Facebook sustainability reporting posts were categorised based on the checklist formulated in Table 4.4. To illustrate, ENV1 was related to emission of a firm in the form of carbon dioxide, nitrogen oxides, sulphur dioxides and particle emissions. The following Facebook post was identified as ENV1:

> "We do not release harmful emissions to the atmosphere or any harmful affluent."

Likewise, the indicators of environment were identified and labelled accordingly. The example of each environmental indicator is depicted in Table 4.7.

Table 4.7: Facebook Posts Example-Environmental Indicators

Environment	
ENV2.1	The hospital has well set procedure for neutralizing hazardous waste before releasing it.
ENV2.2	It's scary to think that of all the plastics in the whole world, less than 7% are recycled. So let's do our parts and remember to TWIST & RECYCLE after we're done rehydrating with…
ENV3	Can tertiary or advanced treatment can help in water recycling ?
ENV4.1	The consumption of natural resources in 2050 will be three time of the current consumption per year.
ENV4.2	Customers, investors, and employees today expecting manufacturers to use processes that reduce environmental impacts, conserve energy and natural resources, and offer safe community living. How should organisations respond?
ENV4.3	A formal policy to minimize the use of electricity generated by oil fuel.
ENV4.4	A recently installed solar power generation increased our reliance on renewable energy.
ENV5.1	Unsustainable use of natural resources is a major risk to biodiversity.
ENV5.2	Habitat protection can save biodiversity.
ENV6	Will Industry 4.0 technology solutions help factories and supply chains become smarter with greater operational visibility, and effective control? Our EMEIA Advisory Markets and Solutions Leader
ENV7	By ensuring a diversified sourcing of inputs we have succussed in lowering the harmful impacts of our products on the environment of county.
ENV8.1	Last weekend, we joined hands with … River Care Programme 2019, where 52 of our… scoured Sungai Congkak, Hulu Langat, clearing it from litter. The volunteers also had a chance to learn Qua-qua, a method used by LUAS to measure the quality of the river water. #didyouknow the waste produced in the river contains bacteria, parasites, and viruses which cause diseases like diarrhea, cholera and typhoid? The Qua-qua method helps to determine whether the water is contaminated or safe for consumption…we believe that preserving the present is key to building a greater future. Environmental stewardship is one of our four sustainability pillars towards Building Sustainability Through Excellence, and this…River Care Programme 2019 is only one of our contributions to preserve the nature.
ENV8.2	Soil maintenance and compacting is strictly governed by rules and guidelines. We do a better job than when we arrived, and the soil benefits as a result…

Literature provides two approaches for the sustainability reporting disclosure index, namely, unweighted and weighted scoring. A weighted scoring approach gives highest score when more information is disclosed. Meanwhile, the unweighted scoring method uses dichotomous or binary scoring, in which "0" is assigned for non-disclosure and "1" for disclosure. In line with the current study's research objective to examine

whether or not Malaysian firms disclose SRSM on social media, the unweighted scoring approach was used for the SRDF index (Gao & Bansal, 2013; Fallan & Fallan, 2019). The current study adapted the SRDF index from Zahid and Gazali (2015) because they developed the index based on the guidelines from GRI and Bursa Malaysia to examine sustainability reporting disclosures. However, the current study differs from Zahid and Gazali (2015) in the sense that the current study used the SRDF index to identify Facebook posts rather than disclosures in annual or sustainability reports. The indicators shown in Table 4.5 were cross-checked against those of prior studies that examined Facebook to ensure the suitability of the SRDF index (She & Michelon, 2019; Manetti & Bellucci, 2016). A total score for each sustainability reporting disclosure dimension was allocated if a firm fully disclosed sustainability information in its Facebook posts in 2019. Each indicator's sub-category had a maximum score of 1 and a minimum score of 0. The index is illustrated in Table 4.8.

Table 4.8: SRDF Index

	Score	Max score
Economic Indicators		
(1) Procurement practices	0-1	1
(2) Community investment		
1. Create a positive social impact	0-1	2
2. Voluntary contribution to enhance socio-economic benefits	0-1	
(3) Indirect economic impact		
1. Flow of money between organisation and stakeholders	0-1	2
2. Direct impact of financial transactions	0-1	
(4) Climate related financial risk	0-1	1
(5) Career booths		
1. Management trainee programs	0-1	2
2. Career booths	0-1	
Total maximum economic indicators score		**8**
Social indicators		
(1) Diversity		
1. Gender	0-1	
2. Age	0-1	
3. Disability	0-1	4
4. Ethnicity	0-1	
(2) Human rights		
1. Freedom of opinion and expression	0-1	2
2. Right to rest and leisure	0-1	
(3) Occupational health and safety		
1. Accident frequency rate	0-1	

Table 4.8: Continued

	Score	Max score
Social Indicators		
2. Safety and health training for workers	0-1	2
(4) Anti-competitive behaviour	0-1	1
(5) Anti-corruption		
1. Transparency	0-1	2
2. Guard against forms of corruption	0-1	
(6) Labour practices		
1. Fair treatment	0-1	
2. Development of employee's skills and knowledge	0-1	3
3. Employee benefits	0-1	
(7) Society		
1. Impact on society	0-1	2
2. Impact on community	0-1	
(8) Products and services responsibility		
1. Impact on the well-being of society	0-1	3
2. Privacy	0-1	
3. Health and safety	0-1	
(9) Supply chain	0-1	1
(10) Compliance		
1. Anticipated impact of activities	0-1	2
2. Adherence of an organisation to relevant laws and guidelines	0-1	
(11) Donations		
1. Donations	0-1	2
2. Charity	0-1	
(12) Educations/ Trainings	0-1	1
Total maximum social indicators score		25
Environmental Indicators		
(1) Emissions	0-1	1
(2) Waste and effluents		
1. Hazardous waste	0-1	2
2. Non-hazardous waste	0-1	
(3) Water	0-1	1
(4) Energy		
1. Consumption	0-1	4
2. Conservation	0-1	
3. Intensity	0-1	
4. Renewable energy	0-1	
(5) Biodiversity		
1. Risks associated with biodiversity	0-1	2
2. Habitat protection	0-1	
(6) Supply chain	0-1	1
(7) Materials	0-1	1
(8) Contamination		
1. Land contamination	0-1	2
2. Land remediation (efforts to remove or reduce pollutants or contaminants)	0-1	
Total maximum environment indicators score		14

4.5.2 Big Data Analytics Capabilities (BDAC)

BDAC is defined "as the competence to provide business insights using data management, infrastructure (technology) and talent (personnel) capability" (Kiron et al., 2014; Wamba et al., 2017). BDAC has three dimensions: BDA management, infrastructure, and personnel capability. BDAC is also known as IT capability. Most studies measured management, infrastructure, and personnel capabilities to measure IT capability (e.g., Garrison et al., 2015; Martin-Rojas et al., 2019). Prior studies in Malaysia have also used management, infrastructure, and personnel capabilities to measure IT capability (e.g., Chong et al., 2017; Makhloufi et al., 2018). The measurement provided by Wamba et al. (2017) for BDAC is validated and reliable because it is based on the previous well-tested scales provided by Kim et al. (2012) to measure IT capability. Table 4.9 shows that the Cronbach's alpha values for all the first-order constructs of BDAC are higher than 0.70, indicating high internal reliability (Nunnally, 1994). Hence, the current study adapted the measurement from Wamba et al. (2017).

Table 4.9: Cronbach Alpha Values for First-order BDAC Dimensions

Third-order construct	Second-order constructs	First-order constructs	Kim et al. (2012)	Wamba et al. (2017)
BDAC	BDA management capabilities	Planning (PLAN)	0.90	0.93
		Coordination (COD)	0.88	0.91
		Control (COL)	0.88	0.93
	BDA infrastructure capabilities	Connectivity (CN)	0.80	0.86
		Compatibility (CP)	0.80	0.92
	BDA personnel capabilities	Technical knowledge (TK)	0.91	0.94
		Technological management knowledge (TMK)	0.88	0.91
		Business knowledge (BK)	0.87	0.91

BDA management capability is defined as "the unit's ability to handle routines in a structured (rather than ad hoc) manner to manage IT resources following business needs and priorities" (Kim et al., 2012). In line with other studies (e.g., Adrian et al.,

2017; Shamim et al., 2019), BDA management capability was measured via planning (PLAN), coordination (COD), and control (COL) dimensions. The dimensions and measurement items are shown in Table 4.10 below.

Table 4.10: Items for BDA Management Capabilities

Label	BDA Management Capabilities	Sources
Planning (PLAN)		Adapted from Wamba et al. (2017); Kim et al. (2012)
PLAN1	We seek innovative opportunities to use data analytics for business sustainability practices.	
PLAN2	We use data analytics to plan strategies to communicate sustainability practices.	
PLAN3	We plan to use data analytics for resolving sustainability concerns raised by stakeholders on social media.	
PLAN4	We use data analytics to plan strategies to communicate sustainability practices on social media.	
PLAN5	We use data analytics to adapt to changing demands of sustainability communication on social media.	
Coordination (COD)		
COD1	In our organisation, data analysts and other employees meet regularly to discuss important issues.	
COD2	In our organisation, data analysts and other employees coordinate their efforts.	
COD3	In our organisation, information is widely shared between data analysts and decision-makers.	
Control (COL)		Adapted from Wamba et al. (2017); Kim et al. (2012)
COL1	In our organisation, the responsibility for data analytics development is clear.	
COL2	Data analytics project proposals are properly appraised in our organisation.	
COL3	We monitor the performance of the data analytics function.	

Planning entails adopting the goals and strategies required to implement BDA in a firm. Coordination involves synchronising all the business units through formal or informal meetings. Control is the checking mechanism that ensures BDA-related activities are performed optimally. All the planning, coordination, and control items were adapted from Wamba et al. (2017). The items were adapted to suit the current study's research objective of analysing the impact of BDAC on SRPSM.

BDA infrastructure capability is defined as "the ability of BDA infrastructure (e.g., applications, hardware, data, and networks) to enable the BDA staff to quickly develop, deploy, and support necessary system components for a firm" (Kim et al.,

2012). BDA implementation requires the firm's infrastructure to be flexible, which depends on connectivity and compatibility. Connectivity refers to the integration of database management systems, hardware, and applications (Gupta & George, 2016). Compatibility allows transparent flow of information in an organisation. Both are an integral part of the BDA infrastructure. The current study adapted the items for connectivity and compatibility from Wamba et al. (2017) to measure BDA infrastructure capability (see Table 4.11).

Table 4.11: Items for BDA Infrastructure Capabilities

Label	BDA Infrastructure Capabilities	Source
Connectivity (CN)		Adapted from Wamba et al. (2017); Kim et al. (2012)
CN1	Compared to rivals within our industry, our organisation uses the best available data analytics systems.	
CN2	Our organisation utilises portable and usable information to boost data analytics connectivity.	
CN3	Our organisation utilises open systems network mechanisms to boost data analytics connectivity.	
CN4	There are no identifiable communications bottlenecks within our organisation for sharing data analytics insights.	
Compatibility (CP)		
CP1	Software applications can be easily used across multiple analytics platforms.	
CP2	Our user interfaces (the use of input devices and software) provide access to all the online platforms in our organisation.	
CP3	Information is shared seamlessly across our organisation, regardless of the location.	

BDA personnel capability is defined as "the BDA staff's professional ability (e.g., skills or knowledge) to undertake assigned tasks" (Kim et al., 2012; Gupta & George, 2016). It is measured using four dimensions: (1) technical knowledge (TK), (2) technological management knowledge (TMK), (3) business knowledge (BK), and (4) a data-driven sustainability culture (DDSC). Technical knowledge refers to knowledge of operating systems, programming, networking, and database management (Kim et al., 2014). Technological management knowledge entails knowledge of IT resources management, deployment, and operation (Kim et al., 2014). Business knowledge refers to a basic understanding of business units (Aral & Weill, 2007). A data-driven

sustainability culture is a result of business knowledge that aims to train personnel to make decisions based on insights provided by BDA. All the items for TK, TMK, and BK were adapted from Wamba et. (2017). Meanwhile, the items for DDSC were adapted from Gupta and George (2016) to suit the research objective of the current study (see Table 4.12).

Table 4.12: Items for BDA Personnel Capabilities

Label	BDA Personnel Capabilities	Sources
Technical knowledge (TK)		Adapted from Wamba et al. (2017); Kim et al. (2012); Aral and Weill (2007)
TK1	Our data analytics personnel are capable in terms of programming skills.	
TK2	Our data analytics personnel are capable in terms of managing project life cycles.	
TK3	Our data analytics personnel are capable in the areas of data management and maintenance.	
TK4	Our data analytics personnel are capable in the areas of distributed computing.	
TK5	Our data analytics personnel are capable of decision support systems (e.g., artificial intelligence, mining).	
Technological management knowledge (TMK)		
TMK1	Our data analytics personnel show an understanding of technological trends.	
TMK2	Our data analytics personnel show the ability to learn new technologies to improve their analytical skills.	
TMK3	Our data analytics personnel are knowledgeable about the critical factors for the success of analytics system in our organisation.	
TMK4	Our data analytics personnel are knowledgeable about the role of data analytics for sustainability communication on social media.	
Business knowledge (BK)		
BK1	Our organisation is capable of developing solutions through data analytics support.	
BK2	Our organisation considers data analytics important to analyse sustainability practices.	
BK3	Our organisation has support from data analytics for concerns raised by stakeholders about sustainability practices on social media.	
BK4	Our organisation is knowledgeable about the ongoing status of sustainability practices communication on social media platforms.	
Data-driven sustainability culture (DDSC)		Gupta and George (2016)
DDSC1	We consider data a tangible asset.	
DDSC2	We base our sustainability practices decisions on data rather than on instinct.	

Table 4.12: Continued

Label	BDA Personnel Capabilities	Sources
Data-driven sustainability culture (DDSC)		
DDSC3	We coach our employees to make sustainability-related decisions based on data analytics.	
DDSC4	We assess and improve our sustainability practices in response to insights extracted from social media data.	
DDSC5	We are willing to override our own intuition when data contradict our viewpoints about sustainability communication on social media.	

4.5.3 Tone at the top

Hart (2000) defined tone at the top as "the shared set of values that an organisation has to channel from the most senior executives". The author developed the measurements for tone at the top to demonstrate all the possible relevant attributes of non-verbal communication by the top leadership of a firm. The benefit of these standard attributes is that they are comparable to other studies that analysed tone at the top. These attributes, termed as "master variables", consist of certainty, optimism, activity, realism, and commonality (Hart, 2000). These variables were selected on the basis that "if only five questions could be asked of a given passage, these five would provide the most robust understanding" of tone at the top (Amernic et al., 2010). Each variable aims to address a particular leadership phenomenon in a firm: certainty (a tendency of actions with authority); activity (new ideas implementation with the expulsion of lethargy); optimism (prevalence of a positive environment); realism (daily matters handled in an organisation); and commonality (the environment to adopt eccentric capabilities in the organisation).

These five master variables of tone at the top are examined from the CEO's letter to the stakeholders. Amernic et al. (2010) identified five main reasons for analysing the CEO's letters to determine tone at the top. First, they are the public representation of a firm (Cha et al., 2019). The CEO's signature signifies that the CEO is personally responsible for the letter and stands behind their writing without any

confusion. The fact that the letter is written rather than improvised increases the validity of the communication. Secondly, the letter is associated with other contents of the annual report to provide an overall idea of management's financial integrity. Third, the letter provides insights into what top management regards as important. An analysis of the metaphors used in the CEO's letter exposes implicit ideologies (Craig & Amernic, 2004). Fourth, the letter often highlights the key performance measurements that hold the CEO accountable. For example, in Enron's annual report for the year 2000, top executives described Enron as a firm that was laser-focused on earnings per share. A single-minded fixation on one measure of financial performance has been acknowledged as one of the key reasons for Enron's failure (Stewart, 2006). In summary, the CEO's letter in the annual report provides insights into a firm's tone at the top because leadership is enacted through how people speak to one another. The letter echoes the CEO's priorities, mindset, ideologies, and perceived charisma and greatness.

Previous studies have investigated the CEO's letter in relation to various aspects. For instance, Cho et al. (2010) examined whether a firm that has a CEO with high certainty and low optimism in tone produce better sustainability reports and performance. Similarly, Hassan (2019) analysed how certainty and optimism are used in sustainability assurance statements, and Carroll and Einwiller (2014) compared CSR and annual reports. The studies mentioned above explored the impact of certainty and optimism on sustainability. However, they neglected the other non-verbal attributes of tone at the top, namely commonality, activity, and realism. Few studies have analysed all five master variables (e.g., Fisher et al., 2019; Tailab & Burak, 2018). Literature suggests that sustainability reporting is affected by the different CEO attributes (García-Sánchez et al., 2020). Therefore, all five master variables were used to measure tone at the top in the current study because the three variables (commonality, realism, and activity) are related to the determination of a firm's flexibility. It is important for firms

to have the capability to change quickly in response to the dynamic internal and external environments. A summary of the studies that investigated the five master variables of tone at the top is presented in Table 4.13.

Table 4.13: Previous Studies on Tone at the Top's Master Variables

Tone at the top variables	Sources
Optimism and certainty	Nakao et al. (2019); Cho et al. (2010); Barkemeyer et al. (2014); Hassan (2019)
Optimism	Arena et al. (2015)
Optimism, realism, and certainty	Feng and Gao (2020)
All five master variables	Fisher et al. (2019); Tailab and Burak (2018)

The measurement of tone at the top is executed on an automated software known as DICTION. It was designed by Hart (1984), a communication researcher. DICTION is similar to other content analysis software packages in that it relies on word frequency counts. It has several benefits. First, the programme relies on linguistic theory to perform the word count (Bligh et al., 2004). Second, DICTION uses artificial intelligence techniques that have not yet been integrated with accounting. Third, DICTION is in the scope of impression management research that draws on systemic linguistics (Sydserff & Weet-man, 2002). Fourth, the coding process in DICTION has relatively strong objectivity concerning face validity and reliability (Sydserff & Weetman, 2002).

DICTION has been used in several research settings. A list of research works employing DICTION software in various research settings is available on its website . Previous studies have analysed non-verbal tone in sustainability reports. For example, Short and Palmer (2008) used DICTION on a sample of 408 mission statements from higher education institutions of business, focusing on gaining insights regarding the application of DICTION. They find significant differences in mission statements across organisations, especially between organisations that are top MBA schools. They conclude by offering future research proposals. Craig and Amernic (2018) analysed the distinctive language markers of annual shareholders' letters written by CEOs of major

corporations in the accounting literature. They analysed 193 different letters, totalling over 368,000 words, focusing initially on 23 letters signed by CEOs who are allegedly hubristic. The language use of the DICTION participants is statistically significantly high in terms of the DICTION analysis. Based on more analysis, the authors claim that language high in 'realism' is not a distinctive hubris marker but is likely to follow executive letters' genre convention to shareholders.

DICTION has also been used to evaluate the relationship between tone at the top and financial performance. Tailab and Burak (2018) analysed the rhetorical tone in the 'Management's Discussion and Analysis of Financial Condition and Results of Operations (MD&A)' section in the financial report. They measured the rhetorical tone by the five master variables of tone at the top. The findings showed an inverse relationship between the communication management tone and industry type. The narrative disclosures have no link to financial performance. Even firms with different financial circumstances use the same tone to deliver varied messages. This suggests that annual MD&A is required to meet shareholder needs. The authors conclude that a more efficient examination of the narrative disclosures is required to generalise the findings.

Similar to the analysis of the relationship between tone at the top and financial performance, some scholars used DICTION to analyse the language used in sustainability reports and its potential impact on better sustainability disclosure. Nakao et al. (2019) studied environmental and social information aspects in Japanese firms' sustainability reports over a two-year period. The results showed that CEO statements tended to use an optimistic and ambiguous tone when social and environmental performance was poor and that stakeholders might affect this tone. The study found textual expressions to be important for the correct interpretation of performance information. Similarly, Kim and Kim (2017) analysed CEO letters in sustainability reports and determined firms' "resoluteness, positive entailments, sharing of values,

perception of reality, and sustainability strategy and execution feasibility." Computer-based content analysis was used, and rhetorical analysis was done using Leximancer and an SPSS text retrieval program. The CEO letter analysis revealed that listed firms showed relatively low realism and high commonality, with North American firms demonstrating relatively high commonality and European firms exhibiting relatively high realism.

Besides analysing the master variables, previous studies have also used DICTION to identify the signs of transparency and accountability. For example, Rim et al. (2019) used DICTION to analyse 181 CSR reports from the US, South Korea, and China to determine the extent of signalling. The results showed that signalling, participation, and accountability were higher in the US and South Korea than in China. A limitation of their study is that despite using DICTION, the study did not include and present the automated analysis of the five master variables of tone at the top.

In the accounting-related literature, the studies conducted by Sydserff and Weetman (2002) and Yuthas et al. (2002) illustrated the use of DICTION in conducting automated content analysis. Sydserff and Weetman (2002) justified their support of DICTION by contending that:

> "…DICTION offers considerable potential for the accounting researcher. It is simple to use, it is automated, and yet it embraces a considerable degree of sophistication. The dictionaries have been constructed by experts in linguistics… (p. 533). In relation to validity and reliability, the objectivity of DICTION analysis is a particular strength. Its automated nature, both for coding and quantification, renders it attractive as a research instrument…In particular, the specific theoretical basis of the approach in linguistic semantics, the fact that the approach is well established in the applied linguistics literature and the independent attestation of the approach all point to strength in face validity. (p. 534)."

Moreover, DICTION 7.0 was suitable to be used for the current study due to its scope that excludes human error and provides valid and reliable results (Sydserff & Weetman, 2002). DICTION's inbuilt capacity to analyse any text related explicitly to the business genre makes it a useful content analysis tool. It is also consistent with the

current study's research objective to investigate the moderating role of tone at the top between BDAC and SRSM. Many studies have manifested the ways to measure the CEO's attributes. However, the measures proposed by Hart (2000) are highly cited and validated in prior studies (e.g., Patelli & Pedrini, 2015; Greiner et al., 2020). Table 4.14 below provides the definition and formula used by DICTION for each master variable of tone at the top.

Table 4.14: Master Variables of Tone at the Top

Master variables	Definition	Formula used by DICTION	Sources
Certainty	It indicates resoluteness, inflexibility, completeness, and a tendency to speak authoritatively.	[Tenacity + Levelling + Collectives + Insistence] – [Numerical Terms + Ambivalence + Self Reference + Variety]	Hart (2000); Amernic et al. (2010); Patelli and Pedrini (2015)
Activity	It is a thematic indicator capturing movement, change, the implementation of an idea, and the avoidance of inertia.	[Aggression + Accomplishment + Communication + Motion] – [Cognitive terms + Passivity + Embellishment]	
Optimism	It refers to the words endorsing some person, group, concept, or event, or highlighting their positive entailments.	[Praise + Satisfaction + Inspiration] – [Blame + Hardship + Denial]	
Realism	It focuses on a language describing tangible, immediate, recognisable matters that affect everyday life.	[Familiarity + Spatial awareness + Temporal awareness + Present concern + Human interest + Concreteness] – [Past concern + Complexity]	
Commonality	It measures the emphasis on the agreed-upon values of a group and the rejection of idiosyncratic modes of engagement.	[Centrality + Cooperation + Rapport] – [Diversity + Exclusion + Liberation]	

Source: Hart (2000); Amernic et al. (2010)

DICTION can analyse the master variables on any given text against a pre-installed dictionary of more than 50,000 words at a time. DICTION uses 33 wordlists or

dictionaries to search text. It produces 33 corresponding raw frequency measures based on 500-word segments of the text (Hart, 2000). The word lists were constructed based on linguistic theory by analysing more than 20,000 texts, and the lists contain no duplication (Sydserff & Weetman, 2002). DICTION allows users to analyse text in numerous ways, such as only the first 500 words, an average for a complete text (up to 500,000 words) as averages of 500-word segments, and in separate 500-word segments.

DICTION permits the user to choose either a raw score option or an option that extrapolates the result to a 500-word segment. The 33 dictionary measures have labels such as "numerical terms", "ambivalence", "self-reference", and "tenacity". DICTION also produces measures of four calculated variables (insistence, embellishment, variety, and complexity) using linguistically based methods of calculation. Finally, five master variables (activity, optimism, certainty, realism, commonality) are constructed using various combinations of the 33 dictionary measures. DICTION can focus on texts extracted from "Business", "Politics", and "Media communication" simultaneously. Like any other content analysis software, a standard DICTION output includes the names of the variables, their frequencies, the percentage of words analysed, the average score range, the standard range, and whether the scores are out of range. In the current study, the CEO's letter to stakeholders was used as an input for DICTION 7.0. The CEO's message is a mandatory part of annual or sustainability reports in Malaysia. Some Malaysian firms include the CEO's message, and a few include the Chairman's message. Few firms include both the CEO's and the Chairman's message. For a firm that issued a sustainability report and an annual report, the CEO's letter in the sustainability report was selected due to the report's explicit focus on sustainability reporting policies and results.

DICTION generates numeric values for each master variable based on "normal range low" and "normal range high" in the input files containing the CEOs' letters.

These individual numeric values allow the researcher to determine which attribute contributes more to tone at the top. Each master variable's score is interpreted according to the high and low score range. The normal range low indicates a weak presence of the attribute in the tone of the master variable. In contrast, the normal range high shows a strong tone of the master variable. The high and low scores represent +1 S.D. and −1 S.D. from the mean. The means are derived from an analysis of some 50,000 passages drawn from a wide variety of English-language texts from all sectors: business, politics, law, science, fiction, media, and others.

4.5.4 Competitive Advantage

In the current study, competitive advantage is defined as "the capability (or set of capabilities) or resource (or set of resources) that gives a firm an advantage over its competitors" (Wiggins & Ruefli, 2002; Sigalas & Pekka Economou, 2013). Competitive advantage has several theoretical backings. For instance, resource-based view theory identifies a firm's resources as a source of competitive advantage, and DCV theory terms a firm's capability to adapt in changing environments as a competitive advantage (Donnellan & Rutledge, 2019). Studies from diverse domains, such as IT implementation, green innovation, environmental disclosures, and firm performance, verify that a firm can gain competitive advantage through its tangible and intangible resources (Saeidi et al., 2019; Schulz & Flanigan, 2016; Khan et al., 2019). The empirical investigations in prior studies have revealed that better reputation, environment-friendly products, and satisfied stakeholders have substantial impacts on competitive advantage (Papadas et al., 2018). Since the inclusion of sustainability performance as an integral part of firm performance, many firms have recognised it as a source of competitive advantage. Literature suggests a strong association between proactive environmental practices and competitive advantage (Mishra & Yadav, 2021).

Moreover, green technologies implementation is also regarded as a cost-effective way to attaining economic competitiveness (Costantini et al., 2017).

The capabilities and resources of a firm can be captured from primary and secondary data. Maury (2018) used secondary data such as return on assets (ROA), sales growth, and financial performance to measure competitive advantage. However, secondary data lacks the dimensions and definitions required to measure competitive advantage. Moreover, secondary measurement sources lack a holistic view of firms' resources and capabilities that contribute to competitive advantage (Li & Liu, 2014). Although secondary data is easier to obtain when the sample size is large, it lacks the uniformity required for the complete definitions and variables to measure competitive advantage (Sabherwal & Jeyaraj, 2015). Thus, primary data measurements, for instance, a questionnaire, are superior to secondary data measurements. They can capture a holistic view of a firm's resources that are utilised in gaining competitive advantage (Saeidi et al., 2015). Secondary data cannot assess the contribution of tangible and intangible resources and all other information, unlike respondents who can assess their firms' competitive advantage against competitors.

Given the evidence of a robust relationship between sustainability practices and competitive advantage, the current study opted for the primary measurement method to analyse the impact of SRSM on competitive advantage. Chang (2011) and Papadas et al. (2018) examined competitive advantage in the context of sustainability. The current study adapted the measurement of competitive advantage from Papadas et al. (2018) because they analysed the link between internal and external green initiatives and competitive advantage, which is in line with the current study's research objective of examining the impact of SRSM on competitive advantage. Hence, competitive advantage was measured using six items in the questionnaire (see Table 4.15).

Table 4.15: Items for Competitive Advantage

Label	Competitive advantage	Source
CA1	Our company is more capable of research and development (R&D) than our competitors.	Adapted from Papadas et al. (2018); Chang (2011)
CA2	Our corporate sustainability image is better than our competitors.	
CA3	Our company is better than our competitors in stakeholder engagement.	
CA4	Our company has better sustainability communication capability than our competitors.	
CA5	Our quality of sustainability communication on social media platforms is better than our competitors.	
CA6	Our company is better than our competitors in reducing the cost of sustainability communication on social media platforms.	

Scale: 5-point Likert: 1 (Low) to 5(High)

The measurement dimensions of competitive advantage include research and development (R&D), stakeholder engagement, capability to communicate with stakeholders, quality of firm's communication, and the cost borne by the firm to communicate sustainability reporting on social media platforms. The study by Papadas et al. (2018) used a seven-point Likert scale to measure the items. According to Dawes (2008), data from five- and seven-point Likert scales produce the same mean scores and show similar characteristics. Hence, a five-point Likert scale was employed in the current study for simplification, generalisation, and comparison of the results with other studies.

4.5.5 Control Variables

Excluding the control variables can affect the external and internal validity of a study (Webb, 2019). Control variables should be accorded equal importance when designing a study, as without them, the accurate impact of the independent variable on the dependent variable cannot be determined (Webb, 2019). The control variable's inclusion may enhance the explanatory power (R2) of a proposed model in a study. Hence, six control variables were included in the current study based on the evidence in literature.

The first control variable is industry type. It is an important variable that has an impact on sustainability reporting because industry type is subject to various social–environmental concerns. Firms that belong to environmentally sensitive industries are generally held to a higher standard than firms in other industries (Reverte, 2012). Stakeholders (namely, investors) place higher importance on firms' corporate social responsibility practises (Young & Marais, 2012). Thus, environmentally sensitive firms make more CSR disclosures to resolve any misperceptions about their intentions (Pled & Latridis, 2012). Moreover, there is a positive association between environment-sensitive firms' investment performance and CSR disclosure (Plumlee et al., 2008).

Several factors need to be considered when choosing a data source for analysis. First, an annual report is the most important document prepared by a firm (Gray & Bebbington, 2000). Second, firms mainly used annual reports to disseminate information as a primary means (Gray et al., 1995). Third, the listed firms' annual reports are the best corporate financial information source in Malaysia (Yusoff et al., 2013). Other means of disclosing environmental information besides the corporate environmental report are project reports, bulletin, newspapers, and electronic media. Montabon et al. (2007) analysed demographic data from corporate annual reports to determine the demographics. The researchers expected that the corporate environmental report would be the most reliable data source on a topic such as this. However, the focus on the corporate websites and stand-alone environmental reports indicates otherwise. The reports published by the firms are not a sole source of reliable information, but other platforms are also equally important to examine whether the environment-sensitive firms are perceived to share sustainability reporting information more.

Following the introduction of mandatory sustainability reporting, many studies have investigated the impact of industry type on the extent of sustainability disclosure (e.g., Amran & Haniffa, 2011; Vormedal & Ruud, 2009). Industry type refers to

industry sectors, categorised into environmentally sensitive and non-environmentally sensitive sectors. Environmentally sensitive firms develop a long-term relationship with the stakeholders because they face stakeholder pressure (Sotorrío & Sánchez, 2010). Firms that operate in environment-sensitive industries are generally held to a higher standard than firms in other industries (Guidry & Patten, 2010; Reverte, 2012). Environmentally sensitive firms increase their CSR disclosures to address any misperceptions about their intentions (Pled & Latridis, 2012). Moreover, a positive association has been found between CSR disclosure and environmentally sensitive firms' investment performance (Plumlee et al., 2008; Reverte, 2012). Therefore, drawing on the literature, the current study predicted a positive association between industry type and SRSM. The current study followed Cho et al. (2010) in measuring industry type as a dummy variable. Cho et al. (2010) and Mokhtar (2015) categorised chemical, mining, metals, oil exploration, paper, plantation, construction, and transportation as environmentally sensitive companies, giving firms in these sectors a score of 1, whereas firms in all other sectors were categorised as non-environmentally sensitive and given a score of 0.

The second control variable for the current study is consumer proximity. Consumer proximity means the visibility of firms in relation to the stakeholders. Broadly, firms are categorised into high visibility and low visibility industry sectors. Firms that have greater visibility due to size or media exposure are subject to the judgement of a broader community. They also tend to attract more attention from stakeholders, and they are susceptible to political actions that can affect their performance consequently they are more committed to social disclosure (Chan et al., 2014). If a firm or client has a high potential for environmental impact or is better known to the consumer, they are more likely to disclose sustainability information (Gavana et al., 2017). In other words, firms in industries with the potential for a larger

environmental impact are under greater scrutiny. Smaller businesses are more likely to disclose environmental information than larger, less regulated companies (Dias et al., 2016). Studies in the prior literature found a significant positive relationship between the proximity of the business to the consumer and sustainability reporting (Branco & Rodrigues, 2006; Gavana et al., 2017).

Large firms are more visible to the consumers due to greater outreach. A closer proximity to individual consumers means higher social visibility (Dias et al., 2016). Previous studies have termed this visibility "consumer proximity" (Hahn & Kühnen, 2013). Consumer proximity refers to firms that are more visible to the consumers. Prior research has found a positive association between highly visible firms and CSR disclosures (e.g., Dias et al., 2016; Radhouane et al., 2018; Goettsche et al., 2016). Drawing on previous studies' findings that firms with high consumer proximity were more likely to generate better sustainability reports and subsequently share these reports on various platforms, the current study also aimed to categorise and compare the sustainability reporting on Facebook between firms with high and low consumer proximity. The current study followed Gavana et al. (2017) and Fernandez-Feijoo et al. (2014) in measuring consumer proximity as a dummy variable. Gavana et al. (2017) categorised household goods and textiles, beverages, food and drug retailers, telecommunications, electricity, gas distribution, and water as high visibility sectors and gave firms in these sectors a score of 1, whereas all other sectors were categorised as low visibility sectors and firms in these sectors were given a score of 0.

The third control variable of the current study is firm age. It is an influential factor in the extent of sustainability reporting since older firms are likely to disclose more sustainability information due to their longer sustainability records. Firm age is commonly measured as the number of years since a firm's formation (Dienes et al., 2016). Studies have recently demonstrated a direct relationship between firm age and

sustainability disclosure (Dissanayake et al., 2016; Mahmood & Orazalin, 2017). Khan et al. (2013) have shown that firms with higher age are more likely to disclose their CSR practises. By comparing the ages of the oil and gas companies in Kazakhstan, Mahmood and Orazalin (2017) discovered that older companies are more likely to provide sustainability disclosures. A more recent study by Sellami et al. (2019) demonstrated that firm age could improve sustainability information assurance. Others also show a positive association between firm age and sustainability reporting. (e.g., Cormier et al., 2005; Orazalin & Mahmood, 2018).

Some studies have found that older firms are less environmentally sustainable than younger firms (e.g., Rettab et al., 2009). Based on a legitimacy perspective, it is assumed that established and older firms will produce more sustainability information since they have already established their legitimacy as an organisation with stakeholders and have managed their reporting systems. For example, Bayoud et al. (2012) observed a positive relationship. However, some studies found a negative correlation between firm size and CSR disclosure (Marquis & Qian, 2014; Shamil et al., 2014). Because of these inconsistent results, making a reliable statement on the tendency of the relationship is impossible.

In line with positive findings of the relationship between firm age and sustainability reporting in other parts of the world, similar findings are reported in Malaysia. For instance, Zahid et al. (2020) reported a positive relationship between firm age and sustainability disclosures. Moreover, Zahid et al. (2019) also found a positive relationship between firm age and sustainability practises in Malaysia. Keeping in view the positive findings and evidence from the literature that older firms have a better capability to share sustainability-related information with the stakeholders (Badulescu et al., 2018).

It is an important factor in determining sustainability reporting. Older firms are believed to be more experienced. Hence, they are proactive in disclosing their contributions to the environment in which they are operating. Prior studies have shown a significant positive association between firm age and the extent of sustainability reporting (e.g., Orazalin & Mahmood, 2018; Bayoud et al., 2012; Rudyanto & Pirzada, 2020). However, some studies have found an insignificant relationship (e.g., Aggarwal, 2013; Amran & Devi, 2007; Marquis & Qian, 2014; Shamil et al., 2014). Due to the inconsistent results, making a reliable statement on the tendency of the relationship is difficult. However, positive findings have been reported in Malaysia (e.g., Zahid et al., 2020; Zahid et al., 2019). In view of the positive findings and evidence from the literature that older firms have better capability to share sustainability reporting-related information with stakeholders (Badulescu et al., 2018), the current study predicted a positive association between firm age and SRSM. Firm age is commonly measured as the number of years since a firm's formation (Dienes et al., 2016). Following Hahn and Kühnen (2013) and Aydiner et al. (2019), the current study categorised firm age into five broad categories with 1 indicating less than 5 years since the firm's formation and 5 indicating more than 50 years since the firm's formation.

The fourth control variable of the current study is firm size. It is considered an important determinant of sustainability reporting. Firms of large size are more likely to perform more corporate practises, or to have more significant effects on society. Larger firms are found to report more detail than smaller enterprises. They have substantially larger resources and are subject to greater regulation than most firms in the sector. Aggarwal and Singh (2019) stated that larger companies attract greater media scrutiny and are under greater pressure to exhibit sustainability performance and reports. Firms have used environmental practices to legitimise their presence and further improve their legitimacy in reaction to increasing public interest and pressures.

Prior literature has generally shown a positive relationship between firm size and the extent of sustainability reporting. Firm size has been used as a measure of public pressure or exposure in evaluating sustainability reporting reasons. Several measures have been used to compare the sizes of firms. The number of assets, the company's market capitalisation, sales, and even the number of employees is the commonly used indicators for firm size evaluation. Even though there are many different methods used to quantify the firm size, the current study chooses revenue as the measure. “Revenue” is a better measure of firm size, as it is based on audited, publicly available information about a firm's revenue. It has been used widely across many studies to represent the scale of a company.

It is an important determinant of sustainability reporting. Firm size has a significant positive impact on CSR or sustainability disclosures. Evidence in the literature shows that large firms have more resources to improve their sustainability performance and disclose it on various platforms (Gavana et al., 2017; Riantani & Nurzamzam, 2015). They are also subjected to greater regulation than most firms in the sector. Larger firms attract greater media scrutiny and are under greater pressure to exhibit sustainability performance and reports (Aggarwal & Singh, 2019). Prior literature has generally shown a positive relationship between firm size and sustainability reporting. Various measures have been used to compare the sizes of firms. The number of assets, market capitalisation, sales, and even the number of employees is the commonly used indicators for firm size evaluation. The current study chose revenue as the measure of firm size. Revenue is a better measure of firm size because it is based on audited and publicly available information. It has been widely used to represent the size of a firm. The natural logarithm of the annual revenue in 2019 was adopted to measure firm size (Gavana et al., 2017; Hahn & Kühnen, 2013). Information on revenue was extracted from the sample firms’ annual reports. Given the previous sustainability

reporting research findings, the current study predicted a positive relationship between firm size and SRSM.

The fifth control variable of the current study is profitability, it is a potential determinant of the legitimacy of sustainability reporting because profitable firms are more likely to disclose sustainability information in order to legitimise their activities (Legendre & Coderre, 2013). On top of economic performance, a firm's sustainability efforts need to consider the public interest. In the case of public firms, Management may wish to disclose more information to promote positive impressions. For instance, (Reverte, 2009) argues that the most explicit connection between sustainability reporting practices and profitability is established on the ground of economic resource availability.

Profitable firms spend more on sustainability investments and sustainability statements (Ruhnke & Gabriel, 2013). Another possible reason why profitable firms are more likely to produce sustainability reports is that they are closely watched by financial intermediaries (Aksu & Kosedag, 2006). Some studies in the literature also presented a negative relationship between profitability and sustainability reporting. For example, Jennifer Ho and Taylor (2007) examined the sustainability reporting practices in the US and Japan context and found a negative relationship between sustainability reporting and the firm's profitability. Where many studies found a positive association between profitability and sustainability reporting (Artiach et al., 2010; Lourenço & Branco, 2013; Kansal et al., 2014; Laskar & Gopal Maji, 2018), some found no significant association (Reverte, 2009), and others found a negative association (Jennifer Ho & Taylor, 2007). Hence, the relationship is unclear.

Some showed a positive relationship between profitability and sustainability in Malaysia (Amran et al., 2015; Zahid et al., 2019; Tong, 2017). The current study measures profitability by the total return on assets (ROA), following prior studies in the

literature (Feng & Gao, 2020; Gavana et al., 2016, 2017). Higher profits show that the firm can create more benefits; hence, the firm will want to build its social obligation and disclose its CSR in the yearly reports (Kamil & Herusetya, 2012). Dienes et al. (2016) believe that profitability can affect the quantity of sustainability reporting positively and negatively. The amount of sustainability information disclosed by a firm is related to its profitability. Firms use profitability to project a positive image. Moreover, profitable firms have additional resources to fund voluntary sustainability reporting (Gamerschlag et al., 2011). Another possible reason for profitable firms' tendency to produce more sustainability reports is that they are closely watched by financial intermediaries (Aksu & Kosedag, 2006). Many studies have found a positive association between profitability and sustainability reporting (e.g., Lourenço & Branco, 2013; Kansal et al., 2014; Laskar & Gopal Maji, 2018). However, some have found an insignificant association (e.g., Reverte, 2009), and others have found a negative association (e.g., Jennifer Ho & Taylor, 2007). In the context of Malaysia, some studies have shown a positive relationship between profitability and sustainability (e.g., Amran et al., 2015; Zahid et al., 2019; Tong, 2017). Since the relationship is unclear, the current study predicted a positive association between profitability and SRSM. The current study measured profitability using total return on assets (ROA), following prior studies in the literature (e.g., Feng & Gao, 2020; Gavana et al., 2017; Hahn & Kühnen, 2013).

The last control variable included in the current study is leverage. The relationship between leverage and sustainability reporting is not as widely explored as the relationship between sustainability reporting, firm size, and profitability (Kansal et al., 2014). Jensen and Meckling (1976) assert that firms use voluntary disclosure to reduce agency costs and, as a result, reduce their financing costs. Moreover, creditors are concerned over the repayment of loans and the interest attached. The sustainability of a firm requires the profitability of the firm and the avoidance of sustainability-related

risks. Firms are expected to consider this group of stakeholders' potential concerns and consider the development of related disclosures (Aribi et al., 2018).

De Beelde and Tuybens (2015) analysed the disclosures made by European firms to find that highly indebted companies tend to make voluntary disclosures. According to Aribi et al. (2018), highly leveraged firms are better at conveying information to Jordan investors. Barako et al. (2006) found that there was a positive relationship between corporate disclosure and leverage. However, empirical research has not supported this hypothesized association (Lourenço & Branco, 2013; Kansal et al., 2014; Shamil et al., 2014; Nazari et al., 2015). Branco et al. (2014) and Sierra et al. (2013) showed that a negative association exists between sustainability information and leverage.

In gauging the firm's leverage, such measurements are used as total debt to total assets and total debt to total equity. Total debt is used to measure leverage to determine the firm's financial risk through how much debt it has compared to its assets. In the Malaysian context, Jamil et al. (2020) found a positive relationship between leverage and sustainability reporting. Whereas, Ghani et al. (2018) found no relation of integrated reports, including sustainability reports with leverage. Hence, the findings are mixed and unclear.

Riantani and Nurzamzam (2015) found that monetary influence had huge consequences for CSR. The link between leverage and sustainability reporting has not been as widely explored as the relationships between firm size, profitability, and sustainability reporting (Kansal et al., 2014). An analysis of European firms' disclosures showed that highly indebted companies tended to make voluntary disclosures (De Beelde & Tuybens, 2015). Barako et al. (2006) found a positive relationship between leverage and corporate disclosures. However, some empirical studies have not supported this association (e.g., Lourenço & Branco, 2013; Kansal et al., 2014; Shamil et al., 2014; Nazari et al., 2015). Branco et al. (2014) and Sierra et al. (2013) showed a

negative association between leverage and sustainability information. Jamil et al. (2020) found a positive relationship between leverage and sustainability reporting in the Malaysian context. However, Ghani et al. (2018) found no relationship between integrated reports, including sustainability reports, and leverage. Hence, the findings are mixed and unclear.

The current study predicted a positive association between leverage and SRSM based on the positive findings of Jamil et al. (2020) in Malaysia. Leverage was measured as total debt to total assets. Total debt was used to measure leverage to determine a firm's financial risk by assessing how much debt the firm had compared to its assets. A summary of the current study's control variable measurements is presented in Table 4.16 below.

Table 4.16 : Measurement of Control Variables

Control Variables	Indicators	Category	Sources
Industry type	Dummy variable, which takes value 1 if the company belongs to any of the environment-sensitive category and value 0 if otherwise	Environment sensitive category: chemical, mining, metals, oil exploration, paper, plantation, construction, and transportation	Cho et al. (2010) and Mokhtar (2015)
Consumer proximity	Dichotomous scale, a score of 1 if the firm belongs to any of the high social visibility sectors and 0 for low visibility sectors	High social visibility sectors: household goods and textiles, beverages, food and drug retailers, telecommunications, electricity, gas distribution and water	Gavana et al. (2017); Fernandez-Feijoo et al. (2014)
Firm age	Number of years since incorporation	1. <5 years 2. 5-10 years 3. 11-30 years 4. 31-50 years 5. >50 years	Hahn & Kühnen, (2013); Aydiner et al. (2019); Gavana et al. (2017); Hahn & Kühnen, (2013)
Firm size	Natural logarithm of annual sales	None	
Profitability	Return on assets (ROA)= Net income/ total assets	None	
Leverage	Debt ratio= total liabilities/ total assets	None	

A summary of the current study's variable measurement is illustrated in Table 4.17 below.

Table 4.17: Measurement of Research Variables

Variables	Acronym	Measurement
***Dependent variable:* Sustainability reporting on social media (SRSM)**		
sustainability reporting perception on social media	SRPSM	Three items in the web-based questionnaire (Appendix B: section two)
Sustainability reporting disclosure on Facebook	SRDF	SRDF index (based on a dichotomous scale for each indicator in the index, one if the information is disclosed and 0 if otherwise. See section 4.5.1
***Independent variable:* Big data analytics capabilities**		
Big data analytics capabilities	BDAC	Based on 36-items in the web-based questionnaire on a 5-point Likert scale (Appendix B: section one)
Moderating variable		
Tone at the top	TAT	A continuous score generated by DICTION for five master variables of tone at the top (activity, commonality, certainty, optimism, and realism)

Table 4.17: Continued

Variables	Acronym	Measurement
Outcome variable		
Competitive advantage	CA	Six items in the web-based based questionnaire on a 5-point Likert scale (Appendix B: section three)
Control variables		
Industry type	IT	Dichotomous scale, a score of 1, if the firm belongs to the environment-sensitive category and 0 for non-environment sensitive category
Consumer proximity	CP	Dichotomous scale, a score of 1 if the firm belongs to a high visibility category and 0 for low visibility category
Firm age	FA	Based on a 5-point scale with 1 indicating the smallest number of years since formation and 5 for no of years more than 50
Firm size	FS	Natural logarithm of annual sales
Profitability	PF	Return on assets (ROA)
Leverage	LV	Gearing ratio=Total liabilities/ total debt

4.6 Questionnaire Design

A questionnaire is a tool used to collect data to analyse the characteristics of specific groups (Gay et al., 2012). Olsen (2011) stated that a structured questionnaire approach is a more straightforward method for data collection. According to Polit and Beck

(2010), close-ended questions are more efficient than open-ended questions by making it easier for respondents to choose an option from a set of alternatives. The response rates of close-ended questions are also noted to be high. Data collected from close-ended items is easy to code and analyse (Rowley, 2014). Thus, the questionnaire designed for the current study consisted of close-ended questions (refer to Appendix B).

Every participant in the current study received a six-page survey, including the cover page. The cover page explained the purpose of the research, and it also included an explanation of the variables for the respondents' understanding. Strict rules were followed to protect the privacy and confidentiality, and hence the anonymity, of the participants. Participation in the survey was voluntary. Moreover, the researcher's contact details were provided to clear any ambiguities the respondents might have with the questionnaire.

The current study's questionnaire had four sections. Section one comprised items for measuring BDAC. BDAC was measured using three sub-dimensions: BDA management, BDA infrastructure, and BDA personnel capabilities. This section had 36 close-ended items and one open-ended item. The open-ended question asked respondents for additional feedback (if any). Section two was designed to examine the impact of BDAC on SRPSM. It had three close-ended items. One open-ended item was included in this section to ask for feedback from the respondents (if any). Section three aimed to capture the relationship between SRPSM and competitive advantage. It had six close-ended items and one open-ended item. The last section of the questionnaire, which included seven close-ended items, was designed to capture the demographic profile of the respondents. The purpose of including demographic questions in a questionnaire is to collect the background information of the respondents (Allen, 2017). These questions provide context to the study for data analysis.

4.6.1 Response Formatting

There are various options to record the responses to items in a questionnaire. For instance, categories of dichotomous questions (true/false) have no ambiguity. However, not all variables can be measured using a fixed dichotomous scale. Likert scales provide many options to respondents. It is easier for them to choose from a variety of options. While Likert scale has many ranges, experts suggest using a five-point Likert scale ranging from one (*Strongly disagree*) to five (*Strongly Agree*) (Boateng Neilands et al., 2018). A five-point Likert scale has various benefits, such as higher reliability, quality, and validity (Revilla et al., 2014). Moreover, the literature suggests that a five-point scale is less confusing, and it increases the response rate (Babakus & Mangold, 1992). Therefore, the questionnaire's responses were recorded on a five-point Likert scale in the current study.

4.6.2 Expert Validation

A preliminary questionnaire was emailed to academics and professionals to ensure its content validity, applicability, and clarity. The feedback received from these experts helped shape a relevant questionnaire for the current study. Responses from five to 10 experts are deemed sufficient for the questionnaire validation (Clark & Watson, 1995; Kennedy et al., 2019). For the current study's questionnaire, seven responses were received from academic and professional experts. Their suggestions were incorporated into the questionnaire to improve its wording and content.

4.6.3 Pilot and Reliability Tests

The purpose of a pilot test is to check the research instrument for any discrepancies and deficiencies (Kraemer et al., 2006). Saunders et al. (2009) suggested conducting a pilot test on the questionnaire before collecting data so that the respondents would not have a problem in answering the questions, and subsequently, there would be no problems during data recording. A sample with an *N* value of 10–30

is suggested for the pilot study (Fink, 2003; Isaac & Micheal, 1995; Saunders et al., 2009). For the current study, the pilot web-based questionnaire was distributed to 30 randomly selected companies from the sample. The respondents were encouraged to provide additional feedback (if any). Nineteen firms returned the web-based questionnaire. The responses showed that the questionnaire was comprehensive and well-developed.

The reliability test ensures the accuracy of results in other applications (Hair et al., 2017). The *N* value required for the reliability test must be a least 10 (Taylor & Taylor, 2014). A small number of responses may not produce accurate results (Pallant, 2020). However, it can provide an outline of the measurement. The responses received from the 19 firms in the pilot test phase were used to test the questionnaire's reliability. The Cronbach's alpha test within SPSS is recommended for the reliability check (Joseph & Rosemary, 2003; Tavakol & Dennick, 2011). The results are shown in Table 4.18.

Table 4.18: Cronbach's Alpha Results for Reliability (*n* = 19)

Variables	Items	Cronbach's Alpha
Independent Variable		
Dimensions of BDAC		
BDA management capability	11	0.93
BDA infrastructure capability	7	0.83
BDA personnel capability	18	0.95
Dependent Variable		
Sustainability reporting perception on social media	3	0.86
Outcome variable		
Competitive advantage	6	0.89

The minimum acceptable value for Cronbach's alpha is 0.7 (Taber, 2018). The current study obtained Cronbach's alpha values in the range of 0.80–0.95. This result is in line with the widely accepted range of 0.70–0.95. Hence, the study's questionnaire had satisfactory reliability (Tavakol & Dennick, 2011).

4.7 Content Analysis Design

Automated and manual content analyses were performed in the current study. In measuring tone at the top (the moderator), automated content analysis software was used to analyse the CEO's/Chairman's statement of the firms that returned the questionnaire. The statements were extracted from the annual or sustainability reports. The software used is known as DICTION. It automatically analysed the uploaded text according to the pre-uploaded dictionary containing a list of 50,000 words to analyse the tone at the top variables, namely activity, commonality, optimism, realism, and certainty. Manual content analysis was performed on the Facebook pages of the Malaysian public firms that participated in answering the current study's questionnaire. The Facebook posts were categorised according to the SRDF index formulated to investigate the extent of sustainability reporting on Facebook (see section 4.5.1).

4.7.1 Expert Validation for Content Analysis

The variables for tone at the top were codified and measured automatically via DICTION. DICTION has stable face reliability and validity due to the automatic coding and quantification (Sydserff & Weetman, 2002). However, when content analysis is performed manually, there is a chance of error in the codification. In order to avoid this error, it is pertinent to verify the checklist from the relevant experts. There forth, experts validated the checklist for the manual content analysis performed for sustainability reporting on Facebook pages of the sample firms.

4.7.2 Reliability Issues Related to Content Analysis

When only one person handles the coding for content analysis, reliability issues may arise. Thus, the literature suggests performing a pilot test of content analysis to enhance the coding output (Milne & Adler, 1999; Guthrie & Abeysekera, 2006). The pilot test can familiarise the coder with the analysis to improve reliability. Hence, a pilot

content analysis was conducted on the sample of 19 firms that participated in the current study before proceeding with the actual content analysis.

Test-retest reliability can be used to assess the consistency of the coding output (Krippendorff, 2004a). Riffe et al. (2019) suggest that when only one coder codes the content analysis data, test-retest is a suitable method to assess the coding consistency. Subsequently, in the current study, the Facebook posts of the 19 firms that participated in the pilot test were coded based on the SRDF index. Fifteen days after conducting the first pilot content analysis of the Facebook pages of the 19 firms, coding was done for the second time to ensure the method's reliability, as suggested by Krippendorff (2004b).

Table 4.19: Result of the Kruskal-Wallis Test

Null Hypothesis	Sig. *(p)*	Decision
There is no significant difference between the coding of data collected from Facebook posts at different intervals of time	0.065	Retain the null hypothesis

In manual content analysis, the Kruskal-Wallis test is used to analyse the difference between the coding outputs of two or more groups (Frey, 2018). In employing the Kruskal-Wallis test in the current study, two hypotheses were formed to test the difference between the datasets. The alternate hypothesis is a difference exists between the datasets under investigation, whereas the null hypothesis is there is no difference between the datasets. Table 4.19 shows the *p*-value was above .05 for the null hypothesis, indicating that the null hypothesis should be retained. This result demonstrated that there was no difference in coding the data collected for the current study. Hence, the coding procedure of the content analysis for SRDF can be considered consistent.

4.8 Data collection

Data collection is a systematic approach to collecting information from the target sources to answer relevant questions and make predictions (Madsen et al., 2016). The following sub-sections explain the data collection procedure for the current study.

4.8.1 Phase one: Web-Based Questionnaire

The primary data for the current study was collected using a web-based questionnaire. There are many benefits of using web-based questionnaires compared to postal survey questionnaires. Web-based questionnaires are easy to analyse and inexpensive (McPeake et al., 2014). Web-based questionnaires also provide many other features: tracking of respondents, email response notification, gathering of descriptive responses, and easy transferability options to statistical software tools (Wright, 2005; Yun & Trumbo, 2000). Most importantly, web-based questionnaires can reach a geographically scattered sample. Hence, web-based based questionnaires have become a popular means of data collection over the years (Hair et al., 2016).

Data collection for the current study commenced in August 2019. A web-based questionnaire was distributed via email (Google Form link) to 320 Malaysian public listed firms. The link for the web-based questionnaire was sent only to the sample firms' correspondence address, which only the respondents could open. The Google Form link included a cover letter that asked consent for participation and provided assurance to preserve the confidentiality and privacy of the respondents. Gentle reminders were sent through emails after every 2 weeks. Only 15 firms responded after one month of the web-based questionnaire's distribution. Until April 2020, 114 firms had responded. The Google Form link was deactivated after April 2020 because the response rate of 114 had fulfilled the statistical criteria. According to G*Power estimation, the number of responses for the current study must be at least 85. According to the guidelines by Hair et al. (2019), the minimum sample size can also be calculated using the 10 times

approach. It means calculating the sample size by multiplying the number of variables in a study with 10 (Hair et al., 2013). Since the current study had four variables, the required sample size was 40. Thus, the minimum response rate requirement was achieved for the current study's theoretical model.

4.8.2 Phase two: Content Analysis of Sample Firms' Facebook Posts

Content analysis was used to collect the secondary data for the current study in order to measure the SRDF for 2019. All of the firms that responded to the web-based questionnaire used Facebook as the main social media platform for disclosing sustainability-related information and engagement with stakeholders. Hence, content analysis following the SRDF index and Bonsón and Ratkai (2013) metric was used to collect data. For the measurement of tone at the top, the CEO's/Chairman's message was collected for analysis via DICTION. The data collection for all the variables took 8 months from September 2019 to April 2020.

4.9 Response Rate and Non-Response Bias Assessment

According to Harbaugh (2002), "response rates for traditional mail surveys (including email) have continued to decline to a point where the average is below 20%." However, the current study's web-based questionnaire obtained a response rate of 31.25% (114 out of 320 firms), which exceeded the average response rate. This response rate is consistent with the previous studies that used public listed firms as the unit of analysis (e.g., Du Toit, 2016; Hameed et al., 2018; Hong et al., 2018; Mamat et al., 2016). Fourteen firms were excluded from the main analysis due to inactive Facebook pages and unavailable Facebook data, resulting in 100 usable responses for the main analysis in the current study. Apart from the 114 responses, 18 firms refused to participate in the current study. The justifications given included the firm had a policy of not participating in surveys and not disclosing information to third parties, did not want to share data, the sustainability team was busy, big data implementation was in the

initial phase, and due to competitive reasons. An overview of the response rate is presented in Table 4.20 below.

Table 4.20: Response Rate of the Study

Characteristics	Response Rate
Total web-based questionnaires sent	320
Questionnaires received	114
Omitted questionnaires in the analysis	(14)
Usable questionnaires	100 (31.25%)

Non-response bias occurs when respondents do not return the questionnaires. It can lead to misrepresentation of the population, thus reducing the credibility of a study (Rogelberg, 1999). Ideally, a separate investigation should be carried out on all or a representative sample of the non-respondents (Sheikh & Mattingly, 1981). The required information about the respondents can be obtained indirectly. One of the methods used to assess non-response bias is examining the difference between the outcomes of early and late respondents (Hinkley et al., 2012). In the current study, early responses (n = 30) refer to the responses received in the first 2 months of the data collection period (September–October 2019). Late responses (n = 70) were those received after the first 2 months of data collection. Independent T-test is recommended to be performed to assess the difference between the outcomes of early and late respondents to identify the existence of non-response bias. In the current study, the T values were below the significant threshold of 1.98, indicating that there were no significant differences between the variables (see Table 4.21). Similarly, the p-values were greater than 0.1, indicating no significant difference between early and late respondents. Hence, the current study did not have non-response bias.

Table 4.21: Non-response Bias Result (Independent *T*-test)

Variables	Early responses (n=30) Mean	S.D	Late responses (n=70) Mean	S.D	t-value	p-value
BDA management capability:	3.33	0.96	3.46	0.83	-0.67	0.50
– Planning	3.61	0.90	3.69	0.77	-0.44	0.65
– Control						
– Coordination	3.40	0.85	3.41	0.85	-0.10	0.91
BDA infrastructure capability:	3.12	0.85	3.14	0.83	-0.11	0.90
– Connectivity	3.33	0.73	3.40	0.81	-0.38	0.70
– Compatibility						
BDA personnel capability:						
– Technical knowledge	3.60	0.69	3.72	0.74	-0.76	0.44
– Technological management knowledge	3.71	0.78	3.72	0.78	-0.02	0.97
– Business knowledge	3.45	0.86	3.48	0.90	-0.14	0.88
– Data-driven sustainability communication	3.41	0.79	3.45	0.85	-0.20	0.83
Sustainability reporting perception on social media	3.44	0.96	3.48	0.90	-0.18	0.87
Competitive advantage	3.21	0.83	3.20	0.83	0.03	0.97

S.D = Standard deviation

4.10 Data Analysis

Generally, in social sciences research, first-generation statistical methods and strategies are used (Fornell & Larcker, 1981), such as regression, analysis of variance, confirmatory and exploratory factor analysis, cluster analysis, and multidimensional scaling. However, gradually, social sciences researchers switched to second-generational statistical analysis techniques, which include SEM (Structural Equation Modelling). The second-generation statistical methods facilitate researchers to measure unobservable variables indirectly through indicator variables; and measured errors within observed variables (Chin, 1998). In addition, SEM has effectively been applied to analyse latent construct with multiple dimensions and evaluated the relationship among the latent variables according to the measurement model (Kline, 2013). SEM

integrates multiple independent variables and dependent variables and observes hypothetical relationships (Savalei & Bentler, 2009).

SEM is divided into two kinds, including CB-SEM (Covariance-Based SEM) and PLS-SEM (Partial Least Squares SEM, also called PLS path modelling). The CB-SEM defines the relationship between and variables to confirm or reject the theories. Further, it identifies the effectiveness of a proposed theoretical model and estimates the covariance matrix of a sample dataset. However, for exploring research, which aims at developing theories, PLS-SEM is used. The model is examined by focusing on variance in dependent variables. PLS-SEM applies OLS (Ordinary Least Squares) regression to reduce the error terms of the endogenous constructs. In short, PLS-SEM presents the relationship if paths in the model and maximize the coefficient of determination (R^2) values of the targeted endogenous constructs. It is also a desired method to develop a theory and explain the prediction of variance. Due to this, PLS-SEMM is considered to be an SEM variance-based approach. Further, when sufficient knowledge about the structural model relationships is not available, and the study focuses more on exploration than confirmation, the PLS-SEM is better than CB-SEM (Henseler et al., 2016).

Accounting studies are shifting towards using PLS (Nitzl, 2018). PLS is also known as component-based structural equation modelling (SEM). The advantages of using SEM are the validity, reliability, and relationships of constructs are estimated simultaneously. Moreover, SEM can analyse multiple independent and dependent variables within the same time interval (Savalei & Bentler, 2009). The current study employed partial least squares structural equation modelling (PLS-SEM) due to its superiority to other methods (Latan et al., 2017). PLS-SEM is more appropriate for a study that is in the infancy stage of exploration (Seles et al., 2018). Additionally, Goodhue et al. (2012) asserted that PLS is not inferior to CB-SEM, especially when a

problem of small sample size and also the non-normal distribution of data is expected in a study. It also examines complex relationships where the moderation effect can be handled easily (Fassott et al., 2016). Further, PLS-SEM reduces uncertainties and has flexible assumptions (Hair et al., 2019). It ensures less model complexity in estimating a higher-order hierarchical model (Wetzels et al., 2009).

PLS consists of measurement and structural models. The measurement model (or inner model) indicates the relationships of the latent variables with the manifest variables. The measurement model is used to check the validity and reliability of the latent variables' impact on the manifest variables (Henseler et al., 2009). The validity of a model is assessed using convergent validity. Meanwhile, reliability is assessed using the Cronbach's alpha and outer loadings of the constructs. Discriminant validity validates the instrument used in a study via cross-loadings and square roots of average variance extracted or AVE (Chin, 1998).

There are two types of hierarchical modelling: hierarchical-reflective modelling and hierarchical-formative modelling. The choice of the type of variable depends on the causal relationship between the latent and manifest variables in the measurement model. Any changes in the latent variable will affect the manifest variables. The reflective construct is generally viewed as giving rise to its indicators (Fornell & Bookstein, 1982), but the formative construct is seen as being defined by its indicators. Both reflective and formative constructs were used in the current study.

The current study used SmartPLS 3.0 to estimate the third-order reflective-formative model based on the guidelines on hierarchical modelling (Ringle et al., 2015). PLS-SEM does not provide the goodness of fit (GoF) test to validate a model before proceeding with the regression analysis. For the GoF analysis in PLS, the measurement model is assessed using convergent and discriminant validity before the structural model is assessed.

In total, six hypotheses were developed for the current study, consisting of four direct and two moderating relationships. These hypotheses were evaluated using three data analysis tools: inferential statistics, partial least squares (PLS), and hierarchical regression analysis. Inferential statistics tools were used for preliminary data analysis, as well as cleaning and preparing the collected data for the final analysis. Descriptive statistics were employed to identify the direction of data based on their means and standard deviations.

4.11 Summary

This chapter discussed the methodology of the current study. The current study's measurements were adapted from prior literature based on the research objectives of the current study. Data was collected from Bursa Malaysia-listed firms that mentioned social media usage. The chapter explained how purposive sampling was used to select the firms that used social media. A pilot study was conducted to check the validity of the adapted measurements (web-based questionnaire and content analysis). In total, 320 firms were invited to answer the web-based questionnaire via the Google Form link. The total response rate was 31.25 per cent (100 firms). Cronbach's alpha and Kruskal-Wallis tests were used to assess reliability, and the results were satisfactory. The final data was then collected. The data was then analysed in SPSS and SmartPLS for reliability and validity and to test the proposed research framework of the current study. Table 4.22 presents a summary of the current study's research methodology.

Table 4.22: Summary of Research Methodology

Research design	Research questions	Data types	Collection methods	Analysis methods
Web-based questionnaire	To answer Research question 1 and 3	Quantitative data (ordinal)	Google form-Likert base	Descriptive analysis, frequency count, Convergent and discriminant validity, and regression analysis on SmartPLS
Content analysis	To answer Research question 1 and 2	Quantitative data	Annual/ sustainability report and Facebook	Descriptive analysis, frequency count and regression analysis on SmartPLS
Control variables				
Six control variables		Quantitative	Annual report	SmartPLS

CHAPTER 5: RESULTS AND DISCUSSION

5.1 Introduction

This chapter presents the results to answer the research questions of the current study. The data collected was analysed on SPSS and SmartPLS. SPSS was used to clean and screen the data collected via a web-based questionnaire and content analysis. The web-based questionnaire was also tested for non-response bias and common method variance (CMV). The results are presented in section 5.2. Demographic and descriptive results are presented in sections 5.3 and 5.4, respectively. In SmartPLS, the measurement model was used to assess the reliability and validity of the variables (section 5.5). The results of the hypotheses are presented in section 5.6, followed by an additional analysis of the web-based questionnaire and content analysis of data in section 5.7. The discussion of results is presented in section 5.8. The last section provides the chapter summary.

5.2 Data Cleaning and Screening

The data collected from the web-based questionnaire, content analysis of Facebook and tone at the top was entered into an SPSS spreadsheet. The data collected for tone at the top was also entered into a Word document to be uploaded on DICTION. Data cleaning and screening on SPSS ensures precision and accuracy for final data analysis. The data cleaning process includes missing data and outlier detection.

Missing data needs to be identified and treated before conducting the data analysis. There are several causes of missing data. For example, respondents do not complete all sections of the questionnaire, refuse to answer the questions, have invalid coding, or have inadequate knowledge about the questions. Missing data can be treated in several ways. Hair et al. (2011) suggests that missing data in a questionnaire must not exceed 25 per cent. In the current study, data was collected using the web-based questionnaire via Google Forms. Google Forms enabled the researcher to avoid the

issue of missing data by selecting the mandatory answer option for close-ended questions in the questionnaire. If a respondent missed a question by any chance, the Google Form would automatically identify the missed question for the respondent. Even though the online administration of the questionnaire helped eliminate the missing data issue, SPSS was also used to counter check for any missing data. The frequency function in SPSS was used to identify any missing values in the questionnaire and content analysis data. The spreadsheet was also checked manually for missing values. No missing values were found in the overall data for the current study.

Then, data was evaluated for outliers. An outlier is an extreme response to a question or questions (Ben-Gal, 2005). An outlier can be the outcome of an entry error or extreme response on a Likert scale. Data was screened manually before checking for outliers in SPSS so that any entry errors could be identified. In SPSS, box plot and stem and leaf methods were used to identify the outliers in the data collected via the questionnaire and content analysis. The result demonstrated the absence of entry error outliers and the presence of outliers related to extreme responses. Hu and Bentler (1999) recommended not deleting these outliers from the data set because doing so would disturb the real data results. The z-scores for the normal data distribution were calculated to ensure the final results would not be disturbed by outliers (see Table 5.1). The values ranged between ±4, indicating that outliers did not affect the current study's results.

Table 5.1: Result of the Outlier Test

Variables		Minimum	Maximum
BDA management capability	Planning (PLAN)	-2.09	1.80
	Coordination (COD)	-2.45	1.87
	Control (COL)	-3.27	1.64
BDA infrastructure capability	Connectivity (CN)	-2.26	1.92
	Compatibility (CP)	-3.00	2.04
BDA personnel capability	Technological knowledge (TK)	-3.69	1.79
	Technological management knowledge (TMK)	-3.48	1.64
	Business knowledge (BK)	-2.79	1.72
	Data-driven sustainability culture (DDSC)	-2.94	1.88
Sustainability reporting through social media (SRSM)	SRPSM	-2.32	1.66
Competitive advantage		-2.05	1.95

Common method variance (CMV) can be a potential issue in a cross-sectional research design. CMV occurs when the variables of a study are measured using the same data source or method (Richardson et al., 2009). It can create a false correlation among variables obtained from the same source (Chang et al., 2010). For example, self-reported data can result in false correlations if the respondents have a proclivity to provide consistent responses to unrelated questions. There are several ways to avoid the CMV issue. In the current study, first, the respondents were assured of their confidentiality and anonymity. Second, the questionnaire was designed in Google Document so that the respondents could not distinguish between the independent and dependent variables. This prevented possible bias arising from respondents relating otherwise unrelated variables with each other. Last, Harman's single factor test was performed in SPSS. The results showed that one factor explained 41% variance. Some prior studies have also reported CMV of about 40% (e.g., Mikalef et al., 2019; Papadas et al., 2018; Shamim et al., 2019). Since the CMV value must be less than 50% (Eichhorn, 2014), CMV was not an issue in the current study (see Table 5.2).

Table 5.2: Common-method Variance (CMV) Result

Extraction Sums of Squared Loadings		
Total	% of variance	Cumulative %
18.46	41	41

Multicollinearity exists in a model when two or more independent variables are associated with each other (Graham, 2003). The existence of multicollinearity in a model can affect the regression outcome (Hair et al., 2010). Two tests are recommended to check for multicollinearity, i.e., Pearson correlation and variance inflation factors (VIF).

In the current study, Person's correlation and VIF were used to assess multicollinearity among the variables (first-order). Pearson's correlation provides a matrix to identify the presence of multicollinearity in a study. A model is free from multicollinearity issues if the values are below the 0.9 threshold (Pallant, 2020). The Pearson correlation matrix presented in Table 5.3 represents the bivariate relationships between the variables. There were positive and negative values and strong correlations at the 0.01 significance level. Moreover, all the values were below the 0.9 threshold. Hence, multicollinearity was not an issue in the current study.

Table 5.3: Multicollinearity Results Based on Correlation Coefficients (*n* = 100)

	PLAN	COD	COL	CN	CP	TK	TMK	BK	DDSC	SRPSM	SRDF	CA	CP	IT	FA	FS	LV	PF
PLAN																		
COD	0.42**																	
COL	0.54**	0.66**																
CN	0.55**	0.61**	0.61**															
CP	0.47**	0.45**	0.66**	0.58**														
TK	0.47**	0.48**	0.75**	0.58**	0.61**													
TMK	0.48**	0.53**	0.77**	0.60**	0.67**	0.80**												
BK	0.65**	0.43**	0.66**	0.60**	0.59**	0.68**	0.74**											
DDSC	0.74**	0.52**	0.67**	0.65**	0.54**	0.66**	0.71**	0.83**										
SRPSM	0.73**	0.33**	0.55**	0.49**	0.45**	0.43**	0.43**	0.63**	0.71**									
SRDF	0.14	0.13**	0.22*	0.12	0.23*	0.17**	0.27**	0.28**	0.24*	0.25*								
CA	0.69**	0.36**	0.59**	0.58**	0.54**	0.49	0.58**	0.72**	0.73**	0.72**	0.25*							
CP	0.19	0.12**	0.09	0.25*	0.08	0.07	0.05	0.10	0.17	0.15	-0.07	0.13						
IT	0.09	-0.03	0.01	-0.10	-0.02	0.03	0.06	0.07	0.03	0.11	0.10	0.02	-0.02					
FA	0.02	0.01	0.14	-0.02	0.15	0.03	0.12	0.09	0.03	-0.04	0.00	0.05	0.05	0.00				
FS	-0.12	-0.03	-0.09	-0.07	-0.23*	-0.09	-0.08	-0.12	-0.10	-0.11	-0.01	-0.05	-0.11	0.00	0.17			
LV	-0.22	0.04	-0.02	0.02	0.03	-0.08	-0.09	-0.10	-0.15	-0.17	0.03	-0.10	-0.13	0.08	-0.24*	-0.14		
PF	0.17	0.15	0.23*	0.29**	0.17	0.20*	0.14	0.21*	0.29**	0.27	0.02	0.32**	0.13	-0.05	0.09	0.09	-0.12	

Note: *Correlation is significant at the .05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

PLAN = Planning; COD = Coordination; COL = Control; CN = Connectivity; CP = Compatibility; TK = Technical knowledge; TMK = Technological management knowledge; BK = Business knowledge; DDSC = Data-driven sustainability culture; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage; CP = Consumer proximity; IS = Industry sensitivity; FA = Firm age; FS = Firm size; PF = Profitability; LV = Leverage.

VIF also examines the effects of multicollinearity. A VIF value greater than 10 indicates the existence of collinearity (Asteriou & Hall, 2007). Nevertheless, a general and widely used rule of thumb is that all values must be around 5 (Hair et al., 2013). Table 5.4 shows that for the current study, all the values were near the recommended value of 5, indicating that collinearity did not exist, and that the current study's variables were reliable.

Table 5.4: Collinearity Assessment Based on VIF (*n* = 100)

	SRPSM	SRDF	CA
PLAN	2.69	2.69	
COD	2.19	2.19	
COL	3.98	3.98	
CN	2.75	2.75	
CP	2.43	2.43	
TK	3.39	3.39	
TMK	4.60	4.60	
BK	4.13	4.13	
DDSC	5.15	5.15	
SRPSM			1.06
SRDF			1.06
Industry sensitivity	1.11	1.11	
Consumer proximity	1.15	1.15	
Firm age	1.24	1.24	
Firm size	1.96	2.00	
Profitability	1.22	1.22	
Leverage	1.31	1.31	

PLAN = Planning; COD = Coordination; COL = Control; CN = Connectivity; CP = Compatibility; TK = Technical knowledge; TMK = Technological management knowledge; BK = Business knowledge; DDSC = Data-driven sustainability culture; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage

5.3 Demographic Profile of Sample Firms

In the current study, the frequency function in SPSS was used to determine the frequencies and percentages of each demographic category for the 100 usable responses. The demographic information was divided into two categories: profile of firms and profile of respondents. Table 5.5 shows the profile of the sample firms. The property sector had the highest representation (18%), followed by conglomerates (15%) and finance services (14%). Other sectors were consumer products & services (11%), construction (7%), health care (7%), energy (6%), technology (6%), telecommunication

& Media (4%), transportation & logistics (7%), industrial products & services (3%), and plantation (2%).

Studies in the literature have also specifically analysed the financial sector's sustainability reporting practices (Merello et al., 2022; Gunawan et al., 2022). Whereas other studies in literature such as Erin et al. (2022) has also followed a holistic approach to include firms belonging to financial, healthcare and consumer goods sectors. According to Mehrotra (2016), in the ASEAN region including Malaysia, financial services, telecommunication & media, and consumers products & services are the leaders in digital dominance and revolution. As Table 5.5 shows, that a significant number of firms belonged to the digitally dominant sectors. Hence, the population in the current study may be appropriately represented.

Table 5.5: Sector Representation of the Responding Firms

Industry affiliation	Frequency	Percentage
Conglomerate	15	15
Construction	7	7
Consumers Products & Services	11	11
Energy	6	6
Finance Services	14	14
Health Care	7	7
Industrial Products & Services	3	3
Plantation	2	2
Property	18	18
Technology	6	6
Telecommunication & Media	4	4
Transportation & Logistics	7	7

Seven questions were included in the current study's questionnaire to collect the respondents' demographic information. Regarding their educational background, the majority of the respondents (52%) were bachelor's degree holders, indicating that they had adequate foundational knowledge to answer the questionnaire. Master/PhD degree holders made up 43% of the respondents, followed by certificate (4%) and diploma (1%) holders.

Most of the respondents belonged to the middle management group (84%). Only 10% of the respondents were from the top management group. Executives (5.9%) were

the least represented. Middle managers are assumed to be in a strong position to introduce change in an organisation. They are also actively involved in a firm's day-to-day strategies and functions (Kumarasinghe & Hoshino, 2010; Ouakouak et al., 2014).

More males (59%) than females (41%) participated in the study. This gender difference is consistent with the findings of Statistic on Women, Family, and Community (2016) that there are more males than females occupying managerial positions in Malaysia. The overall results for the demographic information of the respondents obtained through frequency analysis in SPSS are presented in Table 5.6.

Table 5.6: Demographic Profile of Respondents (*n* = 100)

Variable	Level	Frequency	Percentage
Education			
	Bachelor	52	52
	Certificate	4	4
	Diploma	1	1
	Master/ PhD	43	43
Position level			
	Executive	6	6
	Middle Management	84	84
	Top Management	10	10
Gender			
	Female	41	41
	Male	59	59

5.4 Descriptive Results

Descriptive statistics are used to organise and summarise the data collected from a population or sample before its interpretation (Holcomb, 2016). The sub-sections below explain the descriptive results of the variables of the current study.

5.4.1 Sustainability Reporting on Social Media (SRSM)

Table 5.7 presents the descriptive statistics results for SRPSM, which was measured on a five-point Likert scale. The mean score ranged from 3.35 to 3.57, indicating that Malaysian firms perceived BDAC as a useful tool to improve SRSM. The mean scores are in line with the study of Dubey et al. (2017), which demonstrated BDA's significant role in improving firms' sustainability performance.

Table 5.7: Descriptive Results for SRPSM

Items		Mean	SD
Big data analytics improves communication about the following on social media platforms:			
SRPSM1	Environmental performance.	3.57	1.03
SRPSM2	Social performance.	3.35	1.03
SRPSM3	Economic performance.	3.49	1.08

Table 5.8 presents the descriptive results for the economic dimension of SRDF. The economic indicators were grouped into five main indicators. Among the economic indicators of SRDF, most Malaysian firms posted about career booths (73%), creating a positive social impact (69%), and voluntary contribution to enhance socio-economic benefits (69%). These percentages indicate that Malaysian public firms contribute significantly to the national economy by hiring people from the same geographic region that they are operating in (Malaysia Prime Minister's Department, 2017). Information related to indirect economic impacts was the least posted on Facebook. Although public firms are required to share their quarterly financial progress, only half of the participating firms (52%) shared information pertaining to the flow of money between them and their stakeholders (52%). Perhaps this indicates that the firms use financial reports to communicate financial progress rather than the social media platforms.

Table 5.8: Descriptive Results for Economic Disclosures on Facebook

Label	Facebook post characteristic	Firms reported
E1	**Procurement practices**	63
E2	**Community investment**	
E2.1	Create a positive social impact	69
E2.2	Voluntary contribution to enhance socio-economic benefits	69
E3	**Indirect economic impact**	
E3.1	Flow of money between organisation and stakeholders	52
E3.2	Direct impact of financial transactions	55
E4	**(4) Climate related financial risk**	66
E5	**(5) Career booths**	
E5.1	Management trainee programs	56
E5.2	Career booths	73

Table 5.9 shows the descriptive results for the social indicators in sustainability reporting. More than 70 firms disclosed information about gender, age, disability, and

ethnicity on Facebook. It can be inferred that Malaysian public firms practised ethnic inclusivity in Malaysia given the diversity issues in Malaysia. Daily express reported that in terms of career opportunities 31% felt inequality due their ethnicity (Discrimination Still Major Issue at Malaysian Workplace | Daily Express Online - Sabah's Leading News Portal, 2020). Malaysian public firms encouraged strong morals, with more than 65 firms encouraging guarding against corrupt practices. Malaysian public firms also prioritised workers' health and safety, with 76 firms disclosing on Facebook that they provided health and safety training to employees. Moreover, above 50 firms posted that they strictly followed laws and guidelines. In conclusion, most Malaysian firms disclosed information about the social indicators of sustainability on Facebook which indicates that Malaysia firms are using social media for sustainability reporting.

Table 5.9: Descriptive Results for Social Disclosures on Facebook

Label	Facebook post characteristic	Firms reported
S1	**Diversity**	
S1.1	Gender	75
S1.2	Age	71
S1.3	Disability	73
S1.4	Ethnicity	74
S2	**Human rights**	
S2.1	Freedom of opinion and expression	65
S2.2	Right to rest and leisure	60
S3	**Occupational health and safety**	
S3.1	Accident frequency rate	62
S3.2	Safety and health training for workers	76
S4	**Anti-competitive behaviour**	67
S5	**Anti-corruption**	
S5.1	Transparency	65
S5.2	Guard against forms of corruption	69
S6	**Labour practices**	
S6.1	Fair treatment	49
S6.2	Development of employee's skills and knowledge	68
S6.3	Employee benefits	62
S7	**Society**	
S7.1	Impact on society	66
S7.2	Impact on community	63
S8	**Products and services responsibility**	
S8.1	Impact on well-being of society	56
S8.2	Privacy	62

Table 5.9: Continued

Label	Facebook post characteristic	Firms reported
S8.3	Health and safety	65
S9	**Supply chain**	48
S10	**Compliance**	
S10.1	Anticipated impact of activities	54
S10.2	Adherence of an organisation to relevant laws and guidelines	62
S11	**Donations**	
S11.1	Donations	54
S11.2	Charity	76
S12	**(12) Educations/ Trainings**	69

Regarding environmental disclosures, 82 firms disclosed information about water reuse, recycle, and consumption. This indicator was the most disclosed among all the environmental disclosures on Facebook as seen in Table 5.10. Most Malaysian firms shared efforts in preserving biodiversity (57) and protecting habitats (67). For example, a firm from the banking sector dedicated an entire month to ocean cleaning to help grow the local tortoise population. Fewer than 50 firms disclosed information on emissions and waste and effluents, and 48 firms posted information on energy uses. Similar percentages were reported for biodiversity, supply chain, and materials (see Table 5.10). Land contamination incidents have driven Malaysian public firms to be responsible for the procedures they follow in disposing wastes properly. Hence, 30 firms reported about land contamination, and 58 disclosed their efforts to remove contaminants. Overall, the descriptive results in Table 5.10 show that most Malaysian firms disclosed information about the environmental indicators of sustainability reporting on Facebook. This shows that environmental disclosures constitute an imperative part of SRSM.

Table 5.10: Descriptive Results for Environmental Disclosures on Facebook

Labels	Facebook post characteristic	Firms reported
ENV1	**Emissions**	49
ENV2	**Waste and effluents**	
ENV2.1	Hazardous waste	45
ENV2.2	Non-hazardous waste	41
ENV3	**Water**	82
ENV4	**Energy**	
ENV4.1	Consumption	63
ENV4.2	Conservation	45
ENV4.3	Intensity	34
ENV4.4	Renewable energy	50
ENV5	**Biodiversity**	
ENV5.1	Risks associated with biodiversity	57
ENV5.2	Habitat protection	67
ENV6	**Supply chain**	48
ENV7	**Materials**	49
ENV8	**Contamination**	
ENV8.1	Land contamination	30
ENV8.2	Land remediation (efforts to remove or reduce pollutants or contaminants)	58

According to Hahn and Kühnen (2013), industry type and consumer proximity are among the determinants of sustainability reporting. Although consumer proximity and industry type have no significant impact on SRPSM (as shown in subsection 5.6.4), an additional descriptive analysis was conducted to determine the types of firms in Malaysia that actively posted about sustainability reporting on Facebook and the most commonly posted indicators. Table 5.11 shows that among the participating firms, 32 firms belonged to the environmentally sensitive category. The conglomerate sector had the greatest number of environment sensitive firms (10 firms). Prior studies suggest that environmentally sensitive firms tend to be careful about their sustainability performance. They disclose more information to address the concerns of stakeholders. Likewise, firms with high consumer proximity tend to be careful about their sustainability disclosures. Studies such as Gavana et al. (2017) and Rudyanto and Siregar (2018) have shown a positive association between consumer proximity and sustainability reporting. However, the results presented in Table 5.11 for industry type and consumer proximity revealed otherwise. The highest numbers of economic-related

posts on Facebook were posted by non-environmentally sensitive sectors, namely, Finance & Services (201 posts) and Property (232 posts). The firms with the highest numbers of economic-related posts also had low visibility. These results contradict the findings of Gavana et al. (2017) and Rudyanto and Siregar (2018).

In the environmental disclosure category, firms from the Finance & Services sector recorded the highest number of posts (328 posts). This sector belonged to the non-environmentally sensitive category. The conglomerate sector made the second highest number of posts (317 posts). Fifty percent of the firms from this sector were environmentally sensitive. The significant positive relationship between environmentally sensitive firms and sustainability reporting quality is widely acknowledged (Hahn & Kühnen, 2013). However, the current study found an insignificant relationship. This finding is in line with studies such as Haniffa and Cooke (2005) and Konstantinos et al. (2010) who also found an insignificant association between industry type and sustainability reporting.

In the social disclosure category, the Property sector recorded the highest number of posts on Facebook (654 posts), followed by the Finance & Services sector. Both sectors belonged to the low visibility and non-environmentally sensitive category. These findings indicate that in Malaysia, the public firms that are proactive on Facebook are non-environmentally sensitive public firms with low consumer proximity. A possible explanation for the insignificant findings is that in Malaysia, non-environmentally sensitive firms with low consumer proximity have more resources. Thus, they are proactive in disclosing sustainability-related information on social media platforms.

Table 5.11: Total Social, Environmental, and Economic Posts on Facebook

Sector	Industry type		Consumer proximity					
	Environment sensitive firms	Non-environment sensitive firms	High visibility	Low visibility	Economic	Environment	Social	Total posts
Conglomerate	10	5	10	5	132	317	405	854
Construction	7	0	0	7	70	78	162	310
Consumers Products & Services	0	12	12	0	139	106	253	498
Energy	6	0	6	0	94	152	268	514
Finance & Services	0	15	0	15	201	328	485	1014
Health Care	0	7	7	0	68	151	365	584
Industrial Products & Services	0	3	0	3	38	88	108	234
Plantation	2	0	0	2	12	14	18	44
Property	0	18	0	18	232	294	654	1180
Technology	0	4	0	4	68	125	374	567
Telecommunication & Media	0	4	4	0	76	74	179	329
Transportation & Logistics	7	0	0	7	86	104	185	375
Overall Total	**32**	**68**	**38**	**62**	**1216**	**1831**	**3456**	**6503**

Prior evidence from the literature suggests that in the annual/sustainability reports, environmental disclosures dominate (Miklosik et al., 2021). However, the current study found that social disclosures dominated the Facebook pages of Malaysian firms (Figure 5.1). This finding is consistent with Lodhia et al. (2020). Economic disclosures were the least popular on Facebook, trailing environmental and social disclosures (see Figure 5.1).

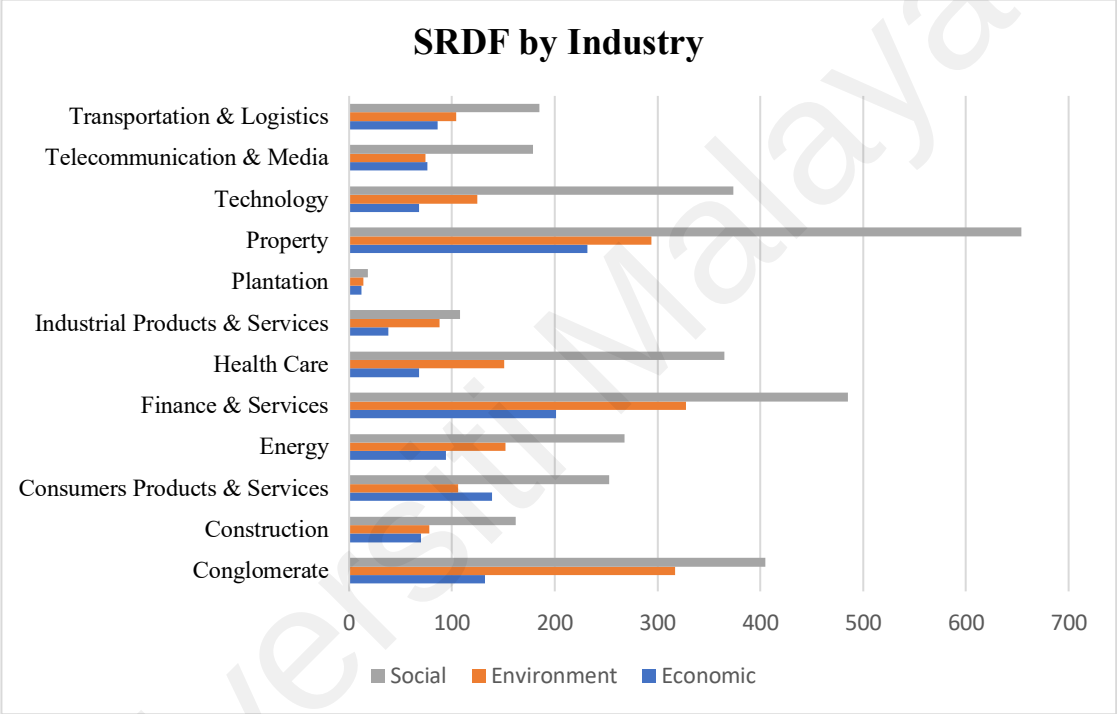


Figure 5.1: Industry Type Presentation of SRDF

The further analysis of the number of posts for each sub-category of economic, environmental, and social indicators revealed that Malaysian public firms posted more frequently on certain types of disclosures on Facebook. In the economic category, the majority of the firms posted about their career booths, accounting for 9.70% of the total disclosures. In the environmental disclosure category, biodiversity-related postings accounted for 7.02% of the total disclosures. This finding reflected the recent biodiversity issues in Malaysia (Leoi, 2019). It thus seems logical that firms were proactive in posting biodiversity-related information on Facebook. In the social

disclosure category, 11.37% of the overall postings on Facebook were related to donations/charity. In Malaysia, public firms make charitable contributions and donations to boost their public image and assure investors that they are good corporate citizens (Esa & Zahari, 2017). The sustainability disclosures on Facebook are voluntary. Firms can post as many times as they want about a certain sustainability indicator. The number of Facebook posts for each dimension of sustainability reporting is shown in Table 5.12.

Table 5.12: Facebook Posts Related to Sustainability Reporting (*n* = 100)

Sustainability reporting disclosures on Facebook		
Economic disclosures	**Number**	**(%)**
Procurement practices	75	1.15
Community Investment	273	4.19
Indirect economic impact	168	2.58
Climate related financial risk	69	1.06
Career booths	631	9.70
Environment disclosures		
Emissions	173	2.66
Wastes and effluents	228	3.50
Water	272	4.18
Energy	304	4.67
Biodiversity	457	7.02
Supply chain	146	2.24
Products and services responsibility	50	0.76
Materials	67	1.03
Contamination	134	2.06
Social disclosure		
Diversity	328	5.04
Human rights	110	1.69
Occupational health and safety	191	2.93
Anti-competitive behaviour	112	1.72
Anti-corruption	155	2.38
Labour practices	128	1.96
Society	446	6.85
Products and services responsibility	371	5.70
Supply chain	125	1.92
Compliance	116	1.78
Donations	740	11.37
Educations/trainings	634	9.74
Overall disclosures	**6503**	**100**

An additional analysis was conducted on the sustainability reporting-related Facebook posts of the sample firms. Bonsón and Ratkai (2013) developed a corporate

Facebook metric to assess stakeholder engagement on CSR related Facebook posts based on the like (popularity), comment (commitment), and share (virality) options on Facebook. The metric is designed to capture actual Facebook data rather than confining it to a Likert scale. Several studies have used the metric to analyse stakeholder engagement on all sorts of Facebook posts to analyse firms' two-way communication. The metric is well cited, validated, and tested by several studies on social media platforms such as Twitter and Facebook (e.g., Cortado & Chalmeta, 2016; Saraite-Sariene et al., 2020). For example, Haro-de-Rosario et al. (2018) analysed the interaction between the Spanish local government and the public. Kucukusta et al. (2019) used the metric to analyse Hong Kong firms' CSR communication on Facebook. The studies by Haro-de-Rosario et al. (2018) and Kucukusta et al. (2019) differed in their sample selection, and they analysed the sustainability reporting posts made by a specific industry on Facebook. Since Facebook is a commonly used social media platform by public listed firms in Malaysia (Ainin et al., 2015), the current study adapted the corporate Facebook metric from Bonsón and Ratai (2013) and Kucukusta et al. (2019) to analyse sustainability reporting-related Facebook posts of the sample firms that returned the web-based questionnaire (n=100).

The measurement of the metric requires the numbers of likes, comments, shares, and followers. These numbers are used to generate the output demonstrating reactivity, dialogue, and stakeholder engagement through popularity, commitment, and virality. The labels and formulas are shown in Table 5.13 below.

Table 5.13: Metric for Sustainability-Related Posts on Facebook

Indicator	Label	Formula	Outcome
Popularity	P1	Total likes/total number of posts	Average number of likes per post
	P2	(P1/number of followers) *1000	Average number of likes per post per 1000 followers
	P3	(P2/number of followers) *1000	Popularity of messages among followers
Commitment	C1	Total comments/total number of posts	Average number of comments per post
	C2	(C1/number of followers) *1000	Average number of comments per post per 1000 followers
	C3	(C2/number of followers) *1000	Commitment of followers
Virality	V1	Total shares/total number of posts	Average number of shares per post
	V2	(V1/number of followers) *1000	Average number of shares per post per 1000 followers
	V3	(V2/number of followers) *1000	Virality of messages among followers
Engagement level	SESRFP	P3+C3+V3	Stakeholder engagement on sustainability reporting-related Facebook posts

Sources: Adapted from Bonson and Ratkai (2013) and Kucukusta et al. (2019)

P1 represents the average number of likes per post. For example, a respondent firm had a total of 124 sustainability posts with 8,063 likes. The average number of likes is obtained by dividing 8,063 by 124. The outcome is 65.02, which indicates reactivity through 65 likes on average for each sustainability reporting-related post. C1 represents the dialogue between stakeholders and the firm. For example, a respondent firm received 405 comments on 124 posts. The average number of comments is computed by dividing 405 by 124. The outcome is 3.2, which means, on average, each sustainability-related post garnered 3.2 comments. V1 represents the average number of shares per post. It is calculated by dividing the total number of shares, i.e., 129 by the total number of posts, i.e., 124. The outcome is 1.04, which means that, on average, 1 follower shared each sustainability-related post. The formulas for P2, C2, and V2 are based on the numbers of likes, comments, and shares per 1,000 followers. Similarly, the formulas for P3, V3, and C3 aim to analyse the engagement per 1,000 followers.

Social media data generated in the forms of likes, comments, and shares are part of big data (Teoh, 2018). In the current study, the data from Facebook was collected to assess stakeholder engagement. Table 5.14 presents the descriptive results of each indicator of stakeholder engagement. For the 100 Malaysian firms analysed, P1 obtained a mean score of 0.98, indicating that 98% of the sustainability-related posts on Facebook were liked. Similarly, V1 obtained a mean score of 0.75, indicating that stakeholders shared 75% of the sustainability-related posts. C1 reported the lowest mean score, indicating that only 69% of the sustainability-related posts were commented by the followers. The mean values of P1, C1, and V1 show that stakeholders interacted with the sustainability-related posts on Facebook.

Table 5.14: Descriptive Results for the Stakeholder Engagement Metric

	Label	Minimum	Maximum	Mean	SD
Reactivity (Popularity)	P1	0.10	1.00	0.98	0.13
	P2	2.56	28348.92	774.67	3042.49
	P3	0.01	103.89	13.76	23.67
Dialogue (Commitment)	C1	0.10	1.04	0.69	0.28
	C2	0.32	1082.84	50.26	140.76
	C3	0.00	85.16	3.20	8.85
Engagement (Virality)	V1	0.11	1.00	0.75	0.27
	V2	0.88	4760.93	102.32	490.49
	V3	0.00	68.00	3.80	9.42

The mean scores of P2, C2, and V2 reflect the average numbers of likes, comments, and shares on sustainability posts. The mean score of P2 shows that 774.67 followers of the Facebook pages liked the sustainability posts. Further, the mean score of V2 depicts that on average, 102.32 followers of the Facebook pages shared the sustainability-related posts. C2 obtained the lowest mean score, indicating that on average, 50.26 followers commented on the sustainability-related Facebook posts. From the low percentage and average number of comments, it can be inferred that followers tend to spend only a little time on each post (Stieglitz & Dang-Xuan, 2013). To post comments, followers need to type their thoughts and opinions, but for likes and shares, they only need to press the Like and Share buttons, which is less time-consuming.

P3, C3, and V3 demonstrate the level of popularity, commitment, and virality of sustainability posts among the followers. P3 obtained a mean score 13.76, indicating that sustainability-related Facebook posts by Malaysian firms were popular (n = 100). However, C3 and V3 reported substantially lower mean scores of 3.20 and 3.80, respectively. Thus, the current study concluded that the Facebook followers of the sample firms were not that committed, and the firms' sustainability posts on Facebook lacked virality.

5.4.2 Big Data Analytics Capabilities (BDAC)

The descriptive results for each BDAC dimension are discussed in this sub-section. Table 5.15 presents the mean scores for BDA management capability's sub-dimensions (planning, coordination, and control). PLAN1 obtained a mean score of 3.84, showing that Malaysian firms were seeking opportunities for the BDA implementation. PLAN2 reported a mean score of 3.37, indicating Malaysian firms used BDA for strategic planning related to sustainability reporting's overall communication. PLAN3 recorded a mean score of 3.52, illustrating that the firms planned to use BDA to manage stakeholders' concerns on social media platforms. PLAN4's mean score of 3.16 implied that Malaysian firms used BDA to develop the strategies for disclosing sustainability practices on social media. Lastly, PLAN5 obtained a mean score of 3.23, indicating that the firms used BDA to manage stakeholders' changing demands for sustainability reporting on social media platforms.

Table 5.15: Descriptive Results for BDA Management Capability

	Items	Mean	SD
Planning (PLAN)			
PLAN1	We seek innovative opportunities to use data analytics for business sustainability practices.	3.84	1.11
PLAN2	We use data analytics to plan strategies to communicate sustainability practices.	3.37	1.13
PLAN3	We plan to use data analytics for resolving sustainability concerns raised by stakeholders on social media.	3.52	0.95
PLAN4	We use data analytics to plan strategies to communicate sustainability practices on social media.	3.16	1.13
PLAN5	We use data analytics to adapt to changing demands of sustainability communication on social media.	3.23	1.14
Coordination (COD)			
COD1	In our organisation, data analysts and other employees meet regularly to discuss important issues.	3.43	1.00
COD2	In our organisation, data analysts and other employees coordinate their efforts.	3.50	0.99
COD3	In our organisation, information is widely shared between data analysts and decision makers.	3.31	1.06
COL1	In our organisation, the responsibility for data analytics development is clear.	3.72	0.99
COL2	Data analytics project proposals are properly appraised in our organisation.	3.79	1.01
COL3	We monitor the performance of the data analytics function.	3.49	0.97

COD1 reported a mean score of 3.43, indicating that data analytics personnel met regularly to coordinate efforts related to the BDA implementation. Similarly, COD2's mean value of 3.50 denoted that data analysts and employees coordinated efforts to implement BDA. COD3 recorded the lowest mean value of 3.31 among the COD measurement items, which could mean that the firms were in the process of implementing BDA to aid decision-makers.

COL1 obtained a mean value of 3.72, indicating that the responsibilities related to data analytics were clearly elaborated in the Malaysian firms. COL2's mean value of 3.79 can be perceived as a positive sign of appreciation for data analytics. COL3 reported a mean value of 3.49, indicating that the Malaysian firms had already established a monitoring mechanism for BDA functions. Studies such as Ferraris et al. (2018) and Mikalef et al. (2019) reported similar mean scores for the development of

BDA management capability. It can be interpreted as the process of developing BDA management capability to improve SRSM was ongoing in Malaysian firms.

Table 5.16 shows the mean scores for BDA infrastructure capability's sub-dimensions (connectivity and compatibility). CN1 reported the lowest mean score of 2.97 among all the BDAC items, which can be inferred as the responsibilities related to the BDA implementation were not well-defined in the Malaysian firms. CN2's mean score of 3.06 implied that BDA projects were appraised properly. Similarly, the mean score of 3.10 for CN3 showed that Malaysian firms were boosting their BDA connectivity. Among the CN items, CN4 reported the highest mean score of 3.43, indicating that there were no noticeable communication gaps in the Malaysian firms' sharing of BDA insights.

Table 5.16: Descriptive Results for BDA Infrastructure Capability

	Items	Mean	SD
Connectivity			
CN1	In our organisation, the responsibility for data analytics development is clear.	2.97	1.18
CN2	Data analytics project proposals are properly appraised in our organisation.	3.06	0.95
CN3	Our organisation utilises open systems network mechanisms to boost data analytics connectivity.	3.10	0.97
CN4	There are no identifiable communications bottlenecks within our organisation for sharing data analytics insights.	3.43	1.04
Compatibility			
CP1	Software applications can be easily used across multiple analytics platforms.	3.55	1.00
CP2	Our user interfaces (the use of input devices and software) provide access to all the online platforms in our organisation.	3.40	1.02
CP3	Information is shared seamlessly across our organisation, regardless of the location.	3.19	1.13

CP1 obtained the highest mean score of 3.55 among all the CP items, indicating that BDA-related software was easy to use. CP2's mean score of 3.40 showed that the firms had an online interface for most of their functions. CP3 reported the lowest mean score of 3.19, indicating that having multiple locations could encumber information sharing. The mean scores for BDA infrastructure capability's sub-dimensions are lower

than reported in Mikalef et al. (2020) and Rialti et al. (2019). A possible explanation for this phenomenon is that Malaysian firms are in the process of developing their BDA infrastructure. It can also be suggested that the BDA infrastructure implementation is showing an upward trend, which is consistent with Wong et al. (2015).

Table 5.17 presents the mean scores for BDA personnel capability's sub-dimensions. The values are higher than those reported for the sub-dimensions of BDA management and personnel capabilities. TK1 and TMK1 obtained the highest mean scores of 3.97 and 3.96, respectively, among all the items. These findings showed that Malaysian personnel were perceived as possessing excellent programming skills that are required for data analytics and that they fully understood the current technological trends in Malaysia. TK2 and TMK2 also reported the high mean scores of 3.80 and 3.88, respectively. TK3 and TMK3 obtained relatively low mean scores of 3.75 and 3.73, respectively, indicating that the personnel in Malaysian firms faced challenges in adopting the advanced skills associated with BDAC.

Table 5.17: Descriptive Results for BDA Personnel Capability

	Items	Mean	SD
Technical knowledge (TK)			
TK1	Our data analytics personnel are capable in terms of programming skills.	3.97	0.95
TK2	Our data analytics personnel are capable in terms of managing project life cycles.	3.80	0.95
TK3	Our data analytics personnel are capable in the areas of data management and maintenance.	3.75	0.91
TK4	Our data analytics personnel are capable in terms of programming skills.	3.41	0.84
TK5	Our data analytics personnel are capable in terms of managing project life cycles.	3.53	0.99
Technological management knowledge (TMK)			
TMK1	Our data analytics personnel show understanding of technological trends.	3.96	1.07
TMK2	Our data analytics personnel show ability to learn new technologies to improve their analytical skills.	3.88	0.99
TMK3	Our data analytics personnel are knowledgeable about the critical factors for the success of analytics system in our organisation.	3.73	0.91
TMK4	Our data analytics personnel show understanding of technological trends.	3.31	1.00

Table 5.17: Continued

	Items	Mean	SD
Business knowledge (BK)			
BK1	Our data analytics personnel show ability to learn new technologies to improve their analytical skills.	3.67	1.10
BK2	Our organisation considers data analytics important to analyse sustainability practices.	3.70	1.10
BK3	Our organisation has support from data analytics for concerns raised by stakeholders about sustainability practices on social media.	3.18	1.04
BK4	Our organisation is knowledgeable about the ongoing status of sustainability practices communication on social media platforms.	3.36	1.03
Data-driven sustainability culture (DDSC)			
DDSC1	Our organisation is capable of developing solutions through data analytics support.	3.92	1.01
DDSC2	We base our sustainability practices decisions on data rather than on instinct.	3.47	1.01
DDSC3	We coach our employees to make sustainability related decisions based on data analytics.	3.21	1.16
DDSC4	We consider data a tangible asset.	3.34	1.08
DDSC5	We are willing to override our own intuition when data contradict our viewpoints about sustainability communication on social media.	3.26	0.99

Note: Likert scale range: 1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly agree*.

Rialti et al. (2019) and Rialti et al. (2020) reported higher mean scores for TK among European firms than those obtained in the current study. It can be interpreted as firms in developed countries have more personnel who possess programming skills than the firms in Malaysia. However, the mean scores for BK2 (3.70) and BK3 (3.18) showed that while the personnel were rather slow in acquiring BDA skills, the firms in Malaysia provided support to their personnel to improve the required skills. BK4 reported a mean score of 3.36, indicating that Malaysian firms possessed knowledge about the status of SRSM. Regarding the decision-making for sustainability reporting, the mean score of 3.47 for DDSC2 revealed the perception that sustainability decisions in Malaysian firms were based on data instead of instincts. This perception was verified by DDSC5's mean score of 3.26. DDSC3 obtained the lowest mean value of 3.21, highlighting the need to train the firms' employees to make sustainability-related decisions based on data analytics. In conclusion, all the BDA management,

infrastructure, and personnel capability items obtained mean values above the average range of 2.5 on a 5-point Likert scale. This shows a positive trend of BDAC implementation in Malaysia. These findings are also consistent with the prior studies on BDAC implementation such as Ferraris et al. (2018).

5.4.3 Tone at the Top

Table 5.18 shows the descriptive results comprising the minimum, maximum, mean, and standard deviation values for tone at the top's five master variables. Certainty reported a mean value that was greater than the normal high range. The maximum (384.24) and mean (67.45) values for certainty reflected the confidence of top leaderships in Malaysian firms regarding the policies adopted in their organisations. Most firms reported their policies on the adoption of new technologies, which are a requirement in the changing external environment (TIME, 2019). The firms also highlighted their approaches to improve the sustainability practices (CIMB, 2019). Similarly, the mean (53.19) and maximum (58.49) values for optimism depicted a parallel relation with the certainty in the non-verbal tone, indicating that Malaysian firms' top management was optimistic about their firms' prospects to adopt new measures. It can be presumed from the descriptive scores of each tone's attributes that the Malaysian firms are confident in their adoption of the changing business environment. Among the tone at the top's five master variables, realism has lowest mean score indicating that although the top management is certain and optimistic about their practices, they lack a realistic view.

Table 5.18: Descriptive Results for Tone at the Top (n = 100)

Variables	Minimum	Maximum	Mean	SD
Activity	40.78	53.53	50.11	1.74
Optimism	44.67	58.49	53.19	2.00
Certainty	45.07	384.24	67.45	39.07
Realism	37.47	53.70	44.19	2.64
Commonality	43.97	57.33	51.24	2.03

Activity refers to the flexibility needed to implement new ideas, and commonality is associated with agreed-upon values in a group. Even though the two concepts are different, they displayed similar mean and maximum values in the current study. Activity and commonality obtained mean values of 50.11 and 51.24, respectively. These mean values portrayed a similar pattern in the top management's non-verbal tone about being flexible in adopting new ideas and maintaining established values. Realism obtained the lowest mean value of 44.19 among the five variables. This shows that tangible, immediate and recognisable matters are less addressed in the non-verbal top management's tone. priority

5.4.4 Competitive Advantage

Table 5.19 presents the descriptive results for competitive advantage in the current study. CA1 obtained the highest mean value of 3.36 among all the competitive advantage items. This finding is consistent with the earlier studies that showed the importance of research and development (R&D) in attaining competitive advantage (Ko & Liu, 2017; Markus & Swift, 2019; Salimi & Rezaei, 2018). The mean value of 3.30 for CA3 is consistent with the notion that sustainability reporting is a predictor of competitive advantage. CA2 and CA5 reported similar mean values of 3.14 and 3.14, respectively, indicating that the firms' sustainability image and quality of sustainability communication were considered to be better than their competitors'. The mean value of 3.25 for CA6 denoted that Malaysian public firms competed with other firms to reduce the cost of sustainability reporting. CA4 recorded the lowest mean value of 3.05, indicating that the Malaysian firms were developing their capabilities in sustainability communication.

Table 5.19: Descriptive Statistics Results for Competitive Advantage (*n* = 100)

	Items	Mean	SD
CA1	Our company is more capable of research and development (R&D) than our competitors.	3.36	0.99
CA2	Our corporate sustainability image is better than our competitors.	3.14	1.03
CA3	Our company is better than our competitors in stakeholder engagement.	3.30	1.02
CA4	Our company has better sustainability communication capability than our competitors.	3.05	1.12
CA5	Our quality of sustainability communication on social media platforms is better than our competitors.	3.14	1.00
CA6	Our company is better than our competitors in reducing cost of sustainability communication on social media platforms.	3.25	1.04

Note: 1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly agree*

5.4.5 Control Variables

Six control variables were included in the current study based on the evidence in literature regarding their impact on sustainability reporting. The mean values reported in Table 5.20 illustrated that most firms had been around for more than 30 years. Older firms are perceived as disclosing more information about their sustainability performance and practices (Orazalin & Mahmood, 2018). Sustainability reporting was also positively associated with firm size (Haniffa & Cooke, 2005). The maximum value of firm size presented in Table 5.20 demonstrated that on average, Malaysian public listed firms earned revenues of around RM20 million.

Table 5.20: Descriptive Results for Control Variables (*n* = 100)

Continuous Variables	Minimum	Maximum	Mean	SD
Firm age	2.0	5.0	3.83	0.84
Firm size	8.50	20.78	14.84	3.07
Profitability	-0.84	0.82	0.03	0.14
Leverage	0.00	1.70	0.17	0.22
	Frequency			
Dichotomous/dummy Variables	**1**		**0**	
Consumer proximity	38 (38%)		62 (62%)	
Industry type	32 (32%)		68 (68%)	

The mean score of 14.84 for firm size represents the natural log of the annual revenues generated by Malaysian public firms. A similar mean score for firm size was reported by Lee and Min (2015), and they found a positive association between firm

size and green innovations to promote sustainability practices. Large firms are motivated to practise better sustainability reporting because they are under the scrutiny of the investigative media and environmental protection agencies (Ikpor et al., 2022). Profitable firms are more likely to contribute to society through sustainability disclosures (Jennifer Ho & Taylor, 2007). In the current study, profitability reported a mean value of 0.03, equivalent to an average profit of 3%. It was measured as return on assets. The 3% mean value of profitability could mean that it may have a positive influence on SRSM in the current study. Leverage is one of the factors affecting sustainability reporting. Firms with a high proportion of debt disclose more sustainability information to address the concerns of creditors and shareholders (Ferguson et al., 2002). The mean value for leverage showed that 17% of the total assets were financed by debt.

Consumer proximity and industry type were included as dummy variables with a score of 0 or 1. The frequency analysis for consumer proximity signified that 39 per cent of the firms belonged to the high consumer proximity category, whereas 62 per cent of them belonged to the low consumer proximity category. For industry type, the frequency analysis showed that 69 per cent of the sample firms belonged to the non-environmentally sensitive sector, and 31 per cent belonged to the environmentally sensitive sector.

5.5 Measurement Model

The measurement model assessment allows the researcher to evaluate the reliability and validity of the constructs' measurements. The current study used two types of constructs: reflective and formative. The reliability of the reflective constructs was assessed using composite reliability and Cronbach's Alpha (Hair et al., 2016). The validity of the reflective constructs was assessed using convergent validity and discriminant validity (Henseler et al., 2009; Hair et al., 2017). The reliability and

validity of formative constructs were examined using VIF, outer weights, and outer loadings.

5.5.1 Reliability and Validity Assessment (First-order Constructs)

The reliability assessment is important as it assures the authenticity of the research findings. Reliability is explained as the capability of the scale to measure the variable fully (Kline, 2013). In other words, the reliability assessment includes evaluating whether the items are measuring what they are intended to measure (Urbach & Ahlemann, 2010). The commonly recommended methods for checking reliability are composite reliability and Cronbach's alpha (Ramayah et al., 2017).

Cronbach's alpha presents an estimate of reliability based on the inter-correlations among constructs (Cronbach, 1971). Composite reliability also increases the reliability by considering the divergence in each construct's items. Both tests were conducted in the current study to provide reliable results. A Cronbach's alpha value that is greater than 0.80 shows that constructs are reliable (Cronbach, 1971). Table 5.21 shows that most of the constructs reported satisfactory Cronbach's alpha values of higher than 0.80 (Fornell & Larcker, 1981).

Table 5.21: Reliability Test Results

Constructs	Composite reliability	Cronbach Alpha
Planning (PLAN)	0.90	0.86
Coordination and control (COD-COL)	0.89	0.85
Connectivity (CN)	0.89	0.75
Compatibility (CN)	0.79	0.62
Technical knowledge and Technological management knowledge (TK-TMK)	0.91	0.88
Business knowledge and data driven sustainability culture BK-DDSC)	0.92	0.89
Sustainability reporting on social media (SRPSM)	0.91	0.85
Sustainability reporting disclosure on Facebook (SRDF)	0.89	0.83
Competitive advantage (CA)	0.91	0.89

Connectivity and compatibility reported Cronbach's alpha values of lower than 0.80, but they were retained in the model because their composite reliability values were

above 0.80. Ramayah et al. (2018) suggested that composite reliability values ranging from 0.70 to 0.90 are satisfactory. It can thus be concluded that the construct measurements in the current study were reliable.

The purpose of assessing the validity of constructs is to ensure that they measure what they were designed to measure (Kline, 2013). The current study used convergent validity and discriminant validity tests to conduct validity assessment, as recommended by Hair et al. (2016). Convergent validity is the degree of correlation between measures of a construct (Urbach & Ahleman, 2010). It is assessed using factor loadings and average variance extracted (AVE). Factor loadings examine the extent to which the indicator is consistent with its measurement, and AVE is the mean value of the squared loadings of the indicators of a construct (Hair et al., 2014). Hair et al. (2010) suggested the minimum value of items loadings of 0.70. Table 5.20 shows that except for CP3, all the other constructs recorded satisfactory loadings of above 0.70. There results showed that the latent variables explained at least 50% of the indicator's variance (Hair et al., 2010). CP3 reported loading of 0.59, which was below the threshold value of 0.70. According to Byrne (2016), item loading equal to or higher than 0.60 is acceptable if the AVE value is also close to 0.60. Since the AVE value for CP3 was close to 0.60, CP3 was retained in the model. Hence, all the constructs' values satisfied the thresholds for factor loadings and AVE, as shown in Table 5.22 below.

Table 5.22: Convergent Validity Results for First-Order Constructs (*n* = 100)

Constructs	Label	Factor loadings	AVE
Planning (PLAN)	PLAN1	0.74	0.64
	PLAN2	0.82	
	PLAN3	0.77	
	PLAN4	0.84	
	PLAN5	0.81	
Coordination and control (COD-COL)	COD1	0.80	0.57
	COD2	0.73	
	COD3	0.73	
	COL1	0.80	
	COL2	0.75	
	COL3	0.71	
Connectivity (CN)	CN3	0.90	0.80
	CN4	0.88	
Compatibility (CP)	CP1	0.78	0.57
	CP2	0.86	
	CP3	0.59	
Technical knowledge and Technological management knowledge (TK-TMK)	TK1	0.80	0.63
	TK2	0.78	
	TK3	0.80	
	TMK1	0.78	
	TMK2	0.84	
	TMK3	0.76	
Business knowledge and Data-driven sustainability culture (BK-DDSC)	BK2	0.80	0.65
	BK3	0.84	
	BK4	0.81	
	DDSC2	0.82	
	DDSC3	0.80	
	DDSC5	0.76	
Sustainability reporting on social media (SRPSM)	SRPSM1	0.89	0.77
	SRPSM2	0.86	
	SRPSM3	0.89	
Sustainability reporting disclosure on Facebook (SRDF)	Economic	0.89	0.74
	Social	0.90	
	Environment	0.77	
Competitive advantage	CA1	0.78	0.64
	CA2	0.73	
	CA3	0.81	
	CA4	0.87	
	CA5	0.82	
	CA6	0.80	

Discriminant validity examines the extent to which each construct is differentiated from the other constructs used in a study. Discriminant validity analysis is a precondition for analysing the latent variables (Henseler et al., 2016). The literature

recommends three methods for assessing discriminant validity, namely Fornell Larcker's criterion (1981), cross loading criterion, and hetrotrait-monotrait (HTMT) ratio of correlations. All the three recommended tests for discriminant validity were applied in the current study. The criterion for the Fornell and Larcker test assessment is that each construct must have the highest value with its own construct on the diagonal and off-diagonal (Ramayah et al., 2018). Table 5.23 below shows the Fornell and Larcker values in the current study. The top values on the diagonal were higher than all other values horizontally and vertically. Hence, discriminant validity was achieved.

Table 5.23: Fornell and Larcker Test Results for First-Order Constructs

		1	2	3	4	5	6	7	8	9
1	PLAN	**0.80**								
2	COL-COD	0.52	**0.75**							
3	CN	0.45	0.56	**0.89**						
4	CP	0.45	0.61	0.51	**0.75**					
5	TK-TMK	0.41	0.69	0.48	0.62	**0.79**				
6	BK-DDSC	0.72	0.61	0.54	0.52	0.61	**0.81**			
7	SRPSM	0.73	0.49	0.41	0.46	0.36	0.69	**0.88**		
8	SRDF	0.14	0.20	0.11	0.21	0.24	0.30	0.25	**0.86**	
9	CA	0.68	0.52	0.48	0.53	0.45	0.75	0.72	0.26	**0.80**

PLAN = Plan; COL-COD = Control and coordination; CN = Connectivity; CP = Compatibility; TK-TMK = Technical knowledge and technological management knowledge; BK-DDSC = Business knowledge and data-driven sustainability culture; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability disclosures on Facebook; CA = Competitive advantage.

Many studies have criticised the use of Fornell and Larcker test for assessing discriminant validity (Radomir & Moisescu, 2019; Ramayah et al., 2017). Ringle et al. (2020) suggested an alternative approach to verifying discriminant validity, known as the multi-trait and multi-method matrix or HTMT ratio of correlations. The HTMT ratio measures the correlation between two constructs. Henseler et al. (2015) opine that the HTMT ratio yields higher specificity and sensitivity rates (97%–99%) compared to other discriminant validity methods, i.e., Fornell and Larcker and cross loadings. In the current study, the initial results of the HTMT ratio demonstrated the problem of discriminant validity, indicating that the respondents were not able to distinguish between certain constructs.

The discriminant validity issue can be solved using the various measures suggested by Hair et al. (2017) and Ramayah et al. (2017). Ideally, highly correlated indicators must be merged into one construct. This approach has the theoretical backing of measurement theory, which suggests merging two strongly related constructs. If merging is not possible, highly correlated indicators must be eliminated from the study. However, the total indicators eliminated must not exceed 20% of the total indicators in the model. Considering the treatment guidelines for discriminant validity provided by Hair et al. (2017), the current study merged control with coordination, technical knowledge with technological management knowledge, and business knowledge with data-driven sustainability culture. Also, following Hair et al. (2017), CN1, CN2, BK1, DDSC1, DDSC4, TMK4 TK4, and TK5 were eliminated to improve discriminant validity.

After merging and eliminating the highly correlated constructs, the discriminant validity improved significantly. Finally, Gold et al. (2001) suggested that the HTMT values must be under 0.90. Table 5.24 shows that all values were below 0.90, indicating the constructs were distinct from each other. Hence, discriminant validity was established.

Table 5.24: HTMT Ratio Results for First-Order Constructs

		1	2	3	4	5	6	7	8	9
1	PLAN									
2	COD_COL	0.60								
3	CN	0.56	0.70							
4	CP	0.63	0.83	0.70						
5	TK-TMK	0.48	0.79	0.59	0.83					
6	BK-DDSC	0.82	0.71	0.66	0.70	0.69				
7	SRPSM	0.85	0.57	0.51	0.62	0.42	0.80			
8	SRDF	0.17	0.23	0.13	0.30	0.28	0.31	0.28		
9	CA	0.78	0.60	0.59	0.73	0.51	0.84	0.82	0.28	

PLAN = Plan; COL-COD = Control and coordination; CN = Connectivity; CP = Compatibility; TK-TMK = Technical knowledge and technological management knowledge; BK-DDSC = Business knowledge and data-driven sustainability culture; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage.

The purpose of using cross-loadings is to confirm that each item loads on its own construct more than on the other constructs by row and by column. In other words, the loading on the individual construct must be higher than on the other constructs. In Table 5.25, the values in bold represent the loadings of items on their respective constructs. Based on the 'by row and by column' rule of thumb, all the items loaded higher on their own constructs. Hence, discriminant validity was established.

Table 5.25: Cross Loadings Results for First-Order Constructs

	PLAN	COL-COD	CN	CP	TK-TMK	BK-DDSC	SRPSM	SRDF	CA
PLAN1	**0.75**	0.46	0.35	0.22	0.34	0.58	0.60	0.17	0.49
PLAN2	**0.82**	0.52	0.39	0.49	0.35	0.59	0.60	0.07	0.58
PLAN3	**0.77**	0.32	0.31	0.26	0.42	0.57	0.53	0.12	0.52
PLAN4	**0.85**	0.41	0.38	0.37	0.28	0.61	0.55	0.08	0.53
PLAN5	**0.81**	0.39	0.38	0.43	0.29	0.55	0.66	0.13	0.62
COD1	0.43	**0.80**	0.39	0.41	0.40	0.39	0.34	0.09	0.30
COD2	0.27	**0.73**	0.44	0.30	0.44	0.38	0.20	0.15	0.25
COD3	0.34	**0.73**	0.46	0.36	0.35	0.44	0.30	0.09	0.36
COL1	0.52	**0.80**	0.50	0.58	0.74	0.58	0.49	0.19	0.53
COL2	0.40	**0.75**	0.42	0.45	0.66	0.57	0.47	0.32	0.49
COL3	0.42	**0.72**	0.35	0.64	0.51	0.44	0.42	0.08	0.45
CN3	0.45	0.53	**0.91**	0.51	0.39	0.50	0.44	0.14	0.47
CN4	0.35	0.49	**0.89**	0.42	0.48	0.44	0.29	0.06	0.40
CP1	0.33	0.41	0.52	**0.78**	0.45	0.39	0.38	0.14	0.46
CP2	0.35	0.56	0.43	**0.87**	0.58	0.45	0.38	0.16	0.36
CP3	0.38	0.41	0.15	**0.60**	0.37	0.36	0.26	0.22	0.41
TK1	0.34	0.57	0.38	0.52	**0.81**	0.36	0.26	0.20	0.31
TK2	0.32	0.50	0.40	0.46	**0.78**	0.52	0.32	0.13	0.37
TK3	0.34	0.55	0.32	0.41	**0.80**	0.52	0.29	0.18	0.33
TMK1	0.21	0.50	0.45	0.57	**0.78**	0.49	0.27	0.24	0.43
TMK2	0.38	0.63	0.36	0.56	**0.84**	0.54	0.35	0.28	0.42
TMK3	0.37	0.55	0.38	0.46	**0.76**	0.49	0.26	0.14	0.31
BK2	0.60	0.51	0.44	0.39	0.56	**0.81**	0.51	0.25	0.57
BK3	0.58	0.49	0.41	0.55	0.49	**0.85**	0.57	0.26	0.67
BK4	0.55	0.47	0.45	0.47	0.51	**0.81**	0.58	0.31	0.64
DDSC2	0.60	0.45	0.47	0.40	0.46	**0.82**	0.59	0.23	0.60
DDSC3	0.59	0.56	0.42	0.41	0.42	**0.80**	0.60	0.18	0.62
DDSC5	0.60	0.53	0.47	0.32	0.55	**0.77**	0.55	0.25	0.56
SR1	0.66	0.46	0.42	0.42	0.29	0.61	**0.89**	0.13	0.66
SR2	0.67	0.49	0.37	0.40	0.34	0.62	**0.86**	0.27	0.62
SR3	0.61	0.34	0.29	0.39	0.35	0.61	**0.89**	0.28	0.62

Table 5.25: Continued

	PLAN	COL-COD	CN	CP	TK-TMK	BK-DDSC	SRPSM	SRDF	CA
Economic	0.17	0.16	0.11	0.26	0.17	0.30	0.28	**0.89**	0.27
Environmental	0.03	0.13	0.05	0.12	0.19	0.17	0.21	**0.77**	0.13
Social	0.15	0.22	0.12	0.17	0.28	0.31	0.18	**0.90**	0.26
CA1	0.52	0.36	0.44	0.37	0.28	0.51	0.58	0.30	**0.78**
CA2	0.51	0.47	0.27	0.46	0.36	0.51	0.58	0.16	**0.73**
CA3	0.55	0.39	0.34	0.43	0.38	0.64	0.52	0.26	**0.81**
CA4	0.59	0.50	0.44	0.47	0.41	0.73	0.62	0.20	**0.87**
CA5	0.52	0.39	0.41	0.38	0.30	0.59	0.58	0.25	**0.83**
CA6	0.62	0.43	0.43	0.46	0.47	0.65	0.61	0.11	**0.80**

Note: PLAN = Plan; COL-COD = Control and coordination; CN = Connectivity; CP = Compatibility; TK-TMK = Technical knowledge and technological management knowledge; BK-DDSC = Business knowledge and data-driven sustainability culture; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage.

5.5.2 Reliability and Validity Assessment-First-Order Formative Constructs

Different protocols are used to assess the formative constructs and the reflective constructs. The absence or presence of multicollinearity in the formative constructs must be verified (Peng & Lai, 2012). A high correlation in the formative constructs indicates that some indicators may be redundant. This scenario can affect the structural model results by increasing the standard error and reducing the capability to illustrate that actual weights are distinct from zero (Hair et al., 2017).

The standard method used to identify multicollinearity in the formative constructs is VIF assessment (Thompson et al., 2017). The weights and outer loadings are also checked to identify which constructs must be retained in the model. For the current study, Table 5.26 shows that the VIF values were below the stringent criterion of 3.33, as suggested by Kalnins (2018). Hence, multicollinearity was not an issue for the current study's formative constructs.

Table 5.26: First-Order Formative Constructs

Indicators	Loading	Weight	p-values loadings	p-values weights	VIF
Activity	0.10	-0.12	0.74	0.68	1.16
Certainty	0.70	0.51	0.20	0.21	1.18
Commonality	0.66	0.40	0.07	0.08	1.19
Optimism	0.39	0.28	0.22	0.30	1.15
Realism	-0.71	-0.40	0.17	0.25	1.35

Although the formative constructs shown in Table 5.26 recorded insignificant weights, it does not necessarily mean that the constructs were measuring the required variables poorly. Hair et al. (2019) suggested offered several justifications for being careful in deleting the formative constructs based solely on statistical outcomes. First, the weights of the formative constructs are based on the number of indicators. The higher the number of indicators, the lower the weights. Thus, the weights of formative constructs have a limited chance of achieving statistical significance (Cenfetelli & Bassellier, 2009). Second, the formative measurement theory requires the indicators of a

study to fully capture the meaning of the constructs as conceptualised in the study. Last, compared to reflective indicators, formative indicators are non-interchangeable, and their removal from the model can compromise the content validity (Diamantopoulos & Winklhofer, 2001). Based on the justifications provided by Hair et al. (2019), all the formative indicators were retained in the current study.

5.5.3 Assessment of Second-Order Constructs

The current study's independent variable (BDAC) is a third-order latent variable with three sub-dimensions namely, BDA management, infrastructure, and personnel capabilities. SmartPLS uses a repeated indicator approach to estimate a higher-order model. This approach entails repeating the first-order indicators in the second and third-order constructs. Although the first-order constructs have been assessed for validity and reliability, it is recommended to also test the second-order constructs for reliability and validity. Hence, factor loadings, composite reliability, and AVE were assessed to confirm the validity and reliability of the second-order constructs. As Table 5.27 below shows, BDA management capability, BDA infrastructure capability, and BDA personnel capability recorded factor loadings of 0.85–0.90, which were above the threshold of 0.70 (Hair et al., 2017). Likewise, the composite reliability values were also above 0.70, indicating that the constructs were reliable. Similarly, the AVE values demonstrated that the current study's second-order constructs were valid.

Table 5.27: Convergent Validity Result for Second-Order Constructs (*n* = 100)

3rd order	2nd order	1st order	Factor loading	Composite reliability	AVE
BDAC	BDA management capability	PLAN	0.86	0.86	0.87
		COD-COL	0.89		
	BDA infrastructure capability	CN	0.85	0.86	0.87
		CP	0.88		
	BDA personnel capability	TK-TMK	0.89	0.89	0.90
		BK-DDSC	0.90		

The validity and reliability of the second-order constructs were also examined using the bootstrap function in SmartPLS. In Table 5.28, the T- and P-values denoted

the presence of significant relationships between the second-order constructs and their third-order construct (BDAC). The beta value indicated each construct's contribution to its higher-order construct. BDA personnel capability obtained the highest beta value of 0.94, followed by BDA management capability (0.92) and lastly, BDA infrastructure capability (0.81). Hence, infrastructure capability contributed the least in developing BDA into a capability. The low contribution of BDA personnel capability to BDAC in Malaysia could be due to the process of full BDAC implementation was still ongoing (Wong et al., 2015).

Table 5.28: Test of Second-Order Constructs using Bootstrapping Function

	Beta	T-value	P-value
BDA management capability	0.92	57.33	0.000*
BDA infrastructure capability	0.81	20.50	0.000*
BDA personnel capability	0.94	79.32	0.000*

*Significance at $p<0.05$

5.6 Structural Model

Structural Equation Modelling (SEM) combines factor analysis, direct effect, indirect effect, and multiple regression to examine the complex relationships between the independent and dependent variables. SEM is a confirmatory technique used to test and determine the validity and fitness of the proposed model (Hooper et al., 2008). SmartPLS 3.0 was used to assess the structural model in the current study. SmartPLS is a powerful and widely used software package to assess structural models (Ringle et al., 2015; do Nascimento & da Silva Macedo, 2016). The current study estimated the structural model by investigating the path coefficients, R2, of the dependent variable and significance values (t-value and p-value). Additionally, the strength of the relationships between the proposed variables was examined using effect size and predictive relevance.

5.6.1 Test of Direct Paths

Path analysis based on linear regression analysis is widely used in accounting research. Hair et al. (2010) defined path analysis as a technique that utilises bivariate correlations to measure the relationships among the variables of a study. Path coefficient is also known as standardised regression coefficient (beta). It evaluates the complex relationships among variables (Fuller et al., 2016; Podsakoff et al., 2003). Evaluating variables by using path analysis provides details of their relationships via size, direction, and the significance of the hypothesised paths. In SmartPLS 3.0, the bootstrap function is used to conduct the path analysis. Bootstrapping uses the original dataset to generate new random samples of the same size. This technique assesses reliability and the significance of the path coefficients (Chin, 1998).

Table 5.29 shows the path coefficients and p-values. The beta value of H1a manifests that a one-unit increase in BDAC will cause an increase of 0.65 units (66%) in SRPSM. Similarly, a one-unit increase in SRPSM will cause a change of 0.69 units (70%) in competitive advantage. A one-unit change in BDAC will cause a change of 0.31 units (39%) in SRDF, and a one-unit change in SRDF will cause a change of 0.09 units (8%) in competitive advantage. These values showed that BDAC had a greater impact on SRPSM than on SRDF. Likewise, SRPSM had a greater impact than SRDF did on competitive advantage.

Table 5.29: Results of Direct Paths

Hypotheses	Path	Path coefficient (beta)	SE	t-value	p-value	Decision
H1a: There is a positive association between BDAC and SRPSM.	BDAC→ SRPSM	0.65	0.08	8.05	0.000*	Supported
H1b: There is a positive association between BDAC and SRDF.	BDAC→ SRDF	0.31	0.09	3.22	0.001*	Supported
H3a: There is a positive association between SRPSM and the competitive advantage of a firm.	SRPSM →CA	0.69	0.05	13.86	0.000*	Supported
H3b: There is a positive association between SRDF and the competitive advantage of a firm.	SRDF→ CA	0.09	0.07	1.23	0.21*	Not Supported

*Significance at p<0.05. BDAC = Big data analytics capabilities; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage.

Based on the p-value, BDAC had a significant impact on SRPSM (p-value = 0.00). Similarly, SRPSM had a significant impact on competitive advantage (p-value = 0.00). Hence, hypotheses H1a and H3a were supported. The p-value of 0.00 for H1b showed that BDAC significantly impacted SRDF. However, the p-value of 0.09 for H3b showed an insignificant relationship between SRDF and competitive advantage.

One of the necessary evaluation tests for the structural model is the coefficient of determination (R2). It is defined as the collective impact of the exogenous variables on the endogenous variable (Hair et al., 2016). The R2 value measures the amount of variance caused by an independent variable on the dependent variable. Hair et al. (2016) opines that assessing the structural model based of R2 alone is not sufficient. Hence, the adjusted R2 can be used to avoid bias in a complex model. In SmartPLS, the algorithm function generates the values of R2 and adjusted R2. The rule of thumb for interpreting R2 is provided by Henseler et al. (2009) and Hair et al. (2011). They categorised the

variance caused by an independent variable on the dependent variable into weak (<0.25), moderate (0.25–0.50), and substantial (0.50–0.70). The current study's R2 values are presented in Table 5.30. SRPSM reported an adjusted R2 value of 0.46, indicating that BDAC moderately explained variance in SRPSM. The adjusted R2 for SRDF (0.08) showed that BDAC caused a weak variance in SRDF. The adjusted R2 value of 0.51 for competitive advantage demonstrated that the variance in competitive advantage was moderately explained by SRPSM and SRDF.

Table 5.30: Coefficient of Determination (R^2) Results

	R^2	Adjusted R^2
SRPSM	0.47	0.46
SRDF	0.10	0.08
CA	0.52	0.51

Note: SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage.

In the structural model, it is important to consider the effect size in addition to the p-values (Lowry & Gaskin, 2014). Even if the p-value is significant, the relationship between the independent and dependent variables may be weak. In other words, effect size estimates the importance of the difference between the observed variables. In parallel to R2, according to the guidelines provided by Hair et al. (2017), the effect size values of 0.02, 0.15, and 0.35 indicate small, medium, and substantial effects, respectively (Cohen, 1988). In SmartPLS, the algorithm function is used to obtain the effect size values. Table 5.31 shows that BDAC had a large effect of 0.76 on SRPSM (>0.35). SRPSM's effect on competitive advantage was also large, as shown by the effect size of 0.97. The large effect size value is consistent with the significant p-value for H1a. The effect sizes of BDAC on SRDF and SRDF on competitive advantage were 0.10 and 0.01, respectively. Both values are close to the small effect size criterion of 0.02. A possible explanation for the wide difference between the effect sizes of SRPSM and SRDF is that measuring variables based on data from the web-based questionnaire

incorporates respondents' perceptions. However, when secondary data is used to measure the dependent variable, respondents' perceptions are not included.

Table 5.31: Results of Effect Size (f^2)

	SRPSM	SRDF	CA
BDAC	0.76	0.10	
SRPSM			0.97
SRDF			0.01

Note: BDAC= Big data analytics capabilities; SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook; CA = Competitive advantage

Predictive relevance is a non-parametric measure used to investigate a model's predictive ability (Nitzl & Chin, 2017). In SmartPLS, the blindfolding option is used to determine the predictive ability of a model. A Q2 value that exceeds zero indicates a higher predictive ability of the model (Hair et al., 2011). The results presented in Table 5.32 are consistent with the R2 and f2 values of the current study.

Table 5.32: Results of Predictive Relevance (Q^2)

	SSO	SSE	Q^2 (=1-SSE/SSO)
BDAC	2800	2800	
SRPSM	300	193.52	0.35
SRDF	300	274.05	0.08
CA	600	400.67	0.33

The Q2 value of 0.35 for SRPSM showed strong predictive ability, but the Q2 value of 0.05 for SRDF demonstrated weak predictive ability. This large difference again reflects the difference between the respondents' answers to the web-based questionnaire and the secondary data collected through Facebook.

5.6.2 Test of Moderation

A moderator variable is a third variable that changes the impact of the predictor on the dependent variable (Memon et al., 2019). The moderator variable was introduced in the current study because empirical evidence in the literature suggests a position relationship between top management's non-verbal tone and sustainability reporting (e.g., Vasylieva et al., 2017; Lozano et al., 2016). Ramayah et al. (2018) recommended using a two-stage approach in SmartPLS when a model includes a formative construct

(Henseler & Chin, 2010). This approach harvests higher statistical power and presents the most accurate estimations compared to other moderation approaches (Ramayah et al., 2018). In the two-stage approach, moderation is analysed by forming an interaction term. Since the current study's moderator variable, tone at the top, is formative, the two-stage approach was used for the analysis. Before proceeding to the moderation analysis, the prerequisites of a formative variable were achieved in the measurement model presented in the current study (see subsection 5.5.2).

Table 5.33 presents the results for the moderation analysis. The p-value of 0.28 for H2a denoted insignificant moderation. It showed that tone at the top did not strengthen the relationship between BDAC and SRPSM, i.e., there was no moderating effect. Likewise, for H2b, the p-value of 0.12 depicted that tone at the top did not strengthen the relationship between BDAC and SRDF. Thus, tone at the top did not moderate the link between BDAC and SRSM.

Table 5.33: Results of Moderation Analysis

Hypotheses	Path	Beta	SD	t-value	P-value
H2a: Tone at the top will strengthen the relationship between BDAC and SRPSM*.	BDAC*TONE AT THE TOP→SRPSM	0.04	0.08	0.58	0.28*
H2b: Tone at the top will strengthen the relationship between BDAC and SRDF.	BDAC*TONE AT THE TOP→SRDF	0.22	0.19	1.13	0.12*

*Significance at p<0.05. BDAC= Big data analytics capabilities SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook

Ramayah et al. (2018) recommended analysing the R2 values to measure the change in the relationship between the independent and dependent variables that is caused by the moderator. Table 5.34 illustrates the changes in the R2 values caused by tone at the top as the moderator. R2 and R2 changed did not reflect any change for both SRPSM and SRDF, showing that the inclusion of tone at the top as a moderator had no significant impact.

Table 5.34: Change in R^2 Due to Moderation

	R^2	R^2 Changed
SRPSM	0.47	0.47
SRDF	0.10	0.16

Note: SRPSM = Sustainability reporting perception on social media; SRDF = Sustainability reporting disclosure on Facebook

The model of the current study after including the interaction terms is shown in Figure 5.2.

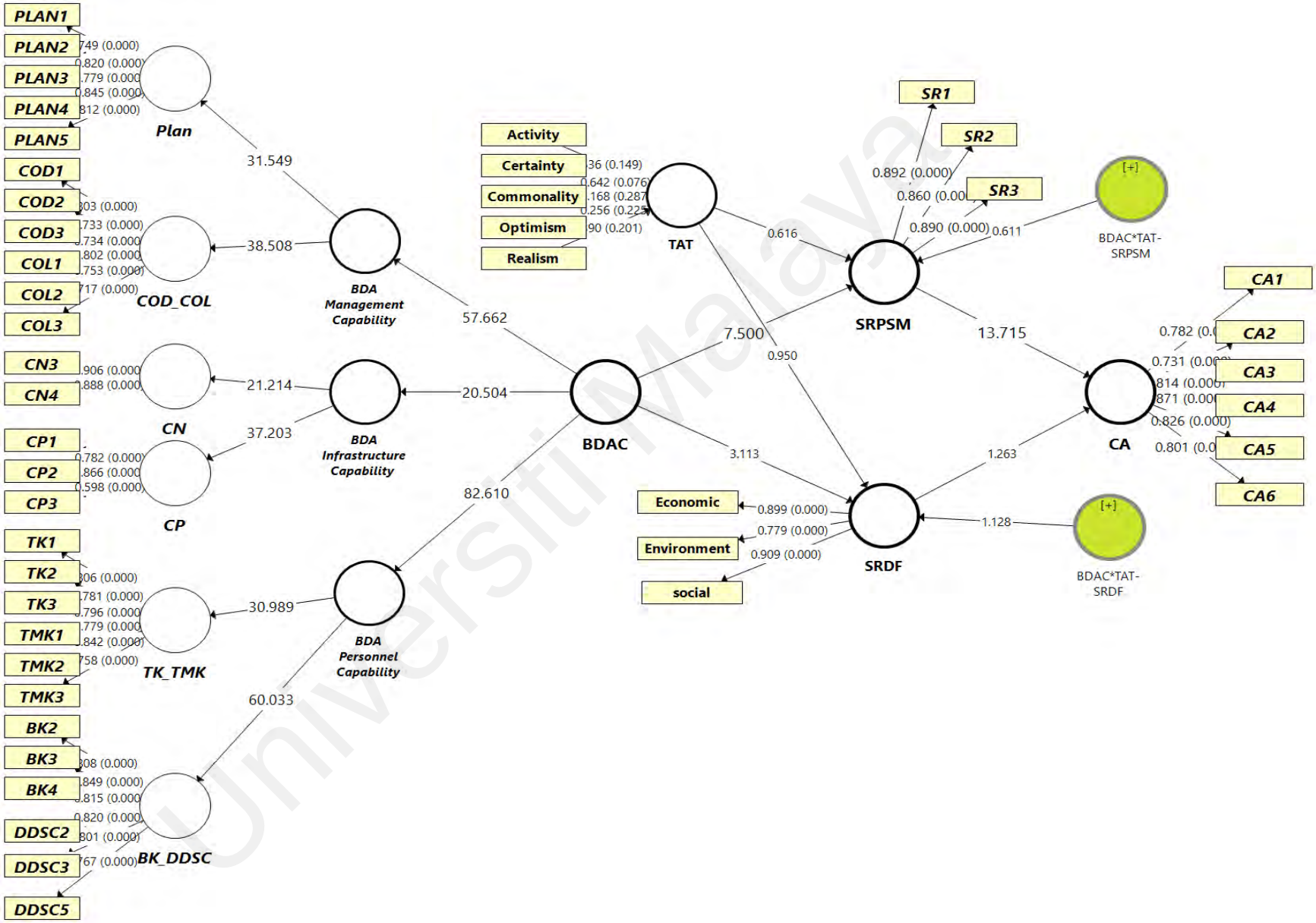


Figure 5.2: Research Model with Interaction Term

5.6.3 Hypothesis Testing Results

Hypotheses were developed based on the theoretical framework of the current study. A statistical analysis was performed to analyse the significance of the proposed hypotheses. The hypotheses were tested using path coefficients (beta), *p*-values, and *t*-values attained by stimulating 5,000 iterations using the SmartPLS bootstrap function. A summary of the hypothesis results is shown in Table 5.35.

Table 5.35: Summary of Hypothesis Results

Research Objectives	Hypotheses	Path	Beta	P-value	Decision
1. To investigate the impact of big data analytics capabilities implementation on sustainability reporting through social media.	**H1a:** There is a positive association between BDAC and SRPSM.	BDAC→ SRPSM	0.66	0.00*	Supported
	H1b: There is a positive association between BDAC and SRDF.	BDAC→ SRDF	0.39	0.00*	Supported
2. To investigate the moderation of tone at the top between big data analytics capabilities and sustainability reporting through social media.	**H2a:** Tone at the top will strengthen the relationship between BDAC and SRPSM.	BDAC* TONE AT THE TOP→ SRPSM	0.01	0.89*	Not supported
	H2b: Tone at the top will strengthen the relationship between BDAC and SRDF.	BDAC* TONE AT THE TOP →SRDF	0.15	0.49*	Not supported
3. To examine the impact of sustainability reporting through social media on the competitive advantage of a firm.	**H3a:** There is a positive association between SRPSM and the competitive advantage of a firm.	SRPSM →CA	0.70	0.000 *	Supported
	H3b: There is a positive association between SRDF and the competitive advantage of a firm.	SRDF→ CA	0.08	0.29*	Not supported

*Significance at p<0.05.

For H1a, a positive relationship was obtained between BDAC and SRPSM (p = 0.00). For H1b, a positive relationship was also obtained between BDAC and SRDF (p = 0.001). The current study concludes that overall, BDAC has a significant relationship

with SRSM in the case of Malaysian public firms. Tone at the top was added as a moderator in the current study. Two successive hypotheses were developed to examine if tone at the top strengthens the relationship between BDAC and SRSM. Based on the hypothesis results for H2a and H2b presented in Table 5.35, tone at the top had no moderation impact. In parallel to the p-value, the beta coefficient of the subsequent hypothesis also showed that tone at the top did not strengthen the relationship between BDAC and SRSM. Hence, H2a and H2b were not supported. Competitive advantage was examined as a dependent variable in the current study. The results showed that SRPSM significantly impacted competitive advantage. Hence, H3a was supported. In contrast, SRDF had an insignificant impact on competitive advantage. Thus, H3B was not supported.

5.6.4 Structural Model with Control Variables

Six control variables were added in the current study, namely, firm age, firm size, consumer proximity, industry type, profitability, and leverage. These variables were included based on evidence in the literature regarding their impact on sustainability reporting (e.g., Oncioiu et al., 2020; Buallay, 2019). The control variables were also included to measure the relationship between BDAC and SRSM accurately and to avoid skewness in the results. According to Allen (2017), control variables can help determine the accurate impact of an independent variable on a dependent variable. Hence, the six variables were introduced as control variables in the current study.

Among these six control variables, only profitability significantly impacted SRPSM (p-value = 0.002). ROA was used to operationalise profitability. The path coefficient value for profitability implies that one standard deviation change in profitability will cause a 10% change in SRPSM. This result indicates that profitable public firms in Malaysia tend to disclose more information related to sustainability on social media platforms. This finding is consistent with other studies conducted in

America and South Korea (Laskar, 2019; Whetman, 2017). All the other variables had an insignificant role as control variables. The values of coefficient of determination, R2, before and after introducing the control variables should be compared. Table 5.36 shows a slight increase in the R2 value by 0.52 for SRPSM. However, there was no notable change for SRDF. The path coefficients and p-values pertaining to SRPSM and SRDF are presented for the control variables (see Table 5.36).

Table 5.36: Path Coefficients and *P*-values for Control Variables

Control variables		Path coefficients	P-values
Firm age	SRPSM*	-0.09	0.22*
	SRDF **	0.01	0.73*
Firm size	SRPSM	-0.04	0.55*
	SRDF	0.03	0.73*
Profitability	SRPSM	0.10	**0.02***
	SRDF	-0.08	0.95*
Leverage	SRPSM	-0.10	0.10*
	SRDF	0.03	0.68*
Consumer proximity	SRPSM	0.08	0.30*
	SRDF	-0.08	0.43*
Industry type	SRPSM	0.10	0.16*
	SRDF	0.08	0.37*
R^2 for SRPSM=0.52 **R^2 for SRDF=0.15**			

*Significance at p<0.05. Note: *DV is measured from the questionnaire data (SRPSM) **DV is measured from the content analysis of Facebook (SRDF)

5.7 Additional Analyses

Additional analyses of SRDF and tone at the top's moderation between BDAC and SRSM was performed on SmartPLS. The dependent variable of the current study, SRDF, which was measured using content analysis, was further examined in the context of industry type and consumer proximity. The aim was to investigate any differences in the voluntary disclosures on Facebook among the sample firms. The descriptive results obtained from SPSS and SmartPLS 3.0 were used for multi-group analysis.

5.7.1 Multi-Group Analysis (MGA)

Another way to analyse moderating effects in path models is multiple group analysis (MGA), which is especially useful for discrete moderator variables. Group

comparisons are also used in CBSEM environments (J¨oreskog, 1971), but can also be applied in PLS (Chin, 2000). Basically, a discrete moderator variable can be interpreted as dividing the data into groups of subsamples. The same PLS path model can then be estimated in each of the distinct subsamples. CBSEM models usually report having used different measures for global fit (based on their hard distributional assumptions), which allows for a statistical assessment of the group differences in terms of the structural invariance between the groups. This approach is an easy-to apply instrument for testing discrete moderators.

The current study performed MGA to analyse the possible difference in SRDF between environmentally sensitive and non-environmentally sensitive firms and between high social visibility and low social visibility firms. First, data were categorised into two sets of groups. In Group 1, Group A included environmentally sensitive firms and Group B included non-environmentally sensitive firms. In Group 2, Group A consisted of firms with high social visibility (household goods and textiles, beverages, food and drug retailers, telecommunications, electricity, gas distribution and water) and Group B comprised firms with low social visibility (all other sectors that are not included in Group A).

Measurement invariance of composite models (MICOM) analysis was done to confirm the model fit before performing MGA. According to Vinzi et al. (2010, p. 504), "the loadings and weights of the… constructs' measurement model must not differ significantly within the model". Hair et al. (2017) stated that MICOM analysis is important because "variations in the structural relationship between latent variables could stem from different meanings, the groups' respondents attribute to the phenomena being measured, rather than the true differences in the structural relationships". Henseler et al. (2016) established a three-step procedure for assessing MICOM when using PLS-SEM. Step one examines the configural invariance, step two examines the

compositional invariance, and in step three, the equality of composite mean values and variance is tested.

The requirements for steps one and two must be met to eliminate possible issues in the model or data. The requirements for step one include identical indicators, data treatment, and algorithm settings or criteria across groups. In SmartPLS, step one is automatically calculated via the measurement model. However, dividing data into two or more groups requires careful consideration. The sample size of each group should be in line with the guidelines provided by Cohen (1992). Based on Cohen's (1992) guidelines, at a 5% significance level and a minimum R2 value of 0.50, the minimum sample size for the current study should be 26. This condition was fulfilled when the dataset was divided into subsets. The original correlation with the 5% quantile was examined to establish the compositional invariance in step two. Compositional invariance is established if the correlation values are greater than the 5% quantile. However, if the values are below the 5% quantile, measurement invariance is not established. Table 5.37 shows that both industry type and consumer proximity subsets attained the original correlation values of greater than the 5% quantile. Thus, composite invariance was established where p-values were also insignificant. After validating the absence of discrepancies between the variables in steps one and two, step three was performed to check composite equality. The criterion is that the mean and variance values must fall between the upper and lower limits to establish the full measurement invariance (Henseler et al., 2016). As Table 5.37 shows, the original differences for mean and variance values fell between the lower limit and upper limits. Hence, the current study could proceed with the MGA on the dataset.

Table 5.37: MICOM Results for Steps Two and Three

	Step two				Step three							
	Original Correlation	**5.00%**	**Permutation p-Values**	**Compositional invariance**	**Mean-Original Difference**	**LL 2.5%**	**UL 97.5%**	**Equality of means**	**Variance-Original difference**	**LL 2.5%**	**UL 97.5%**	**Equality of variances**
Industry type (environment sensitive vs non-environment sensitive)												
BDAC	0.999	0.995	0.818	Established	0.387	-0.411	0.433	Equal	-0.39	-0.626	0.748	Established
SRDF	0.946	0.688	0.252	Established	-0.115	-0.418	0.425	Equal	0.087	-0.665	0.813	Established
Consumer proximity (High social visibility vs low social visibility)												
BDAC	0.997	0.996	0.082	Established	0.28	-0.412	0.404	Equal	-0.221	-0.706	0.616	Established
SRDF	0.986	0.786	0.863	Established	-0.119	-0.399	0.393	Equal	-0.244	-0.748	0.636	Established

Note: LL = Lower limit; UL = Upper limit

The MICOM analysis in SmartPLS ensures that the model can be divided into the required subsets to observe any differences. Table 5.38 presents the MGA results. The bootstrap results showed the difference between the path coefficients of the industry type and consumer proximity subsets. For the environmentally sensitive group, BDAC caused a 38.3% change in SRDF, whereas for the non-environmentally sensitive group, BDAC caused a change of 29.5% in SRDF. There was no noticeable difference between both values. The parametric test was used to further examine the difference between these groups, based on the p-value. The p-value of 0.692 showed that there was statistically insignificant difference between environmentally sensitive and non-environmentally sensitive firms in their SRDF.

Table 5.38: MGA Results

Bootstrap results	**Path coefficient**	**p-values**
Environment sensitive	0.383	0.017*
Non-environment sensitive	0.295	0.025*
High visible	0.504	0.000*
Less visible	0.181	0.187*
Parametric test		
Environment sensitive vs non-environment sensitive	0.088	0.692*
Highly social visibility vs Less social visibility	0.323	0.116*

*Significance at p<0.05. Path: BDAC→SRDF

For consumer proximity, Table 5.38 shows a noticeable difference in the SRDF between high and low social visibility firms. The path coefficient value of 0.504 showed that BDAC caused a change of about 50% in SRDF for the high social visibility group. Firms with low social visibility obtained a lower path coefficient value of 0.18 than firms with high social visibility. A comparison between low social visibility and high social visibility groups using the parametric test illustrated that there was no significant difference between these two groups concerning BDAC's impact on SRDF (p-value = 0.116). Perhaps, the small sample size caused the non-noticeable differences between the groups for both industry type and consumer proximity.

5.7.2 Tone at the Top

Each master variable of tone at the top has a different meaning. It is possible that each master variable will differently moderate the relationship between BDAC and SRSM. For this purpose, each master variable of tone at the top was analysed as a moderator separately. Among the five master variables of tone at the top, the impacts of certainty and optimism on sustainability reporting have been analysed in previous literature. Cho et al. (2010) found that firms with certainty in their non-verbal tone tended to disclose more about their sustainability reporting-related indicators. Meanwhile, firms with low sustainability performance were more optimistic in their non-verbal tone. It can be assumed that optimism means less sustainability disclosure thus it may weaken the relationship between BDAC and SRSM. All five master variables of tone at the top were included in the current study to obtain a holistic measurement. However, following Cho et al. (2010), only certainty and optimism were analysed separately as moderator between BDAC and SRSM.

Table 5.39 elucidates the moderating effects of certainty and optimism on the relationship between BDAC and SRPSM. It was found that certainty and optimism in the non-verbal tone of top management neither strengthened nor weakened the relationship between BDAC and SRPSM. However, certainty strengthened the relationship between BDAC and SRDF. Meanwhile, the negative path coefficient value showed that more optimism in the tone caused a decrease in SRDF. These findings are in line with Cho et al. (2010).

Table 5.39: Additional Moderation Results

Paths	Path coefficients	T statistics	P Values	Decision
BDAC*Certainty-SRPSM -> SRPSM	0.203	1.019	0.308*	Not supported
BDAC*Optimism-SRPSM -> SRPSM	0.007	0.101	0.919*	Not supported
BDAC*Certainty-SRDF -> SRDF	0.74	2.025	0.043*	Supported
BDAC*Optimism-SRDF -> SRDF	-0.115	1.1	0.271*	Not supported

*Significance at p<0.05. SRSM measured via SRPSM and SRDF.

Interaction plots were also drawn to visualise the results of the moderation analysis (Dawson, 2014). In Figure 5.3, the green line slope means the relationship moved towards a stronger trend when tone at the top had certainty in their non-verbal communication in annual or sustainability reports. Hence, these firms tended to disclose more about sustainability on Facebook.

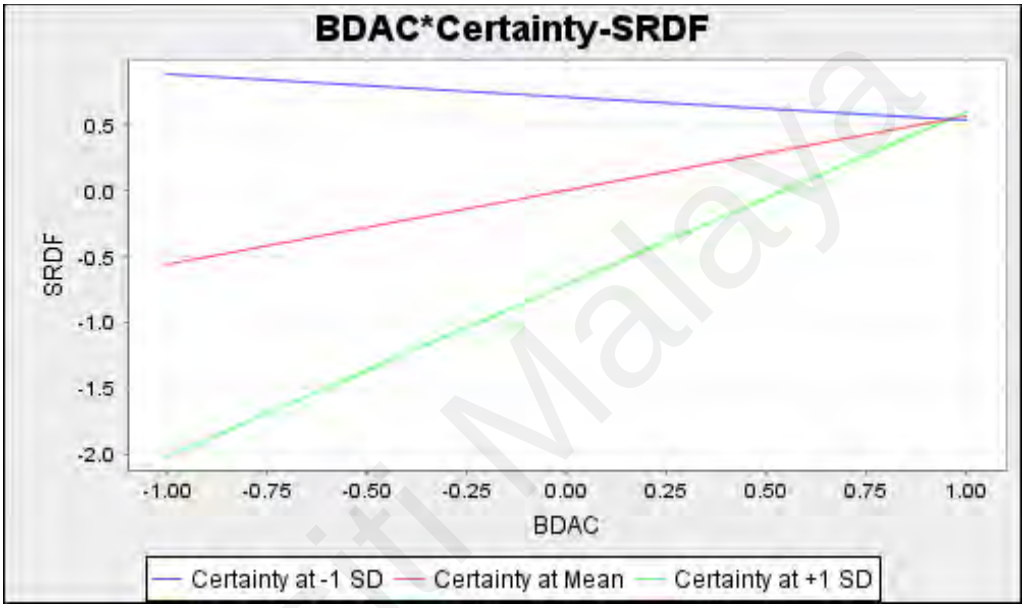


Figure 5.3: Simple Slope Analysis

The interface used in SmartPLS is illustrated in Figure 5.4.

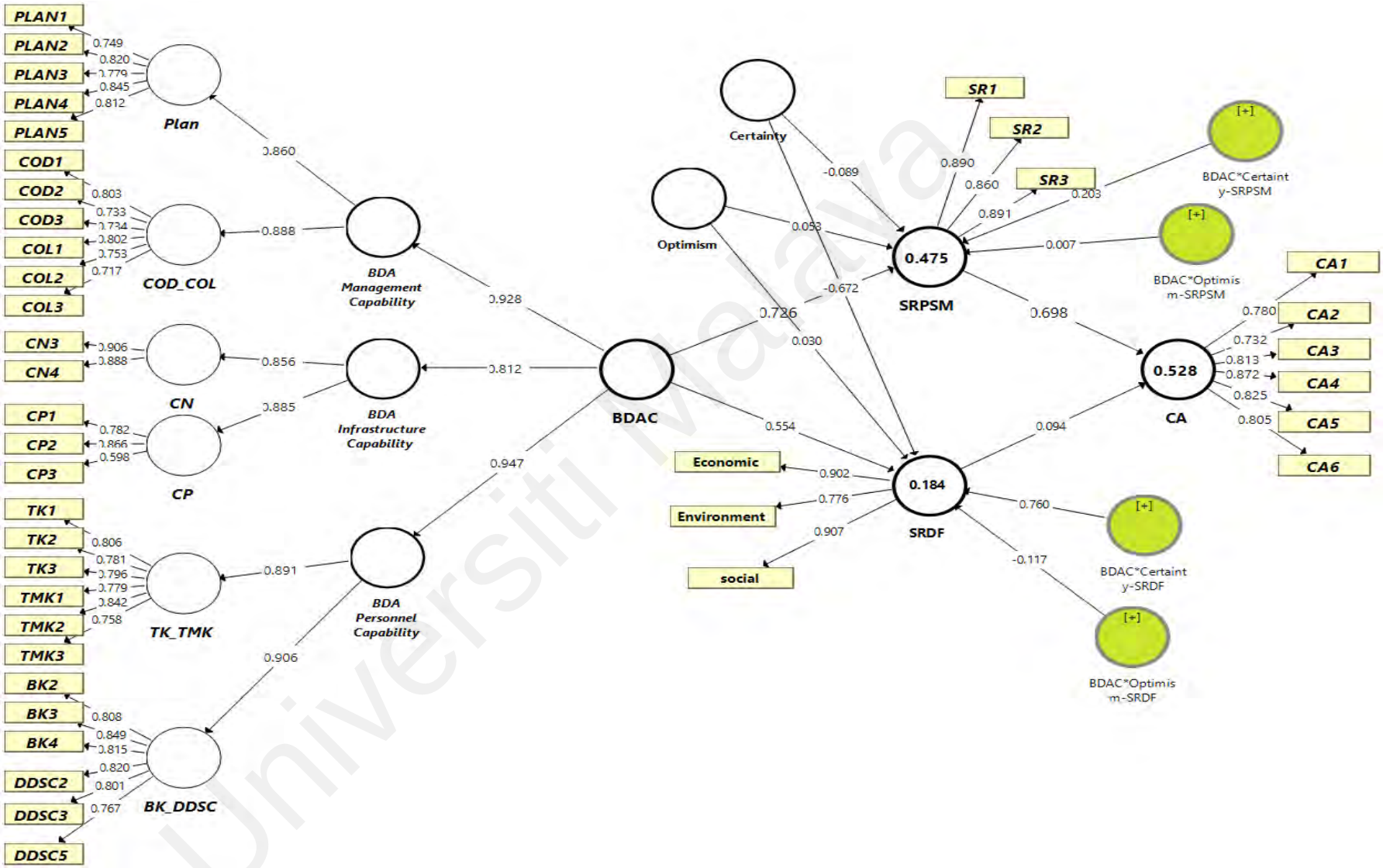


Figure 5.4: Additional Analysis of Tone at the Top Moderation

5.8 Discussion of Results

The current study explored the relationships between the key variables consisting of BDAC, SRSM, tone at the top, and competitive advantage. Six hypotheses were developed to test the direct relationships and moderation effects to answer the three research questions. Three direct hypotheses (H1a, H1b, H3a) were supported, and one direct hypothesis (H3b) was not supported. None of the hypotheses for moderation was supported (H2a and H2b). The indications and interpretations produced from the current study's results are discussed in the forthcoming sub-sections.

5.8.1 Big Data Analytics Capability (BDAC) and Sustainability Reporting on Social Media (SRSM)

The first research objective of the current study was to analyse the impact of BDAC on SRSM. H1a and H1b were developed to test the proposed relationship. The results for H1a ($\beta = 0.66$; p-value = 0.000) and H1b ($\beta = 0.39$; p-value = 0.000) showed a significant positive relationship between BDAC and SRPSM as presented in Table 5.29 of section 5.6.1. The finding for H1a implies that SRPSM is proliferating with the support of BDAC.

DCV states that for the firms to compete, they need to have change-oriented capabilities that help the firms to be adaptive and innovative in nature (Leonidou et al., 2015). In order to adapt to the changing environment a specific set of routines is required that is organized in nature. Prior studies have identified BDA capabilities as dynamic capabilities of a firm (Mikalef et al., 2018). The traditional methods of data collection, analysis, and reporting are changing due to big data, and so do the platforms for sharing sustainability information as an advanced form of voluntary reporting (Yang & Ji, 2019). Amran and Haniffa (2011) found that Malaysian firms were actively reporting their sustainability practices on all sorts of communication platforms. Their finding is consistent with the result for H1a that Malaysian firms were active on social

media platforms for sustainability reporting with the support of BDAC. The reason for doing so is the social media platforms' growing popularity among the stakeholders (Roth-Cohen & Avidar, 2022). Due to their widespread usage, social media platforms have become a source of big data generation. She and Michelon (2019) opine that social media is a source of big data due to the freedom it accords to the stakeholders to express their opinions. Thus, firms need the analytics function to manage the social media platforms. In line with She and Michelon (2019), the need for BDAC in SRPSM is suggested by the results for H1a.

The results for H1b showed that BDAC had a significant positive impact on SRDF. This result implies that the BDAC implementation helps Malaysian firms with their sustainability reporting on Facebook. The finding is in line with the discussion stimulated by Al-Htaybat and von Alberti-Alhtaybat (2017) on the use of big data for improving business functions and reporting. Further, the authors found that the BDA implementation can help firms improve their social media platform management better for reporting and disclosure purposes. BDA can also help firms manage stakeholders' perceptions and expectations. Based on Al-Htaybat and von Alberti-Alhtaybat (2017), Bellucci and Manetti (2017) provided further evidence on the use of Facebook by top US philanthropic organisations to share sustainability information and how Facebook changed their relationship with stakeholders.

In line with DCV, which states that firms need to have dynamic capabilities, Malaysian firms manage stakeholders' informational demands by adopting dynamic capabilities such as BDAC. BDA is a necessary innovative strategy, and sustainability reporting is directly related to a firm's strategy (Herremans et al., 2016). Ruggiero and Cupertino (2018) opine that innovation in terms of adopting new technologies is crucial because it enables firms to address new challenges associated with sustainability and its reporting. The finding is also similar to the suggestion of Wanner and Janiesch (2019)

that BDAC can improve sustainability reporting. Since social media is a source of big data, results from the current study suggests that BDAC improves SRSM.

In general, Sivarajah et al. (2020) showed that BDAC is used to convert social media data and it was used to identify sustainability initiatives. The social media campaigns driven by BDAC proved to have positive influence on the relationship between the firm and stakeholders. BDAC helps the firms process the social media information efficiently to engage with the stakeholders. They also reported that BDAC allows firms to improve CSR or sustainability reporting disclosures on social media platforms. The competition on social media platforms is challenging; many firms derive critical insights from social media data (Birim, 2016). Social media analytics is helping firms gain a strategic edge (Wu et al., 2019). DCV suggests that an organisation's sustainability efforts transform into a capability (Amui et al., 2017). As mentioned earlier, DCV may assist in transforming SRSM as a capability with the influence of BDAC. The significant impact of BDAC on SRSM is consistent with the fact that SRSM transform into an organisation's capability, which may result in competitive advantage.

5.8.2 Moderation of Tone at the Top between BDAC and SRSM

The second research objective of the current study was to analyse the moderation role of tone at the top. Two hypotheses, H2a and H2b, were developed for this purpose. The results of H2a ($\beta = 0.04$; p-value =0.57) and H2b ($\beta = 0.23$; p-value =0.24) showed insignificant moderation of tone at the top between BDAC and SRSM as showed in Table 5.33 in section 5.8.2. Tone at the top was operationalised in the current study via five thematic indicators: activity, certainty, optimism, commonality, and realism.

DCV is of the view that flexible internal and external organisational processes are important. The flexibility in the organizational processes is channelled from top

management. It plays an imperative role in the determination of a firm's policies and strategies (Makhdoomi, 2018). Prior studies have analysed tone at the top as an independent construct. Some studies have analysed the links between different combinations of the thematic indicators and fraud, transparency, financial performance, and environmental disclosures (e.g., Barkemeyer et al., 2014; Fisher et al., 2019; Tailab & Burak, 2018). High certainty and low optimism in the CEO's verbal tone were found to be positively associated with sustainability disclosures. All five thematic indicators were included in the current study to examine the CEO or chairman message non-verbal tone in the sustainability reporting by Malaysian public listed firms. The results showed negative and insignificant moderation of tone at the top, which could be due to several reasons.

First, the non-verbal tone of the top management is determined by the type of sustainability disclosure. The non-verbal tone when sustainability disclosures are part of the annual report has different thematic characteristics than when the disclosures are presented in a stand-alone sustainability report (Cho et al., 2010). Studies that showed a significant relationship between tone at the top and sustainability reporting were conducted in developed countries where sustainability reports are produced in stand-alone reports (Cho et al., 2010). The situation is different in Malaysia, where Bursa Malaysia as the capital market regulator requires public listed firms to disclose sustainability performance in their annual reports. Malaysian firms' focus on stand-alone sustainability reports can be analysed by referring to their representation on FTSE4Good Bursa Malaysia, which is the dedicated index for sustainability disclosures. Out of the 791 firms listed on Bursa Malaysia, only 73 were listed on FTSE4Good Bursa Malaysia as of June 2020. This indicates that while the focus on sustainability reporting is growing among public listed firms in Malaysia, there is still a considerable gap in prioritising stand-alone sustainability reports.

Second, public listed firms in Malaysia and developed countries have different governance structures. The chairman/chairperson is the head of the board of directors, and the CEO is the senior executive that leads the management (Amran et al., 2014). There is increasing differentiation between the CEO's and the chairman's roles in the US in recent years (Larcker & Tayan, 2016). The CEO has an important role in overseeing the management in American firms. Similarly, in Malaysia, the latest Malaysian Code on Corporate Governance (as of 28 April 2021) clearly differentiates the chairman and CEO role, but the data was collected in 2019, which included the CEO and chairman's letter to the stakeholders. Some annual reports had CEO letter so that was included, while some reports had chairman's message instead of the CEO letter so that was included. Although both represent a firm's top management, but their non-verbal tone might differ. The current study included both of the letters as a firm's top management representation to be inclusive of the sample. Thus, the current study concludes that tone at the top do not play a role in strengthening the relationship between BDAC and SRSM among Malaysian public listed firms.

Third, a possible explanation for tone at the top's insignificant moderating role could be that Malaysian firms lack the long-term vision required to adopt the new technologies associated with digital revolution. This evidence is provided by an IDC (2020) survey on the senior management of large Malaysian firms. The survey showed that a lack of vision for the adoption of technologies, such as BDAC, created hurdles in changing the organisational culture. Organisational culture change is linked to one of the master variables of tone at the top.

Last, the insignificant findings point towards the existence of other factors influencing tone at the top in Malaysia. The current study used a cross-sectional research design, which might not reflect the cultural factor. A longitudinal analysis of

the CEO's message to the stakeholders may project robust values for tone at the top's thematic indicators.

The results obtained from additional analyses showed that certainty in tone at the top had a significant positive impact on SRDF. This finding implies that certainty strengthens the relationship between BDAC and SRDF. This finding is similar to the result of Cho et al. (2011). The difference between these two studies is that Cho et al. (2011) focused on environmental disclosures in sustainability reports, but the current study looked at all three dimensions of sustainability reporting: economic, social, and environment, as well as the disclosures on Facebook. It can be inferred from the findings that certainty in the top management's tone affects disclosures not only in the sustainability reports but also on social media platforms. Since different attributes of tone at the top may signal different messages to stakeholders, it is useful for companies and stakeholders to understand the different messages signalled by these different attributes of tone at the top. This understanding may enable the companies to convey the right message to the stakeholders, and subsequently, the message conveyed is understood by the stakeholders. Effective communication between these two parties may partly reduce the information asymmetry problem. In the context of this study, the findings indicate that companies that demonstrate certainty in their CEO's letter and implement BDAC disclose a significantly greater extent of sustainability reporting on Facebook.

The result also showed that optimism in the top management's tone weakened the relationship between BDAC and SRDF. Cho et al. (2011) found that firms with weak environmental disclosures tended to display more optimism in their tones. Similarly, the current study found that optimism weakened the relationship between BDAC and SRDF, indicating that optimistic firms may disclose less information regarding sustainability reporting on social media.

5.8.3 Sustainability Reporting on Social Media (SRSM) and Competitive Advantage

The third research objective of the current study was to analyse the impact of SRSM on competitive advantage. H3a and H3b were developed to test the proposed relationship. The results for H3a (β = 0.70; p-value = 0.000) showed a significant positive impact of SRPSM on competitive advantage as illustrated in Table 5.29 of section 5.6.1. However, the results for H3b (β = 0.08; p-value =0 .29) showed an insignificant impact of SRDF on competitive advantage. Hence, H3a was supported, but H3b was not supported.

The result for H3a signifies that SRPSM affects the competitive advantage of Malaysian firms. This result is consistent with the findings reported by Lodhia et al. (2020). They relied on media richness theory to explain competitive advantage, whereas the current study employed DCV, which states that dynamic capabilities of a firm can be a source of competitive advantage. Firms that can develop information-sharing capability will gain a competitive advantage. Information sharing and reporting pertaining to sustainable practices was identified as a source of competitive advantage in a developing country (Kwarteng et al., 2016). Their finding is consistent with the current study's finding that information sharing pertaining to sustainability reporting on social media platforms resulted in competitive advantage for Malaysian firms.

The result of the current study is also consistent with the finding that social media use for communication with stakeholders is an established source of competitive advantage in developed countries. Recent empirical evidence also indicates that firms attain competitive advantage by investing in sustainability practices (Abbas et al., 2019). The finding is consistent with the importance of stakeholder engagement on Facebook. The use of social media and analytics has been proven to be a source of competitive advantage (Correia Pereira & García Medina, 2014; Ribarsky et al., 2014).

Countries aiming for digitalisation also focus on the use of social media platforms. For example, the result of the current study shows that Malaysian firms have acquired the capability to share sustainability reporting information on social media platforms, which is in line with Malaysia's digitalisation vision. The firms also boost their image by using social media platforms because sustainability reporting issues are of major concern for the stakeholders. Firms constantly compete to reduce the efforts required for sustainability reporting on social media platforms. Hence, the current study concludes that SRSM can be a source of competitive advantage for Malaysian public listed firms.

The result for H3b showed an insignificant impact of SRDF on competitive advantage, indicating that SRDF does not result in competitive advantage for Malaysian firms. In line with DCV, sustainability practices have been viewed as a dynamic capability that arises from strategies that prioritize sustainability initiatives (Amui et al., 2017). Previous studies reported mixed findings regarding the link between sustainability reporting and competitive advantage. Studies such as Yu et al. (2017) also reported an inconsistent relationship between CSR and competitive advantage. However, other studies have indicated that firms that actively disclose sustainability information on Facebook are perceived to be connected with the stakeholders. This practice reduces firms' communication costs, and the resulting relationship with the stakeholders provides a competitive advantage to the firms (Baric, 2017). However, the current study's finding indicates otherwise.

A possible explanation for the current study's finding is that the questionnaire respondents considered all types of social media platforms, whereas the content analysis solely focused on Facebook. If the content analysis data were collected from all types of social media platforms, the collective data might produce different results.

Another possible explanation is that the current study obtained a lower number of sustainability-related posts on Facebook compared to those obtained by studies

conducted in other parts of the world. For example, Manetti and Buellucci (2016) analysed sustainability reporting disclosures on three types of social media platforms: Facebook, Twitter, and YouTube. They found 731,298 likes on average on sustainability reporting-related posts on Facebook, whereas in the current study, the average number of likes per 1000 followers is 774. This difference is significant. Perhaps because of the fact that disclosure on social media platforms is voluntary and in the current study among social media platforms, only posts on Facebook were analysed. Overall, the current study has highlighted SRSM as a potential source of competitive advantage for firms. Social media platforms provide vast opportunities for firms to connect with stakeholders and address their concerns. Since markets are competitive, a good connection with the stakeholders helps firms develop a long-lasting relationship with them (Jones et al., 2018). This connection also enables firms to develop a positive image of their sustainable practices, leading to the creation of a competitive advantage.

5.9 Summary

This chapter explained the statistical analyses of the quantitative data and their results. Two software, SPSS and SmartPLS, were used for the quantitative analyses, which involved descriptive and inferential statistics. The descriptive statistic calculated the frequency percentage, mean, and standard deviation for BDAC, SRPSM, SRDF, tone at the top, and competitive advantage. SmartPLS was used for hypothesis testing and moderation analysis. The findings on the current study's proposed relationships were then presented.

CHAPTER 6: CONCLUSIONS

6.1 Introduction

This final chapter summarises the main findings and presents the conclusion of the study. A summary of the research findings is provided in section 6.2. Section 6.3 elaborates on the current study's contributions and implications. In section 6.4, the limitations of the current study and recommendations for future research are presented.

6.2 Research Findings Summary

The first research objective of the current study was to investigate the impact of BDAC on SRSM. This objective was operationalised using a web-based questionnaire and content analysis of the Facebook pages of the sample firms. The questionnaire was adapted from Wamba et al. (2017) and Gupta and George (2016) to suit the current study's objective. The finding on the web-based questionnaire revealed that BDAC had a significant impact on SRPSM.

Since most of the firms that participated in the current study used Facebook as their official social media platform, content analysis was carried out on their Facebook posts. A checklist was adapted from GRI and Bursa Malaysia to identify sustainability-related Facebook posts. Further, the extent of disclosure was analysed using a disclosure index (SRDF) adapted from Zahid et al. (2015). The index comprises three dimensions and further sub-dimensions of sustainability reporting, with a total score of 48. The content analysis finding revealed that firms disclosed sustainability-related information. Additional analysis of the sustainability-related posts showed that although the firms shared information, the numbers of disclosures for each sustainability indicator differed. Some firms posted more about a particular indicator of sustainability reporting on Facebook. Overall, the findings showed that BDAC had a significant impact on SRDF. Hence, the current study's findings suggest that BDAC has a significant impact on SRSM.

The second research objective of the current study was to investigate the moderating role of tone at the top on the relationship between BDAC and SRSM. Tone at the top was operationalised using five master variables (Hart, 2000) to examine the top management's non-verbal tone. Each variable measures a specific attribute of the non-verbal tone of the top management. The attributes are proposed to promote sustainability reporting on platforms distinct from traditional sustainability reports. Hence, tone at the top was hypothesised to strengthen the relationship between BDAC and SRSM, but the findings do not support this. The findings from additional analysis showed that among the master variables of tone at the top, certainty strengthened the relationship between BDAC and SRSM, but optimism weakened the relationship.

The final research objective of the current study involved investigating the impact of SRSM on competitive advantage. SRSM was operationalised using a web-based questionnaire and content analysis, and competitive advantage was operationalised using a web-based questionnaire. The findings from the web-based questionnaire revealed a significant impact of SRPSM on competitive advantage. However, the findings from the content analysis showed an insignificant relationship between SRDF and competitive advantage. Underpinning DCV, it is still unclear whether SRSM is a source of competitive advantage. Therefore, based on the findings, the impacts of SRSM on competitive advantage are mixed.

Overall, the current study's findings have expanded the body of literature on the relationship between BDAC and sustainability reporting. Competition has forced firms to develop a competitive advantage based on their capabilities. Hence, the current study has contributed by investigating the links between BDAC, SRSM, tone at the top, and competitive advantage, underpinned by DCV.

6.3 Research Contributions and Implications

The research findings of the current study make several contributions to the existing body of literature. Further, there are practical implications for stakeholders, including regulators, policymakers, customers, and the public in general. The details are discussed in the subsections below.

6.3.1 Theoretical Contributions

Firstly, from the theoretical point of view, the current study contributes to the existing body of knowledge by investigating SRSM under DCV. Firms need to maintain their relationship with stakeholders. In doing so, they need to inform the stakeholders of their chosen platforms (Reilly & Hynan, 2014). Social media has become stakeholders' chosen platform worldwide. Most studies underpin the perspective of legitimacy theory to analyse sustainability reporting on social media. At the same time, empirical evidence on DCV's propositions and the use of Facebook for sustainability reporting is lacking. The technological advancements have a huge impact on business therefore it is important to view SRSM as a capability. In light of DCV's argument, the current study has contributed to the existing literature by investigating sustainability reporting and stakeholder engagement on Facebook. The empirical evidence presented in the current study shows that DCV propositions add to the firm-to-stakeholder and stakeholder-to-firm relationships. The conceptualisation of SRSM under DCV has enriched the existing body of literature in which the majority of studies used stakeholder and legitimacy theories as a theoretical underpinning. Thus, sustainability reporting can be viewed as an ability as well as a tool to address legitimacy and stakeholders' informational needs.

Secondly, the current study used the propositions of DCV to explain BDAC, tone at the top, and competitive advantage. DCV proposes that firms need to have capabilities to cope with the rapidly changing environment. They need to have dynamic capabilities that can be altered to meet stakeholders' expectations. The current study

investigated BDAC's role in facilitating SRPSM and SRDF. The study's empirical evidence supports DCV's proposition, that dynamic capabilities such as BDAC significantly relate to SRSM. Hence, firms should focus on developing such dynamic capabilities to gain competitive advantage.

Thirdly, DCV was also used in the current study to investigate whether tone at the top moderates the relationship between BDAC and SRSM. DCV states that the ability of a firm to handle dynamic internal environment is imperative. Tone at the top refers to top management's non-verbal tone in showing the firm's ability to adapt to the changing internal and external environments. Tone at the top has been analysed as an independent variable in previous studies. The current study contributes to DCV by testing its moderating role between BDAC and SRSM. Moreover, only a few studies have analysed the non-verbal tone of top management in sustainability reports. In prior studies, only some tone at the top variables were analysed pertaining to sustainability information disclosures (Feng & Gao, 2020; Hassan, 2019). In the current study, all five master variables were included to examine all the dimensions of the top management's non-verbal tone in Malaysia.

Fourthly, DCV theory states that dynamic capabilities help firm gain competitive advantage. The research framework of the current study presented that a firm's ability to disclose SRSM impacts the firm's competitive advantage. The empirical evidence presented makes theoretical contributions to DCV by analysing the relationship between BDAC, SRSM, tone at the top, and competitive advantage.

From the academic perspective, the current study can serve as a starting point for the investigation of the relationship between BDAC and SRSM. The results presented in the current study were derived from the positivist research paradigm. Analyses based on other paradigms, such as critical and interpretive perspectives, may add different findings on the proposed variables.

6.3.2 Practical Implications

The current study contributes to practice in several ways. First, the current study's findings have useful implications for Malaysia's regulators in promoting the BDAC implementation. MDEC is one of the leading bodies overlooking Malaysia's digitalisation vision 2030. The results presented in section 5.10 show that Malaysia needs infrastructure to boost the BDAC implementation in public firms. Hence, MDEC can look into the infrastructural requirements of public listed firms and guide them accordingly.

Second, the current study's findings have implications for sustainable development goals (SDGs). The practice of making sustainability disclosures on social media platforms initiates a collective effort to contribute to the SDGs. The collective efforts of firms to share information on social media may also motivate other stakeholders to adopt sustainable ways of conducting businesses, consequently leading to the achievement of SDGs. The social media platforms also help in the identification of relevant and important sustainability issues. Policymakers can highlight the use of social media to promote sustainable ways and compel firms to share more insights regarding their efforts towards achieving the SDGs.

Third, policymakers can derive useful insights from the current study's findings. In the light of growing digitalisation, policymakers can align voluntary SRSM with GRI's Reporting 2025 vision. This vision focuses explicitly on traditional sustainability reporting challenges and suggests addressing these challenges by introducing stakeholder views GRI guidelines aim to digitalise sustainability reports for interactivity purposes and provide the most relevant sustainability-related information. Social media already provides the interactive facility, and firms are utilising it to share sustainability reports. However, engagement of these reports is low. Hence, the GRI can provide

guidelines to promote stakeholder engagement on these interactive social media platforms.

Fourth, the current study's findings have implications for the firms. It can be inferred that the social media platforms can serve as an important tool to communicate with the stakeholders. This can generate a holistic impact where stakeholders can provide their input on how to improve the firm's efforts towards sustainability practices. This sort of feedback can help the firms to improve their sustainability practices and improve their image at the same time. Resultantly, improved sustainability practices and better image on social media may result in competitive advantage. The firms with similar cultural settings can also follow the social media usage strategy and contribute towards the SDGs.

Finally, currently there are no specific guidelines regarding how to share sustainability information on social media platforms. The current study found that firms' sustainability reporting on Facebook was more about ongoing sustainability issues than on the mandatorily required information. This is because firms have the freedom to choose what type of information to share due to the absence of guidelines. Social media platforms like Facebook provide the facility for a simple way of posting messages. For example, firms can post a picture or a short video about a certain topic. These features allow interactivity and facilitate the understandability of the communicated message. Thus, Facebook provides an opportunity for firms to improve their sustainability reporting beyond the mandatory annual publications. Similarly, Al-Htaybat and von Alberti-Alhtaybat (2017) suggest that the formats provided by social media platforms can improve corporate reporting.

6.4 Limitations and Future Research Recommendations

Research limitations are unavoidable in any research setting, and they provide a realistic view of a study. Reporting a research's limitations is necessary (Price &

Murnan, 2004). Despite the current study's contributions to the literature, it has several limitations. Thus, the results need to be interpreted in the light of the current study's limitations. Nonetheless, the limitations do not invalidate the current study's findings.

First, the current study included 100 public listed firms on Bursa Malaysia in 2019 that used social media. The number of firms using social media in Malaysia might have increased after 2019, and a larger sample might produce different results. Nonetheless, the current study's findings may be compared to findings on other countries that share similar characteristics with Malaysia, such as the ASEAN member countries. Future studies can apply the current study's framework and present a comparative analysis.

Second, the current study used a cross-sectional type of data collection method. A cross-sectional study design means that data is collected at one point in time (Sedgwick, 2014). Hence, the findings obtained in the current study cannot be generalised to other studies that use the longitudinal data collection design, which collects data over a predefined period (Aylmer, 2019). Moreover, the insignificant role of tone at the top in moderating the link between BDAC and SRSM might be due to the cross-sectional study design. A study with a longitudinal design may capture top management tone attributes accurately.

Third, some studies used other dimensions of BDAC. The dimensions used in the current study were derived from well-researched IT capabilities literature (Kim et al., 2012). Nonetheless, using BDAC dimensions other than management, infrastructure, and personnel capabilities might produce different results and impacts on SRSM. Thus, future studies can modify the current study's model by adding new BDAC dimensions.

Fourth, the scales used to investigate the impact of BDAC on SRSM are limited in the existing literature. To fill this gap, content analysis and a web-based questionnaire

were used in the current study. Future studies can develop a new scale by integrating the current study's web-based questionnaire with the SRDF index. After the merger of questionnaire and SRDF index, its validity and reliability can be checked for implementations in other studies and countries.

Fifth, the current study followed the GRI guidelines in identifying sustainability-related posts on Facebook. The GRI guidelines include social, economic, and environmental dimensions of sustainability reporting. Governance is emerging as one of the sustainability reporting dimensions, and it was not included in the current study. Future studies can use four dimensions rather than the three dimensions of sustainability reporting to analyse social media platforms.

Sixth, the current study did not analyse stakeholders' responses on Facebook in detail which would require assessing the quality of their comments and reactions. The current study did not consider the various options of Facebook responses, such as angry, happy, care, and love. Given the growing usage of Facebook, these responses may be used for a detailed analysis of stakeholders' responses to sustainability-related posts. A feedback-oriented sustainability reporting framework for social media can provide valuable insights for future studies (Calabrese et al., 2015).

Lastly, the current study examined only six control variables to determine SRSM. The current study's framework might be affected by other factors such as market size, stakeholder awareness, and organisational policies. Therefore, other studies are recommended to test these factors and improve the current study's framework.

6.5 Summary

This chapter concluded the thesis. It provided a recap of the research findings. Based on these findings, the research contributions and implications were discussed.

Lastly, the current study's limitations were highlighted so that future studies can improve the current study's framework and measurement methods.

REFERENCES

Abbas, J., Mahmood, S., Ali, H., Raza, M. A., Ali, G., Aman, J., Bano, S., & Nurunnabi, M. (2019). The effects of corporate social responsibility practices and environmental factors through a moderating role of social media marketing on sustainable performance of business firms. *Sustainability* (Switzerland), 11(12).

Abbasi, A., Sarker, S., & Chiang, R. H. (2016). Big data research in information systems: Toward an inclusive research agenda. *Journal of the association for information systems, 17*(2), 3.

Abitbol, A., & Lee, S. Y. (2017). Messages on CSR-dedicated Facebook pages: What works and what doesn't. *Public relations review, 43*(4), 796-808.

Abt, G., Boreham, C., Davison, G., Jackson, R., Nevill, A., Wallace, E., & Williams, M. (2020). Power, precision, and sample size estimation in sport and exercise science research.

Accenture, General Electrics. (2015). How the industrial internet is changing the competitive landscape of industries. Accessed May 9, 2018, from Accenture Strategy. https://www. accenture.com/us-en/insight-industrial-internet-competitive-landscape-industries.aspx.

Adrian, C., Abdullah, R., Atan, R., & Jusoh, Y. Y. (2017). Factors influencing to the implementation success of big data analytics: A systematic literature review. *International Conference on Research and Innovation in Information Systems,* ICRIIS.

Aggarwal, P. (2013). Sustainability reporting and its impact on corporate financial performance: A literature review. *Indian Journal of Commerce and Management Studies*, 4(3), 51.

Aggarwal, P., & Singh, A. K. (2019). CSR and sustainability reporting practices in India: an in-depth content analysis of top-listed companies. *Social Responsibility Journal, 15*(8), 1033–1053. https://doi.org/10.1108/srj-03-2018-0078

Agung, N. F. A., & Darma, G. S. (2019). Opportunities and Challenges of Instagram Algorithm in Improving Competitive Advantage. *International Journal of Innovative Science and Research Technology, 4*(1), 743-747.

Ahluwalia, S., Ferrell, O. C., Ferrell, L., & Rittenburg, T. L. (2018). Sarbanes–oxley section 406 code of ethics for senior financial officers and firm behavior. *Journal of Business Ethics, 151*(3), 693-705.

Ahmad, Z. (2016). Communicating CSR in the digital age: An exploratory study of a CSR award winning company in Malaysia. *Journal of education and social sciences, 4*, 1-6.

Ainin, S., Naqshbandi, M. M., Moghavvemi, S., & Jaafar, N. I. (2015). Facebook usage, socialization and academic performance. *Computers & Education,* 83, 64-73.

Aksu, M., & Kosedag, A. (2006). Transparency and disclosure scores and their determinants in the Istanbul Stock Exchange. *Corporate Governance: An International Review,* 14(4), 277-296.

Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment? *International Journal of Production Economics, 182*, 113–131. https://doi.org/10.1016/j.ijpe.2016.08.018

Alharthi, A., Krotov, V., & Bowman, M. (2017). Addressing barriers to big data. *Business Horizons, 60*(3), 285-292.

Al-Htaybat, K., & von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, Auditing and Accountability Journal*, 30(4), 850–873.

Ali, I., Jiménez-Zarco, A. I., & Bicho, M. (2015). Using social media for CSR communication and engaging stakeholders. *In Corporate social responsibility in the digital age*. Emerald Group Publishing Limited.

Ali, M., Sheng, T. K., Yusof, K. M., Suhaili, M. R., Ghazali, N. E., & Ali, S. (2019). The Dynamics of Traffic Congestion: A Specific Look into Malaysian Scenario and the Plausible Solutions to Eradicate it using Machine Learning. Indonesian Journal of Electrical Engineering and Computer Science (IJEECS), 15(2), 1086-1094.

Allen, M. (2017). The sage encyclopedia of communication research methods (Vols. 1-4). Thousand Oaks, CA: SAGE Publications, Inc doi: 10.4135/9781483381411

Alm, A. (2015). " Facebook" for Informal Language Learning: Perspectives from Tertiary Language Students. *The EUROCALL Review*, 23(2), 3-18.

Al-Sartawi, A. M., & Hamdan, A. (2019). Social Media Reporting and Firm Value. In Conference on e-Business, e-Services and e-Society (pp. 356-366). Springer, Cham.

Ambrosini, V., & Bowman, C. (2009). What are dynamic capabilities and are they a useful construct in strategic management?. *International journal of management reviews,* 11(1), 29-49.

Amernic, J., Craig, R. and Tourish, D. (2007), "The transformational leader as pedagogue, physician, architect, commander, and saint: five root metaphors in Jack Welch's letters to stockholders of General Electric", *Human Relations*, Vol. 60 No. 12, pp. 1839-1872.

Amernic, J., Craig, R., & Tourish, D. (2010). Measuring and assessing tone at the top using annual report CEO letters. *The Institute of Chartered Accountants of Scotland.*

Amernic, J.H., & Craig, R.J. (2000). Accountability and rhetoric during a crisis: An analysis of Walt Disney's 1940 letter to stockholders. *Accounting Historians Journal,* 27(2), 49-86.

Amin, M. H., Mohamed, E. K. A., & Elragal, A. (2020). Corporate disclosure via social media: a data science approach. *Online Information Review*, 44(1), 278–298.

Amran, A. B., & Devi, S. S. (2007). Corporate Social Reporting in Malaysia: an institutional perspective. *World Review of Entrepreneurship, Management and Sustainable Development,* *3*(1), 19–44. https://doi.org/10.1504/wremsd.2007.012128

Amran, A., & Haniffa, R. (2011). Evidence in development of sustainability reporting: a case of a developing country. *Business Strategy and the Environment*, 20(3), 141-156.

Amran, A., Lee, S. P., & Devi, S. S. (2014). The influence of governance structure and strategic corporate social responsibility toward sustainability reporting quality. *Business Strategy and the Environment*, 23(4), 217–235.

Amran, A., Ooi, S. K., Mydin, R. T., & Devi, S. S. (2015). The Impact of Business Strategies on Online Sustainability Disclosures. *Business Strategy and the Environment,* 24(6), 551–564.

Amui, L. B. L., Jabbour, C. J. C., de Sousa Jabbour, A. B. L., & Kannan, D. (2017). Sustainability as a dynamic organizational capability: a systematic review and a future agenda toward a sustainable transition. *Journal of cleaner production, 142*, 308-322.

Annunziata, E., Pucci, T., Frey, M., & Zanni, L. (2018). The role of organizational capabilities in attaining corporate sustainability practices and economic performance: Evidence from Italian wine industry. *Journal of Cleaner Production,* 171, 1300–1311.

Aral, S., & Weill, P. (2007). IT assets, organizational capabilities, and firm performance: How resource allocations and organizational differences explain performance variation. *Organization science,* 18(5), 763-780.

Aral, S., Dellarocas, C., & Godes, D. (2013). Introduction to the special issue—social media and business transformation: a framework for research. *Information systems research*, 24(1), 3-13.

Arena, C., Bozzolan, S., & Michelon, G. (2015). Environmental Reporting: Transparency to Stakeholders or Stakeholder Manipulation? An Analysis of Disclosure Tone and the Role of the Board of Directors. *Corporate Social Responsibility and Environmental Management,* 22(6), 346–361.

Arend, R. J., & Bromiley, P. (2009). Assessing the dynamic capabilities view: spare change, everyone?.

Arias, M., Arratia, A., & Xuriguera, R. (2014). Forecasting with twitter data. *ACM Transactions on Intelligent Systems and Technology (TIST),* 5(1), 1-24.

Aribi, Z. A., Alqatamin, R. M., & Arun, T. (2018). Gender diversity on boards and forward-looking information disclosure: evidence from Jordan. *Journal of Accounting in Emerging Economies.*

Arnaboldi, M., Busco, C., & Cuganesan, S. (2017). Accounting, accountability, social media and big data: revolution or hype? *Accounting, Auditing & Accountability Journal,* 30(4), 762–776.

Arslan-Ayaydin, Ö., Boudt, K., & Thewissen, J. (2016). Managers set the tone: Equity incentives and the tone of earnings press releases. *Journal of Banking and Finance, 72,* S132–S147. https://doi.org/10.1016/j.jbankfin.2015.10.007

Artiach, T., Lee, D., Nelson, D., & Walker, J. (2010). The determinants of corporate sustainability performance. *Accounting & Finance, 50*(1), 31-51.

Ashforth, B.E., & Humphrey, R.H. (1997). The ubiquity and potency of labelling in organizations. *Organization Science*, 3, 443-460.

Asteriou, D. & Hall, S.G. (2007). Applied Econometrics: A Modern Approach Using Eviews and Microfit Revised Edition. Palgrave Macmillan.

Aydiner, A. S., Tatoglu, E., Bayraktar, E., Zaim, S., & Delen, D. (2019). Business analytics and firm performance: The mediating role of business process performance. *Journal of Business Research,* 96(October 2018), 228–237.

Aylmer, B. (2019). A Longitudinal Study of Stability and Change in Time Perspective. SAGE Publications Ltd.

Babakus, E., & Mangold, W. G. (1992). Adapting the SERVQUAL scale to hospital services: an empirical investigation. *Health services research, 26*(6), 767.

Babu, D. E., Kaur, A., & Rajendran, C. (2018). Sustainability practices in tourism supply chain. *Benchmarking: An International Journal, 25*(4), 1148–1170.

Badulescu, A., Badulescu, D., Saveanu, T., & Hatos, R. (2018). The relationship between firm size and age, and its social responsibility actions-Focus on a developing country (Romania). *Sustainability (Switzerland), 10*(3).

Bag, S., Pretorius, J. H. C., Gupta, S., & Dwivedi, Y. K. (2021). Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities. *Technological Forecasting and Social Change, 163*, 120420.

Bahuguna, P. C., Srivastava, R., & Tiwari, S. (2023). Two-decade journey of green human resource management research: a bibliometric analysis. *Benchmarking: An International Journal, 30*(2), 585-602.

Bakarich, K. M., Castonguay, J. J., & O'Brien, P. E. (2020). The use of blockchains to enhance sustainability reporting and assurance. *Accounting Perspectives, 19*(4), 389-412.

Baker, C. R. (2011). A genealogical history of positivist and critical accounting research. *Accounting History, 16*(2), 207-221.

Bakri, A. A. A. (2017). The impact of social media adoption on competitive advantage in the small and medium enterprises. *International Journal of Business Innovation and Research, 13(2),* 255-269.

Ballew, M. T., Omoto, A. M., & Winter, P. L. (2015). Using Web 2.0 and social media technologies to foster proenvironmental action. *Sustainability,* 7(8), 10620-10648.

Barako, D. G., Hancock, P., & Izan, H. Y. (2006). Factors influencing voluntary corporate disclosure by Kenyan companies. *Corporate Governance: an international review, 14*(2), 107-125.

Baric, A. (2017). Corporate social responsibility and stakeholders: Review of the last decade (2006-2015). *Business Systems Research, 8*(1), 133–146.

Barkemeyer, R., Comyns, B., Figge, F., & Napolitano, G. (2014). CEO statements in sustainability reports: Substantive information or background noise?. *Accounting Forum, 38*(4), 241–257.

Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of management, 27*(6), 643-650.

Barney, J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management,* Vol. 17 No. 1, pp. 99-120.

Barton, D., & Court, D. (2012). Making advanced analytics work for you. *Harvard Business Review, 90*(10), 78-83.

Basri, W. S. M., & Siam, M. R. (2019). Social media and corporate communication antecedents of SME sustainability performance: A conceptual framework for SMEs of Arab world. *Journal of Economic and Administrative Sciences.*

Batista, A. A. D. S., & Francisco, A. C. D. (2018). Organizational sustainability practices: A study of the firms listed by the corporate sustainability index. *Sustainability, 10*(1), 226.

Bayoud, N.S., Kavanagh, M. and Slaughter, G. (2012), "Factors influencing levels of corporate social responsibility disclosure by Libyan firms: a mixed study". *International Journal of Economics and Finance, Vol. 4* No. 4, pp. 13-29.

Beier, G., Niehoff, S., & Xue, B. (2018). More Sustainability in Industry through Industrial Internet of Things? *Applied Sciences, 8*(2), 219.

Bello-Orgaz, G., Jung, J. J., & Camacho, D. (2016). Social big data: Recent achievements and new challenges. *Information Fusion, 28*, 45–59.

Bellucci, M., & Manetti, G. (2017). Facebook as a tool for supporting dialogic accounting? Evidence from large philanthropic foundations in the United States. *Accounting, Auditing & Accountability Journal*.

Bellucci, M., & Manetti, G. (2018). Stakeholder engagement and sustainability reporting. Routledge.

Ben-Gal, I. (2005). Outlier detection. In Data mining and knowledge discovery handbook (pp. 131-146). Springer, Boston, MA.

Ben-Shlomo Y, Brookes S, Hickman M. (2013). Lecture Notes: Epidemiology, Evidence-based Medicine and Public Health (6th ed.), Wiley-Blackwell, Oxford.

Beretta, V., Demartini, C., & Trucco, S. (2019). Does environmental, social and governance performance influence intellectual capital disclosure tone in integrated reporting?. *Journal of Intellectual Capital.*

Bertello, A., Ferraris, A., Bresciani, S., & De Bernardi, P. (2020). Big data analytics (BDA) and degree of internationalization: the interplay between governance of BDA infrastructure and BDA capabilities. *Journal of Management and Governance,* 1-21.

Bhalodiya, N., & Sagotia, N. (2018). Reasons behind the failure of Nokia: a Case study of Telecom sector. *International Journal of Management and Humaniti*.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: toward a next generation of insights. *MIS Quarterly,* 471-482.

Bligh, M. C., Kohles, J. C., & Meindl, J. R. (2004). Charting the language of leadership: A methodological investigation of President Bush and the crisis of 9/11. *Journal of Applied Psychology, 89,* 562–574.

Blome, C., Schoenherr, T., & Rexhausen, D. (2013). Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective. *International Journal of Production Research, 51*(4), 1295-1318.

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer. *Frontiers in Public Health, 6*(June), 1–18.

Boiral, O., Heras-Saizarbitoria, I., & Brotherton, M. C. (2019). Assessing and improving the quality of sustainability reports: The auditors' perspective. *Journal of Business Ethics, 155*(3), 703-721.

Bonsón E, Royo S and Ratkai M (2017). Facebook practices in Western European municipalities: an empirical analysis of activity and citizens' engagement. *Administration and Society 49*(3): 320–347

Bonsón, E., & Ratkai, M. (2013). A set of metrics to assess stakeholder engagement and social legitimacy on a corporate Facebook page. *Online Information Review, 37*(5), 787–803.

Bradford, M., Earp, J. B., Showalter, D. S., & Williams, P. F. (2017). Corporate sustainability reporting and stakeholder concerns: Is there a disconnect? *Accounting Horizons, 31*(1), 83–102.

Braganza, A., Brooks, L., Nepelski, D., Ali, M., & Moro, R. (2017). Resource management in big data initiatives: Processes and dynamic capabilities. *Journal of Business Research, 70*, 328-337.

Branco, M. C., & Rodrigues, L. L. (2006). Corporate social responsibility and resource-based perspectives. *Journal of Business Ethics, 69*(2), 111-132.

Branco, M. C., Delgado, C., Gomes, S. F., & Eugénio, T. C. P. (2014). Factors influencing the assurance of sustainability reports in the context of the economic crisis in Portugal. *Managerial Auditing Journal.*

Briones, R. L., Kuch, B., Liu, B. F., & Jin, Y. (2011). Keeping up with the digital age: How the American Red Cross uses social media to build relationships. *Public Relations Review, 37*(1), 37-43.

Bryman, A., & Bell, E. (2007a). Business research strategies. *Business Research Methods,* 226-238.

Bryman, A., Bell, E., (2007b). Content analysis. In: Bryman, A., Bell, E. (Eds.), Business Research Methods, third ed. Oxford University Press, Oxford, pp. 288e332.

Brynjolfsson, E., & McAfee, A. (2012). Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy. Brynjolfsson and McAfee.

Buallay, A. (2019). Is sustainability reporting (ESG) associated with performance? Evidence from the European banking sector. *Management of Environmental Quality: An International Journal.*

Buchholz, F., Jaeschke, R., Lopatta, K., & Maas, K. (2018). The use of optimistic tone by narcissistic CEOs. *Accounting Auditing & Accountability Journal, 31*, 531–562.

Burell, G., & Morgan, G. (1979). Sociological paradigms and organisational analysis: Elements of the sociology of corporate life. London: Heinemann.

Buzzao, G., & Rizzi, F. (2021). On the conceptualization and measurement of dynamic capabilities for sustainability: Building theory through a systematic literature review. *Business Strategy and the Environment*, 30(1), 135-175.

Byrne, B. M. (2016). Structural Equation Modelling with AMOS: Basic Concepts, Applications, and Programming (3rd ed.). New York: Routledge.

Cai, Y., Kim, Y., Li, S., & Pan, C. (2019). Tone at the top: CEOs' religious beliefs and earnings management. *Journal of Banking & Finance, 106*, 195-213.

Caiado, R. G. G., Quelhas, O. L. G., Nascimento, D. L. M., Anholon, R., & Leal Filho, W. (2018). Measurement of sustainability performance in Brazilian organizations. *International Journal of Sustainable Development & World Ecology, 25*(4), 312-326.

Çalli, L., & Clark, L. (2015, July). Overcoming SME barriers to gaining competitive advantage through social media. In Proceedings of the 2nd European Conference on Social Media (p. 59).

Caniëls, M. C. J., & Bakens, R. J. J. M. (2012). The effects of Project Management Information Systems on decision making in a multi project environment. *International Journal of Project Management, 30*(2), 162–175.

Cantele, S., & Zardini, A. (2018). Is sustainability a competitive advantage for small businesses? An empirical analysis of possible mediators in the sustainability–financial performance relationship. *Journal of Cleaner Production, 182*, 166-176.

Cantrell, J. E., Kyriazis, E., & Noble, G. (2015). Developing CSR giving as a dynamic capability for salient stakeholder management. *Journal of Business Ethics, 130(2),* 403-421.

Carroll, A. B. (1991). The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Business horizons, 34*(4), 39-48.

Carroll, C. E., & Einwiller, S. A. (2014). Disclosure alignment and transparency signaling in CSR reports. In *Communication and language analysis in the corporate world* (pp. 249-270). IGI Global.

Cavusgil, E., Seggie, S. H., & Talay, M. B. (2007). Dynamic Capabilities View: Foundations and Research Agenda. *Journal of Marketing Theory and Practice, 15*(2), 159–166.

Cenfetelli, R. T., & Bassellier, G. (2009). Interpretation of formative measurement in information systems research. *MIS Quarterly,* 689-707.

Cha, W., Abebe, M., & Dadanlar, H. (2019). The effect of CEO civic engagement on corporate social and environmental performance. *Social Responsibility Journal, 15*(8), 1054–1070.

Chae, B. K. (2015). Insights from hashtag# supplychain and Twitter Analytics: Considering Twitter and Twitter data for supply chain practice and research. *International Journal of Production Economics, 165,* 247-259.

Chan, M. C., Watson, J., & Woodliff, D. (2014). Corporate governance quality and CSR disclosures. *Journal of Business Ethics, 125*(1), 59-73.

Chang, C. H. (2011). The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. *Journal of Business Ethics, 104*(3), 361-370.

Chang, S. J., Van Witteloostuijn, A., & Eden, L. (2010). From the editors: Common method variance in international business research.

Chang, W. F., Amran, A., Iranmanesh, M., & Foroughi, B. (2019). Drivers of sustainability reporting quality: financial institution perspective. *International Journal of Ethics and Systems, 35*(4), 632–650.

Charan, J., & Kantharia, N. D. (2013). How to calculate sample size in animal studies?. *Journal of Pharmacology & Pharmacotherapeutics, 4*(4), 303.

Charmaz, K. (2008). Constructionism and the grounded theory method. *Handbook of constructionist research, 1*(1), 397-412.

Chen, C. P., & Zhang, C. Y. (2014). Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. *Information Sciences, 275*, 314-347.

Chen, K. Z., & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal, 31*(5), 547-561.

Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L., & Chow, W. S. (2014). IT capability and organizational performance: the roles of business process agility and environmental factors. *European Journal of Information Systems, 23*(3), 326-342.

Cheon, S., Maltz, A., & Dooley, K. (2017). The link between economic and environmental performance of the top 10 US ports. *Maritime Policy & Management, 44*(2), 227-247.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research, 295*(2), 295-336.

Cho, C. H., Bohr, K., Choi, T. J., Partridge, K., Shah, J. M., & Swierszcz, A. (2020). Advancing sustainability reporting in Canada: 2019 report on progress. *Accounting Perspectives, 19*(3), 181-204.

Cho, C. H., Roberts, R. W., & Patten, D. M. (2010). The language of US corporate environmental disclosure. *Accounting, Organizations and Society, 35*(4), 431–443.

Cho, M., Furey, L. D., & Mohr, T. (2017). Communicating corporate social responsibility on social media: Strategies, stakeholders, and public engagement on corporate Facebook. *Business and Professional Communication Quarterly, 80*(1), 52-69.

Choi, J., & Wang, H. (2009). Stakeholder relations and the persistence of corporate financial performance. *Strategic Management Journal, 30*(8), 895-907.

Chong, C. W., Yuen, Y. Y., & Tan, B. C. (2017). Cross-border knowledge transfer in Malaysian multimedia super corridor (MSC) status corporations. *Review of International Business and Strategy, 27*(1), 70–92.

Chowdhury, M. M. H., Agarwal, R., & Quaddus, M. (2019). Dynamic capabilities for meeting stakeholders' sustainability requirements in supply chain. *Journal of Cleaner Production*, 215, 34-45.

Chu, S. C., Chen, H. T., & Gan, C. (2020). Consumers' engagement with corporate social responsibility (CSR) communication in social media: Evidence from China and the United States. *Journal of Business Research, 110*, 260-271.

Chua, W. F. (1986). Radical developments in accounting thought. *Accounting Review,* 601-632.

Chua, W. F. (2019). Radical developments in accounting thought? Reflections on positivism, the impact of rankings and research diversity. *Behavioral Research in Accounting.*

CIMB. (2019). 2019 annual report. cimb-2019-annual-report.pdf

Clark, L. A., & Watson, D. (1995). Constructing Validity: Basic Issues in Objective Scale Development. *Psychological Assessment, 7*(3), 309–319.

Clarkson, M. E. (1995). A stakeholder framework for analyzing and evaluating corporate social performance. *Academy of management review, 20*(1), 92-117.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy, 30*(2), 122-144.

Clarkson, P. M., Overell, M. B., & Chapple, L. (2011). Environmental reporting and its relation to corporate environmental performance. *Abacus, 47*(1), 27-60.

Cohen, J. (1992). Statistical power analysis. Current directions in psychological science, 1(3), 98-101.

Cohen, J., (1988). Statistical Power Analyses for the Social Sciences. Lawrence Erlbauni Associates, Hillsdale, NJ.

Cohen, L., Manion, L., & Morrison, K. (2013). Research methods in education. Routledge.

Cong, Y., Freedman, M., & Park, J. D. (2014). Tone at the top: CEO environmental rhetoric and environmental performance. *Advances in Accounting, 30*(2), 322-327.

Constantiou, I. D., & Kallinikos, J. (2015). New games, new rules: big data and the changing context of strategy. *Journal of Information Technology, 30*(1), 44-57.

Cooper, D. R., & Schindler, P. (2001). S, 2001, Business Research Methods. McGraw, New York.

Cormier, D., Magnan, M., & Van Velthoven, B. (2005). Environmental disclosure quality in large German companies: economic incentives, public pressures or institutional conditions?. *European accounting review, 14*(1), 3-39.

Correa-Garcia, J. A., Garcia-Benau, M. A., & Garcia-Meca, E. (2020). Corporate governance and its implications for sustainability reporting quality in Latin American business groups. *Journal of Cleaner Production, 260*, 121142.

Correia Pereira, P. A., & García Medina, I. (2014). Digital social media: An interactive technology incorporated as a competitive advantage for business. *International Journal of Interactive Mobile Technologies, 8*(2), 23–27.

Cortado, F. J., & Chalmeta, R. (2016). Use of social networks as a CSR communication tool. *Cogent Business and Management, 3*(1), 1–18.

Côrte-Real, N., Oliveira, T., & Ruivo, P. (2017). Assessing business value of Big Data Analytics in European firms. *Journal of Business Research, 70*, 379–390.

Costantini, V., Crespi, F., Marin, G., & Paglialunga, E. (2017). Eco-innovation, sustainable supply chains and environmental performance in European industries. *Journal of Cleaner Production, 155,* 141-154.

Craig, R., & Amernic, J. (2004). Enron discourse: The rhetoric of a resilient capitalism. *Critical Perspectives on Accounting, 15*(5/6), 813–851.

Creswell, J. W., & Clark, P. (2019). Designing and conducting mixed methods research. In Thousand Oaks, CA: Sage IOP Conf. Series: Earth and Environmental Science (Vol. 385, p. 012039).

Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, Quantitative, and mixed methods approaches. *Sage Publications*.

Cronbach, L. J. (1971). Test validation. In R. L. Thorndike (Ed.), Educational measurement. (2nd ed., pp. 443-507). Washington, DC: American Council on Education.

Cutler, S.M. (2004). Tone at the top: Getting it right. Retrieved April 2, 2007, from www.sec.gov/news/speech/spch120304smc.htm

Dagnino, G. B., Picone, P. M., & Ferrigno, G. (2021). Temporary Competitive Advantage: A State-of-the-Art Literature Review and Research Directions. *International Journal of Management Reviews, 23*(1), 85-115.

Danso, A., Adomako, S., Amankwah-Amoah, J., Owusu-Agyei, S., & Konadu, R. (2019). Environmental sustainability orientation, competitive strategy and financial performance. *Business Strategy and the Environment, 28*(5), 885-895.

Dartey-Baah, K. (2015). Resilient leadership: A transformational-transactional leadership mix. *Journal of Global Responsibility*.

Davenport, T. H., & Patil, D. J. (2012). Data scientist. *Harvard business review, 90*(5), 70-76.

Davis, C. K. (2014). Beyond data and analysis. Communications of the ACM, 57(6), 39-41.

Dawes, J. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *International Journal of Market Research, 50*(1), 61-104.

Dawson, C. (2002). Practical research methods: A user-friendly guide to mastering research techniques and projects. how to books.

Dawson, J.F. (2014). Moderation in management research: What, why, when, and how. *Journal of Business and Psychology, 29*(1), 1-19.

Day, G. S., & Schoemaker, P. J. (2016). Adapting to fast-changing markets and technologies. *California Management Review, 58*(4), 59-77.

De Beelde, I., & Tuybens, S. (2015). Enhancing the credibility of reporting on corporate social responsibility in Europe. *Business strategy and the environment, 24*(3), 190-216.

de Camargo Fiorini, P., Seles, B. M. R. P., Jabbour, C. J. C., Mariano, E. B., & de Sousa Jabbour, A. B. L. (2018). Management theory and big data literature: From a review to a research agenda. *International Journal of Information Management, 43*, 112-129.

De Hoogh, A. H. B., & Den Hartog, D. N. (2008). Ethical and despotic leadership, relationships with leader's social responsibility, top management team effectiveness and subordinates' optimism: A multi-method study. *Leadership Quarterly, 19*(3), 297–311.

De Micco, P., Rinaldi, L., Vitale, G., Cupertino, S., & Maraghini, M. P. (2020). The challenges of sustainability reporting and their management: the case of Estra. *Meditari Accountancy Research.*

de Villiers, C., & Sharma, U. (2020). A critical reflection on the future of financial, intellectual capital, sustainability and integrated reporting. *Critical Perspectives on Accounting,* 70, 101999.

de Villiers, C., van Staden, C., Kaur, A., & Lodhia, S. K. (2014). The state of disclosures on stakeholder engagement in sustainability reporting in Australian local councils. *Pacific Accounting Review*.

DEI Worldwide (2008). The impact of social media on purchasing behavior. Engaging Consumers Online. available at www.deiworldwide.com/files/DEIStudy-Engaging% 20ConsumersOnline-Summary.pdf

Demchenko, Y., Grosso, P., De Laat, C., & Membrey, P. (2013). Addressing big data issues in scientific data infrastructure. In 2013 International Conference on Collaboration Technologies and Systems (CTS) (pp. 48-55). IEEE.

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of marketing research, 38*(2), 269-277.

Diantimala, Y. (2018). The mediating effect of sustainability disclosure on the relationship between financial performance and firm value.

Dias, A., Rodrigues, L. L., & Craig, R. (2016). Global financial crisis and corporate social responsibility disclosure. *Social Responsibility Journal*.

Dienes, D., Sassen, R., & Fischer, J. (2016). What are the drivers of sustainability reporting? A systematic review. *Sustainability Accounting, Management and Policy Journal, 7*(2), 154–189.

Dijks, J. (2012). Big Data for the Enterprise: Oracle White Paper. Oracle Published Group.

Diouf, D., & Boiral, O. (2017). The quality of sustainability reports and impression management: A stakeholder perspective. *Accounting, Auditing and Accountability Journal, 30*(3), 643–667.

Discrimination still major issue at Malaysian workplace | Daily Express Online - Sabah's Leading News Portal. (2020, January 4). 2022. Retrieved August 21, 2022, from http://www.dailyexpress.com.my/news/145820/discrimination-still-major-issue-at-malaysian-workplace/

Dissanayake, D., Tilt, C., & Xydias-Lobo, M. (2016). Sustainability reporting by publicly listed companies in Sri Lanka. *Journal of Cleaner Production, 129*, 169-182.

do Nascimento, J. C. H. B., & da Silva Macedo, M. A. (2016). Structural Equation Models using Partial Least Squares: an Example of the Application of SmartPLS® in Accounting Research. *Revista de Educação e Pesquisa em Contabilidade, 10*(3).

Dodge, Y. (2008). The concise encyclopedia of statistics. *Springer Science & Business Media.*

Doland, A. (2014). Published on 28th May 2014. https://adage.com/article/cmo-strategy/coke-turns-empty-bottles-paintbrushes-lamps-toys/293434

Domingue, J., d'Aquin, M., Simperl, E., & Mikroyannidis, A. (2014). The web of data: bridging the skills gap. *IEEE Intelligent Systems, 29*(1), 70-74.

Donnellan, J., & Rutledge, W. L. (2019). A case for resource-based view and competitive advantage in banking. *Managerial and Decision Economics, 40*(6), 728-737.

Dörnyei, Zoltán. (2007). Research methods in applied linguistics. Oxford: Oxford University Press.

Døving, E., & Gooderham, P. N. (2008). Dynamic capabilities as antecedents of the scope of related diversification: the case of small firm accountancy practices. *Strategic Management Journal, 29*(8), 841-857.

Drisko, J. W., & Maschi, T. (2015). Content analysis. Pocket Guides to Social Work R.

Du Toit, A. S. (2016). Using environmental scanning to collect strategic information: A South African survey. *International Journal of Information Management, 36*(1), 16-24.

Du, S., & Yu, K. (2020). Do Corporate Social Responsibility Reports Convey Value Relevant Information? Evidence from Report Readability and Tone. *Journal of Business Ethics, 172*(2), 253-274.

Dubey, R., Gunasekaran, A., & Chakrabarty, A. (2015). World-class sustainable manufacturing: framework and a performance measurement system. *International Journal of Production Research, 53*(17), 5207-5223.

Dubey, R., Gunasekaran, A., Childe, S. J., Blome, C., & Papadopoulos, T. (2019). Big data and predictive analytics and manufacturing performance: integrating institutional theory, resource-based view and big data culture. *British Journal of Management, 30*(2), 341-361.

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Luo, Z., Wamba, S. F., & Roubaud, D. (2017). Can big data and predictive analytics improve social and environmental sustainability?. *Technological Forecasting and Social Change*, *144*, 534-545.

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Wamba, S. F., & Song, M. (2016). Towards a theory of sustainable consumption and production: constructs and measurement. *Resources, Conservation and Recycling, 106,* 78-89.

Dubey, R., Gunasekaran, A., Childe, S. J., Wamba, S. F., & Papadopoulos, T. (2016). The impact of big data on world-class sustainable manufacturing. *International Journal of Advanced Manufacturing Technology, 84*(1–4), 631–645.

Dubey, R., Gunasekaran, A., Papadopoulos, T., Childe, S. J., Shibin, K. T., & Wamba, S. F. (2017). Sustainable supply chain management: framework and further research directions. *Journal of cleaner production, 142,* 1119-1130.

Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business strategy and the environment, 11*(2), 130-141.

Eberl, M. (2010). An application of PLS in multi-group analysis: The need for differentiated corporate-level marketing in the mobile communications industry. In Handbook of partial least squares (pp. 487-514). Springer, Berlin, Heidelberg.

Eberl, M. (2010). An application of PLS in multi-group analysis: The need for differentiated corporate-level marketing in the mobile communications industry. In Handbook of partial least squares (pp. 487-514). Springer, Berlin, Heidelberg.

Ebiringa, O. T., Yadirichukwu, E., Chigbu, E. E., & Ogochukwu, O. J. (2013). Effect of firm size and profitability on corporate social disclosures: The Nigerian oil and gas sector in focus. *Journal of Economics, Management and Trade,* 563-574.

Eichhorn, B. R. (2014). Common method variance techniques. Cleveland State University, Department of Operations & Supply Chain Management. Cleveland, OH: SAS Institute Inc, 1-11.

Eikelenboom, M., & de Jong, G. (2019). The impact of dynamic capabilities on the sustainability performance of SMEs. *Journal of Cleaner Production*, *235*, 1360-1370.

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they?. *Strategic management journal, 21*(10-11), 1105-1121.

El-Kassar, A.N., Singh, S.K. (2018). Green innovation and organizational performance: the influence of big data and the moderating role of management commitment and HR practices. *Technological Forecasting and Social Change*.

Elkington, J. (1997). The triple bottom line. Environmental management: Readings and cases, 2.

Elving, W. J., & Postma, R. M. (2017). Social media: The dialogue myth? How organizations use social media for stakeholder dialogue. In *How strategic communication shapes value and innovation in society*. Emerald Publishing Limited.

Enquist, B., Edvardsson, B., & Sebhatu, S. P. (2007). Values-based service quality for sustainable business. *Managing Service Quality: An International Journal*.

Erevelles, S., Fukawa, N., & Swayne, L. (2016). Big Data consumer analytics and the transformation of marketing. *Journal of business research, 69*(2), 897-904.

Erin, O. A., Bamigboye, O. A., & Oyewo, B. (2022). Sustainable development goals (SDG) reporting: an analysis of disclosure. *Journal of Accounting in Emerging Economies.*

Esa, E., & Zahari, A. R. (2017). Disclosure on Corporate Websites: Corporate Social Responsibility in Malaysia & Singapore Government- Linked Companies. *Journal of Technology Management and Business, 4*(1), 87–95.

Esteban Ortiz-Ospina (2019). https://ourworldindata.org/rise-of-social-media accessed on 18th March 2021.

Eyasu, A. M., & Arefayne, D. (2020). The effect of corporate social responsibility on banks' competitive advantage: Evidence from Ethiopian lion international bank SC. *Cogent Business & Management, 7*(1), 1830473.

Fahad, P., & Nidheesh, K. B. (2020). Determinants of CSR disclosure: an evidence from India. *Journal of Indian Business Research.*

Fairhurst, G.T. (2008). Discursive leadership: A communication alternative to leadership psychology. *Management Communication Quarterly, 21*, 510-521.

Fallan, E., & Fallan, L. (2019). Corporate tax behaviour and environmental disclosure: Strategic trade-offs across elements of CSR?. *Scandinavian Journal of Management, 35*(3), 101042.

Fanelli, A., & Grasselli, N. (2005). Defeating the minotaur: The construction of CEO charisma and the US stock market. *Organization Studies, 27*(6), 811–832.

Fassott, G., Henseler, J., & Coelho, P. S. (2016). Testing moderating effects in PLS path models with composite variables. *Industrial management & data systems*.

Fatma, M., Ruiz, A. P., Khan, I., & Rahman, Z. (2020). The effect of CSR engagement on eWOM on social media. *International Journal of Organizational Analysis.*

Faul, F., Erdfelder, E., Buchner, A. and Lang, A. (2009). "'G', Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses". *Behavior Research Methods, Vol. 41*, pp. 1149-1160.

Favaretto, M., De Clercq, E., Schneble, C. O., & Elger, B. S. (2020). What is your definition of Big Data? Researchers' understanding of the phenomenon of the decade. *PloS one, 15*(2), e0228987.

Felin, T., & Powell, T. C. (2016). Designing organizations for dynamic capabilities. *California Management Review, 58*(4), 78-96.

Feng, S., & Gao, L. S. (2020). The Verbal Tone in Mandatory Environmental Disclosures: Evidence from Changes in Disclosures Following SEC Guidance. *Social and Environmental Accountability Journal, 40*(2), 116–139.

Ferguson, M. J., Lam, K. C., & Lee, G. M. (2002). Voluntary disclosure by state-owned enterprises listed on the stock exchange of Hong Kong. *Journal of International Financial Management & Accounting, 13*(2), 125-152.

Fernandez-Feijoo, B., Romero, S., & Ruiz, S. (2014). Effect of stakeholders' pressure on transparency of sustainability reports within the GRI framework. *Journal of business ethics, 122*(1), 53-63.

Fernando, A. A. J., & Pandey, I. M. (2012). Corporate social responsibility reporting: a survey of listed Sri Lankan companies. *Journal for International Business and Entrepreneurship Development, 6*(2), 172-187.

Ferrarez, R. P. F., Vargas, R. V., Alvarenga, J. C., Chinelli, C. K., de Almeida Costa, M., de Oliveira, B. L., ... & Soares, C. A. P. (2020). Sustainability indicators to assess infrastructure projects: Sector disclosure to interlock with the global reporting initiative. *Engineering Journal, 24*(6), 43-61.

Ferraris, A., Mazzoleni, A., Devalle, A., & Couturier, J. (2018). Big data analytics capabilities and knowledge management: impact on firm performance. *Management Decision*.

Ferreira, J., Coelho, A., & Moutinho, L. (2018). Dynamic capabilities, creativity and innovation capability and their impact on competitive advantage and firm performance: The moderating role of entrepreneurial orientation. *Technovation, 92,* 102061.

Fifka, M., & Adaui, C. R. L. (2015). Corporate Social Responsibility (CSR) Reporting—Administrative Burden or Competitive Advantage?. In *New perspectives on corporate social responsibility* (pp. 285-300). Springer Gabler, Wiesbaden.

Fink, A. (2003). The survey handbook. sage.

Fisher, R., van Staden, C. J., & Richards, G. (2019). Watch that tone: An investigation of the use and stylistic consequences of tone in corporate accountability disclosures. *Accounting, Auditing and Accountability Journal, 33*(1), 77–105.

Font, X., & Lynes, J. (Eds.). (2020). Corporate social responsibility for sustainable tourism. Routledge.

Fornell, C., & Bookstein, F. L. (1982). Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing research, 19*(4), 440-452.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research, 18*(1), 39-50.

Fowler, D., & Pitta, D. (2013). Advances in mining social media: implications for marketers. *Journal of Information Technology Management, 24*(4), 25-33.

Franzosi, R. (1998). Narrative analysis—or why (and how) sociologists should be interested in narrative. *Annual review of sociology, 24*(1), 517-554.

Freeman, R.E., (1984). Strategic management: a stakeholder approach. Pitman, Boston.

Frey, B. (2018). The SAGE encyclopedia of educational research, measurement, and evaluation (Vols. 1-4). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781506326139

Fuente, J. A., García-Sanchez, I. M., & Lozano, M. B. (2017). The role of the board of directors in the adoption of GRI guidelines for the disclosure of CSR information. *Journal of Cleaner Production, 141*, 737-750.

Fuller, C. M., Simmering, M. J., Atinc, G., Atinc, Y., & Babin, B. J. (2016). Common methods variance detection in business research. *Journal of Business Research, 69*(8), 3192-3198.

Fuscaldo, D. (2011). More consumers turn to social media for health care information. Fox Business, 9.

GalbRaith, J. R. (2014). Organizational design challenges resulting from big data. *Journal of Organization Design, 3*(1), 2-13.

Gamerschlag, R., Möller, K. & Verbeeten, F. (2011), "Determinants of voluntary CSR disclosure: empirical evidence from Germany", *Review of Managerial Science, Vol. 4* No. 5, pp. 233-262.

Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of Information Management, 35*(2), 137–144.

Gantz, J., & Reinsel, D. (2012). The digital universe in 2020: Big data, bigger digital shadows, and biggest growth in the far east. IDC iView: IDC Analyze the future, 2007(2012), 1-16.

Gao, J., & Bansal, P. (2013). Instrumental and integrative logics in business sustainability. *Journal of Business Ethics, 112*(2), 241-255.

García-Sánchez, I. M., Aibar-Guzmán, B., Aibar-Guzmán, C., & Azevedo, T. C. (2020). CEO ability and sustainability disclosures: The mediating effect of corporate social responsibility performance. *Corporate Social Responsibility and Environmental Management.*

Garmaki, M., Boughzala, I., & Wamba, S. F. (2016, June). The effect of Big Data Analytics Capability on Firm Performance. In PACIS (p. 301).

Garrison, G., Wakefield, R. L., & Kim, S. (2015). The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations. *International Journal of Information Management, 35*(4), 377–393.

Gavana, G., Gottardo, P., & Moisello, A. M. (2017). Sustainability reporting in family firms: A panel data analysis. *Sustainability (Switzerland), 9*(1), 1–18.

Gavana, G., Gottardo, P., Moisello, A. M., & Moisello, A. M. (2016). Controlling Owner Nature, Visibility and Sustainability Disclosure. European Journal of Economics, *Finance and Administrative Sciences, 88(July)*, 73–84. http://www.europeanjournalofeconomicsfinanceandadministrativesciences.com

Gay, L. R., Mills, G. E., & Airasian, P. (2012). Educational research: Competencies for analysis and applications (10th ed.). New York: Pearson.

Géczy, P. (2014). Big data characteristics. *The Macrotheme Review, 3*(6), 94-104.

George, G., Haas, M. R., & Pentland, A. (2014). Big data and management. *Academy of Management, Volume 57*, No 2, 321-326.

George, G., Osinga, E. C., Lavie, D., & Scott, B. A. (2016). Big data and data science methods for management research.

Ghani, E. K., Jamal, J., Puspitasari, E., & Gunardi, A. (2018). Factors influencing integrated reporting practices among Malaysian public listed real property companies: A sustainable development effort. *International Journal of Managerial and Financial Accounting, 10*(2), 144-162.

Ghani, N. A., Hamid, S., Targio Hashem, I. A., & Ahmed, E. (2019). Social media big data analytics: A survey. *Computers in Human Behavior, 101*(December 2017), 417–428.

Gill, J., & Johnson, P. (2002). Research methods for managers. Sage.

Godemann, J., & Michelsen, G. (2011). Sustainability communication–an introduction. In *Sustainability Communication* (pp. 3-11). Springer, Dordrecht.

Goettsche, M., Steindl, T., & Gietl, S. (2016). Do customers affect the value relevance of sustainability reporting? Empirical evidence on stakeholder interdependence. *Business Strategy and the Environment, 25*(3), 149-164.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of management information systems, 18*(1), 185-214.

Goodhue, D. L., Lewis, W., & Thompson, R. (2012). Does PLS have advantages for small sample size or non-normal data?. *Mis Quarterly*, 981–1001.

Graham, M. H. (2003). Confronting multicollinearity in ecological multiple regression. *Ecology, 84*(11), 2809-2815.

Gramling, A., & Schneider, A. (2018). Effects of reporting relationship and type of internal control deficiency on internal auditors' internal control evaluations. *Managerial Auditing Journal*.

Graves, L. M., Sarkis, J., & Gold, N. (2019). Employee pro environmental behavior in Russia: The roles of top management commitment, managerial leadership, and employee motives. *Resources, Conservation and Recycling, 140*, 54-64.

Gray, R., & Bebbington, J. (2000). Environmental accounting, managerialism and sustainability: Is the planet safe in the hands of business and accounting?. In *Advances in environmental accounting & management.* Emerald Group Publishing Limited.

Gray, R., Kouhy, R., & Lavers, S. (1995). Corporate social and environmental reporting. *Accounting, Auditing & Accountability Journal*.

Greiner, A., Patelli, L., & Pedrini, M. (2020). Characteristics of managerial tone priced by auditors: Evidence based on annual letters to shareholders of large US Firms. *Auditing: A Journal of Practice & Theory, 39*(2), 139-161.

GRI – Global Reporting Initiative. (2015). G4 sustainability reporting guidelines. Reporting principles and standard disclosures. Available at https://www.globalreporting.org/information/g4/Pages/default.aspx.

Grundy, T. (2006). Rethinking and reinventing Michael Porter's five forces model. *Strategic Change, 15*(5), 213-229.

Guidry, R. P., & Patten, D. M. (2010). Market reactions to the first-time issuance of corporate sustainability reports. *Sustainability Accounting, Management and Policy Journal.*

Guliyev, E. A. (2022). Ecology, raw materials and economic development. Expectations.

Gunasekaran, A., Papadopoulos, T., Dubey, R., Wamba, S. F., Childe, S. J., Hazen, B., & Akter, S. (2017). Big data and predictive analytics for supply chain and organizational performance. *Journal of Business Research, 70*, 308–317.

Gunawan, J., Permatasari, P., & Sharma, U. (2022). Exploring sustainability and green banking disclosures: a study of banking sector. *Environment, Development and Sustainability, 24*(9), 11153-11194.

Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information and Management, 53*(8), 1049–1064.

Guthrie, J., & Abeysekera, I. (2006). Content analysis of social, environmental reporting: what is new?. *Journal of Human Resource Costing & Accounting.*

Hahn, R., & Kühnen, M. (2013). Determinants of sustainability reporting: a review of results, trends, theory, and opportunities in an expanding field of research. *Journal of cleaner production, 59*, 5-21.

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). A primer on partial least squares structural equation modeling (PLS-SEM). *Sage Publications*.

Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). Advanced issues in partial least squares structural equation modeling. *Sage Publications*.

Hair, J. F. Jr., Black, W. C., Babin, B. J. and Anderson, R. E. (2010), Multivariate data analysis: A global perspective, 7th ed., Pearson Prentice Hall, Upper Saddle River, NJ.

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2013). A primer on partial least squares structural equation modeling (PLS-SEM). *SAGE Publications, Incorporated.*

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice, 19*(2), 139-152.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*.

Halimah, N. P., Irsyanti, A., & Aini, L. R. (2020). The Value Relevance of Sustainability Reporting: Comparison between Malaysia and Indonesia Stock Market. *The Indonesian Journal of Accounting Research, 23*(3).

Hall, B., & Howard, K. (2008). A synergistic approach: Conducting mixed methods research with typological and systemic design considerations. *Journal of mixed methods research, 2(3)*, 248-269.

Hameed, W. U., Basheer, M. F., Iqbal, J., Anwar, A., & Ahmad, H. K. (2018). Determinants of Firm's open innovation performance and the role of R & D department: an empirical evidence from Malaysian SME's. *Journal of Global Entrepreneurship Research, 8*(1), 29.

Hamilton, R. H., & Sodeman, W. A. (2020). The questions we ask: Opportunities and challenges for using big data analytics to strategically manage human capital resources. *Business Horizons, 63*(1), 85-95.

Hanaysha, J. R. (2017). Impact of social media marketing, price promotion, and corporate social responsibility on customer satisfaction. *Jindal Journal of Business Research, 6*(2), 132-145.

Haniffa, R. M., & Cooke, T. E. (2005). The impact of culture and governance on corporate social reporting. *Journal of accounting and public policy, 24*(5), 391-430.

Harbaugh, R. (2002). Proven lessons for generating good mail survey response rates. *Medical Marketing & Media, 37*(10), 70-70.

Hardiningsih, P., Januarti, I., Yuyetta, E. N. A., Srimindarti, C., & Udin, U. (2020). The effect of sustainability information disclosure on financial and market performance: Empirical evidence from Indonesia and Malaysia. *International Journal of Energy Economics and Policy, 10*(2), 18.

Haro-de-Rosario, A., Sáez-Martín, A., & del Carmen Caba-Pérez, M. (2018). Using social media to enhance citizen engagement with local government: Twitter or Facebook?. *New Media and Society, 20*(1), 29–49.

Harrison, J. S., Bosse, D. A., & Phillips, R. A. (2010). Managing for stakeholders, stakeholder utility functions, and competitive advantage. *Strategic management journal, 31*(1), 58-74.

Hart, R. P. (1984). Systematic analysis of political discourse: The development of DICTION. In K. Sanders et al. (Eds.), Political communication yearbook (pp. 1–5). Carbondale, IL: Southern Illinois University Press.

Hart, R. P. (2000). DICTION 5.0: The text-analysis program. Thousand Oaks, CA: Sage

Harymawan, I., Nasih, M., Salsabilla, A., & Putra, F. K. G. (2020). External assurance on sustainability report disclosure and firm value: Evidence from Indonesia and Malaysia. *Entrepreneurship and Sustainability Issues, 7*(3), 1500-1512.

Haseeb, M., Hussain, H. I., Kot, S., Androniceanu, A., & Jermsittiparsert, K. (2019). Role of social and technological challenges in achieving a sustainable competitive advantage and sustainable business performance. *Sustainability* (Switzerland), 11(14).

Hashim, F., Amran, A., Nejati, M., & Ismail, Z. (2016). Examining the determinants of sustainability web-reporting by local authorities in Malaysia. *International Journal of Society Systems Science, 8*(2), 155-170.

Hassan, A. (2019). Verbal tones in sustainability assurance statements: An empirical exploration of explanatory factors. *Sustainability Accounting, Management and Policy Journal, 10*(3), 427–450.

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. (2009). Dynamic capabilities: Understanding strategic change in organizations. John Wiley & Sons.

Henry, L. A., Buyl, T., & Jansen, R. J. (2019). Leading corporate sustainability: The role of top management team composition for triple bottom line performance. *Business Strategy and the Environment, 28*(1), 173-184.

Henseler, J., & Chin, W. W. (2010). A comparison of approaches for the analysis of interaction effects between latent variables using partial least squares path modeling. *Structural Equation Modeling, 17*(1), 82–109.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial management & data systems.*

Henseler, J., Ringle, C. M., & Sarstedt, M. (2016). Testing measurement invariance of composites using partial least squares. *International marketing review*.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In *New challenges to international marketing*. Emerald Group Publishing Limited.

Hermano, V., & Martín-Cruz, N. (2016). The role of top management involvement in firms performing projects: A dynamic capabilities approach. *Journal of Business Research, 69*(9), 3447–3458.

HERNAWATI, E. (2020). Business strategy, corporate governance and sustainability reporting: an analysis of the fit contingency approach. *The Journal of Asian Finance, Economics and Business, 7*(12), 761-771.

Herremans, I. M., Nazari, J. A., & Mahmoudian, F. (2016). Stakeholder relationships, engagement, and sustainability reporting. *Journal of Business Ethics, 138*(3), 417-435.

Hesse-Biber, S., & Johnson, R. B. (2015). The Oxford Handbook of MULTIMETHOD and MIXED METHODS RESEARCH INQUIRY (Vol. 66). Oxford university press.

Hilbert, M. (2013). Big data for development: From information-to knowledge societies. Available at SSRN 2205145.

Holcomb, Z. (2016). Fundamentals of Descriptive Statistics. In *Fundamentals of Descriptive Statistics.*

Hong, C. C., Ramayah, T., & Subramaniam, C. (2018). The relationship between critical success factors, internal control and safety performance in the Malaysian manufacturing sector. *Safety science, 104,* 179-188.

Hongming, X., Ahmed, B., Hussain, A., Rehman, A., Ullah, I., & Khan, F. U. (2020). Sustainability reporting and firm performance: The demonstration of Pakistani firms. *SAGE Open, 10*(3), 2158244020953180.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6(1),* 53– 60.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal, 6(1),* 1-55.

HUSNAINI, W., & Basuki, B. (2020). ASEAN corporate governance scorecard: sustainability reporting and firm value. *The Journal of Asian Finance, Economics and Business, 7*(11), 315-326.

Hussain, N., Rigoni, U., & Orij, R. P. (2018). Corporate Governance and Sustainability Performance: Analysis of Triple Bottom Line Performance. *Journal of Business Ethics, 149(2),* 411–432.

Hutchins, M. J., Richter, J. S., Henry, M. L., & Sutherland, J. W. (2019). Development of indicators for the social dimension of sustainability in a US business context. *Journal of Cleaner Production, 212*, 687-697.

Id Bouichou, S., Wang, L., & Zulfiqar, S. (2022). How Perceived Corporate Social Responsibility Raises Employees' Creative Behaviors Based on Appraisal Theory of Emotion: The Serial Mediation Model. *Frontiers in Psychology, 13*, 865007.

IFAC. (2007). Tone at the top and audit quality. New York: International Federation of Accountants.

Igwe, S. R., Ebenuwa, A., & Idenedo, O. W. (2020). Technology adoption and sales performance of manufacturing small and medium enterprises in port harcourt. *Journal of Marketing Development, 5(1),* 44–59.

Ikpor, I. M., Bracci, E., Kanu, C. I., Ievoli, R., Okezie, B., Mlanga, S., & Ogbaekirigwe, C. (2022). Drivers of Sustainability Accounting and Reporting in Emerging Economies: Evidence from Nigeria. *Sustainability, 14*(7), 3780.

Inauen, S., & Schoeneborn, D. (2014). Twitter and its usage for dialogic stakeholder communication by MNCs and NGOs. In *Communicating corporate social responsibility: Perspectives and practice.* Emerald Group Publishing Limited.

Ioannou, I., & Serafeim, G. (2017). The consequences of mandatory corporate sustainability reporting. *Harvard Business School research working paper*, (11-100).

Isaac, S. and Micheal, W.B. (1995). Handbook in Research and Evaluation. In Hill, R. (1998). "What Sample Size is 'Enough' in Internet Survey Research"? *Interpersonal Computing and Technology: An electronic Journal for the 21st Century.*

Isenmann, R., & Kim, K. C. (2006). Interactive sustainability reporting. Developing clear target group tailoring and stimulating stakeholder dialogue. *Sustainability accounting and reporting* (pp. 533-555). Springer, Dordrecht.

Ismail, M. S., Ramli, A., & Darus, F. (2014). Environmental Management Accounting Practices and Islamic Corporate Social Responsibility Compliance: Evidence from ISO14001 Companies. *Procedia-Social and Behavioral Sciences, 145,* 343–351.

J¨oreskog, K. G. (1971). Simultaneous Factor analysis in several populations. *Psychometrika, 36*(4), 409–426.

Jadoon, I. A., Ali, A., Ayub, U., Tahir, M., & Mumtaz, R. (2021). The impact of sustainability reporting quality on the value relevance of corporate sustainability performance. *Sustainable Development, 29*(1), 155-175.

Jamil, A., Mohd Ghazali, N. A., & Puat Nelson, S. (2020). The influence of corporate governance structure on sustainability reporting in Malaysia. *Social Responsibility Journal.*

Jennifer Ho, L. C., & Taylor, M. E. (2007). An empirical analysis of triple bottom-line reporting and its determinants: evidence from the United States and Japan. *Journal of International Financial Management & Accounting, 18(2),* 123-150.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics, 3*(4), 305-360.

Jia, L., Hall, D., & Song, J. (2015). The conceptualization of data-driven decision making capability.

Johari, J., & Komathy, M. (2019). Sustainability reporting and firm performance: Evidence in Malaysia. *International Journal of Accounting, Finance and Business, 4(17)*, 32-45.

Johnson, P., & Duberley, J. (2000). Understanding management research: An introduction to epistemology. Sage.

Johnson, S. (2014). Advantages & disadvantages of positivism. Retrieved on, 14, 2014.

Jones, T. M., Harrison, J. S., & Felps, W. (2018). How applying instrumental stakeholder theory can provide sustainable competitive advantage. *Academy of Management Review, 43(3),* 371-391.

Joseph, A. gliem, & Rosemary, R. G. (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. *Midwest Research to Practice Conference in Adult, Continuing, and Community Education, 14(C),* 349–372.

Kaisler, S., Armour, F., Espinosa, J. A., & Money, W. (2013). Big data: Issues and challenges moving forward. In 2013 46th Hawaii international conference on system sciences (pp. 995-1004). *IEEE.*

Kalnins, A. (2018). Multicollinearity: How common factors cause Type 1 errors in multivariate regression. *Strategic Management Journal, 39(8)*, 2362-2385.

Kamatra, N., & Kartikaningdyah, E. (2015). Effect corporate social responsibility on financial performance. *International Journal of Economics and Financial Issues, 5(2015)*, 157-164.

Kamil, A., & Herusetya, A. (2012). Pengaruh karakteristik perusahaan terhadap luas pengungkapan kegiatan corporate social responsibility. *Media Riset Akuntansi,* 2(1).

Kansal, M., Joshi, M., & Batra, G. S. (2014). Determinants of corporate social responsibility disclosures: Evidence from India. *Advances in Accounting, 30(1),* 217-229.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons, 53(1)*, 59-68.

Karimi, J., Somers, T. M., & Gupta, Y. P. (2001). Impact of information technology management practices on customer service. *Journal of Management Information Systems, 17*(4), 125-158.

Kasbun, N. F., Teh, B. H., & San Ong, T. (2017). Sustainability reporting and financial performance of Malaysian public listed companies. *Institutions and Economies*, 78-93.

Kaur, A., & K. Lodhia, S. (2014). The state of disclosures on stakeholder engagement in sustainability reporting in Australian local councils. *Pacific Accounting Review, 26*(1/2), 54–74. https://doi.org/10.1108/par-07-2013-0064

Kaya, I., & Akbulut, D. H. (2018). Big data analytics in financial reporting and accounting. *Pressacademia, 7(1),* 256–259.

Keeso, A. (2014). Big data and environmental sustainability: A conversation starter. December, 34.

Kennedy, L. G., Kichler, E. J., Seabrook, J. A., Matthews, J. I., & Dworatzek, P. D. N. (2019). Validity and Reliability of a Food Skills Questionnaire. *Journal of Nutrition Education and Behavior, 51(7),* 857–864.

Khan, A., Muttakin, M. B., & Siddiqui, J. (2013). Corporate governance and corporate social responsibility disclosures: Evidence from an emerging economy. *Journal of business ethics, 114(2),* 207-223.

Khan, M., Lockhart, J., & Bathurst, R. (2020). A multi-level institutional perspective of corporate social responsibility reporting: A mixed-method study. *Journal of Cleaner Production,* 121739.

Khan, S. Z., Yang, Q., & Waheed, A. (2019). Investment in intangible resources and capabilities spurs sustainable competitive advantage and firm performance.

Corporate Social Responsibility and Environmental Management, 26(2), 285-295.

Kilenthong, P., Hultman, C. M., & Hills, G. E. (2016). Entrepreneurial marketing behaviours: impact of firm age, firm size and firm's founder. *Journal of Research in Marketing and Entrepreneurship.*

Kim, D., & Kim, S. (2017). Sustainable supply chain based on news articles and sustainability reports: Text mining with Leximancer and DICTION. *Sustainability* (Switzerland), 9(6).

Kim, G., Shin, B., & Kwon, O. (2012). Investigating the Value of Sociomaterialism in Conceptualizing IT Capability of a Firm. *Journal of Management Information Systems, 29(3)*, 327–362.

Kim, H., & Xu, H. (2019). Exploring the effects of social media features on the publics' responses to decreased usage CSR messages. *Corporate Communications: An International Journal.*

Kiron, D., Prentice, P. K., & Ferguson, R. B. (2014). Raising the bar with analytics. *MIT Sloan Management Review, 55(2)*, 29.

Kline, R. (2013). Exploratory and confirmatory factor analysis. *Applied quantitative analysis in the social sciences,* 171-207.

Ko, W. W., & Liu, G. (2017). Environmental strategy and competitive advantage: The role of small-and medium-sized enterprises' dynamic capabilities. *Business Strategy and the Environment, 26(5),* 584-596.

Kolmakov, V. V., Rudneva, L. N., & Thalassinos, Y. E. (2020). Public survey instruments for business administration using social network analysis and big data.

Konstantinos, G. P., Vaios, B., & Athanasios, S. C. (2010). Environmental reporting in Greece: The Athens stock exchange. *African Journal of Business Management, 4*(13), 2693-2704.

Kraemer, H. C., Mintz, J., Noda, A., Tinklenberg, J., & Yesavage, J. A. (2006). Caution regarding the use of pilot studies to guide power calculations for study proposals. *Archives of general psychiatry, 63(5)*, 484-489.

Krippendorff, K. (2004a). Content analysis: An introduction to its methodology: SAGE Publications.

Krippendorff, K. (2004b). Reliability in content analysis: Some common misconceptions and recommendations. *Human communication research, 30(3),* 411-433.

Kucukusta, D., Perelygina, M., & Lam, W. S. (2019). CSR communication strategies and stakeholder engagement of upscale hotels in social media. *International Journal of Contemporary Hospitality Management, 31(5),* 2129–2148.

Kuhn, T. (2008). A Communicative Theory of the Firm: Developing an Alternative Perspective on Intra-organizational Power and Stakeholder Relationships.

Organization Studies, 29(8–9), 1227–1254. https://doi.org/10.1177/0170840608094778

Kumar, A., & Das, N. (2021). A Text-Mining Approach to the Evaluation of Sustainability Reporting Practices: Evidence from a Cross-Country Study. *Problemy Ekorozwoju, 16*(1).

Kumar, C. R. (2008). Research Methodology. New Delhi: APH Publishing Corporation.

Kumar, V., & Pansari, A. (2016). Competitive advantage through engagement. *Journal of marketing research, 53(4)*, 497-514.

Kumarasinghe, S., & Hoshino, Y. (2010). The role and perceptions of middle managers and their influence on business performance: The case of Sri Lanka. *International Business Research, 3(4),* 3-16.

Kuzey, C., & Uyar, A. (2017). Determinants of sustainability reporting and its impact on firm value: Evidence from the emerging market of Turkey. *Journal of Cleaner Production, 143,* 27–39.

Kwarteng, A., Dadzie, S. A., & Famiyeh, S. (2016). Sustainability and competitive advantage from a developing economy. *Journal of Global Responsibility, 7(1),* 110–125.

Larcker, D. F., & Tayan, B. (2016). Chairman and CEO: the controversy over board leadership structure. Rock Center for Corporate Governance at Stanford University Closer Look Series: Topics, Issues and Controversies in Corporate Governance No. CGRP-58, 16-32.

Laskar, N. (2018). Impact of corporate sustainability reporting on firm performance: an empirical examination in Asia. *Journal of Asia Business Studies*.

Laskar, N. (2019). Does sustainability reporting enhance firms profitability? A study on select companies from India and South Korea. *Indian Journal of Corporate Governance, 12*(1), 2-20.

Laskar, N., & Gopal Maji, S. (2018). Disclosure of corporate sustainability performance and firm performance in Asia. *Asian Review of Accounting* (Vol. 26, Issue 4).

Latan, H., Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Wamba, S. F., & Shahbaz, M. (2018). Effects of environmental strategy, environmental uncertainty and top management's commitment on corporate environmental performance: The role of environmental management accounting. *Journal of Cleaner Production, 180,* 297-306.

Latan, H., Noonan, R., & Matthews, L. (2017). Partial least squares path modeling. Partial least squares path modeling: basic concepts, methodological issues and applications.

Lavrakas, P. J. (2008). Encyclopedia of survey research methods (Vols. 1-0). Thousand Oaks, CA: Sage Publications, Inc.

Lee, K. H., & Min, B. (2015). Green R&D for eco-innovation and its impact on carbon emissions and firm performance. *Journal of Cleaner Production, 108,* 534–542.

Lee, K., Oh, W. Y., & Kim, N. (2013). Social Media for Socially Responsible Firms: Analysis of Fortune 500's Twitter Profiles and their CSR/CSIR Ratings. *Journal of Business Ethics, 118(4)*, 791–806.

Lee, Y. (2021). Bridging employee advocacy in anonymous social media and internal corporate social responsibility (CSR). *Management Decision.*

Legendre, S., & Coderre, F. (2013). Determinants of GRI G3 application levels: the case of the fortune global 500. *Corporate Social Responsibility and Environmental Management, 20*(3), 182-192.

Lehrer, C., Wieneke, A., Vom Brocke, J. A. N., Jung, R., & Seidel, S. (2018). How big data analytics enables service innovation: materiality, affordance, and the individualization of service. *Journal of Management Information Systems, 35(2),* 424-460.

Leoi, Sam (2019) https://www.thestar.com.my/lifestyle/living/2019/01/22/malaysia-extinct-bees

Leonidou, E., Christofi, M., Vrontis, D., & Thrassou, A. (2018). An integrative framework of stakeholder engagement for innovation management and entrepreneurship development. *Journal of Business Research*.

Leonidou, L. C., Leonidou, C. N., Fotiadis, T. A., & Aykol, B. (2015). Dynamic capabilities driving an eco-based advantage and performance in global hotel chains: The moderating effect of international strategy. *Tourism Management, 50*, 268-280.

Li, D. yuan, & Liu, J. (2014). Dynamic capabilities, environmental dynamism, and competitive advantage: Evidence from China. *Journal of Business Research*, 67(1), 2793–2799.

Liao, C. H., & Chen, M. Y. (2019). Building social computing system in big data: From the perspective of social network analysis. *Computers in Human Behavior, 101*, 457-465.

Liu, P., & Nguyen, H. T. (2020). CEO characteristics and tone at the top inconsistency. *Journal of Economics and Business, 108*, 105887.

Lock, I., & Araujo, T. (2020). Visualizing the triple bottom line: A large-scale automated visual content analysis of European corporations' website and social media images. *Corporate Social Responsibility and Environmental Management, 27*(6), 2631-2641.

Lodhia, S. (2018). Is the medium the message?. *Meditari Accountancy Research*.

Lodhia, S., & Stone, G. (2017). Integrated reporting in an internet and social media communication environment: conceptual insights. *Australian Accounting Review, 27(1),* 17-33.

Lodhia, S., Kaur, A., & Stone, G. (2020). The use of social media as a legitimation tool for sustainability reporting. *Meditari Accountancy Research.*

Lombardi, R., & Secundo, G. (2020). The digital transformation of corporate reporting–a systematic literature review and avenues for future research. *Meditari Accountancy Research.*

Lourenço, I. C., & Branco, M. C. (2013). Determinants of corporate sustainability performance in emerging markets: the Brazilian case. *Journal of Cleaner Production, 57,* 134-141.

Lowry, P.B. and Gaskin, J. (2014), "Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: when to choose it and how to use it". *IEEE Transactions on Professional Communication,* Vol. 57 No. 2, pp. 123-146.

Lozada, N., Arias-Pérez, J., & Perdomo-Charry, G. (2019). Big data analytics capability and co-innovation: An empirical study. *Heliyon,* 5(10),

Lozano, R., & Huisingh, D. (2011). Inter-linking issues and dimensions in sustainability reporting. *Journal of cleaner production, 19*(2-3), 99-107.

Lozano, R., Nummert, B., & Ceulemans, K. (2016). Elucidating the relationship between sustainability reporting and organisational change management for sustainability. *Journal of Cleaner Production,* 125, 168-188.

Luthra, S., & Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection,* 117, 168-179.

Lyon, T. P., & Montgomery, A. W. (2013). Tweetjacked: The Impact of Social Media on Corporate Greenwash. *Journal of Business Ethics*, 118(4), 747–757.

Lyons, K. (2022, June 29). Leveraging Sustainability Reporting in Malaysia with Digitalization. Retrieved July 5, 2022, from https://www.azeusconvene.com/articles/leveraging-sustainability-reporting-in-malaysia-with-digitalization

Mack, L. (2010). The philosophical underpinnings of educational research.

Mackenzie, N., & Knipe, S. (2006). Research Paradigms, Methods and Methodology. Issues in Educational Research, 16(3), 213–231.

Macrì, C., Dagnino, D., Guerrina, M., Médail, F., Minuto, L., Thompson, J. D., & Casazza, G. (2021). Effects of environmental heterogeneity on phenotypic variation of the endemic plant Lilium pomponium in the Maritime and Ligurian Alps. *Oecologia,* 195(1), 93-103.

Mądra-Sawicka, M., & Paliszkiewicz, J. (2020). Information Sharing Strategies in the Social Media Era: The Perspective of Financial Performance and CSR in the Food Industry. *Information, 11*(10), 463.

Madsen, E. K., Peck, J. A., & Valdovinos, M. G. (2016). A review of research on direct-care staff data collection regarding the severity and function of challenging behavior in individuals with intellectual and developmental disabilities. *Journal of Intellectual Disabilities,* 20(3), 296-306.

Magnusson, C., Arppe, A., Eklund, T., Back, B., Vanharanta, H., & Visa, A. (2005). The language of quarterly reports as an indicator of change in the company's financial status. *Information & Management*, 42(4), 561-574.

Mahadeo, S.: (2006). 'How management can prevent fraud by example', Fraud NovVDec.

Mahlia, T. M. I., Ismail, N., Hossain, N., & Silitonga, A. S. (2019). Palm oil and its wastes as bioenergy sources: a comprehensive review. *Environmental Science and Pollution Research,* 26(15), 14849-14866.

Mahmood, M., & Orazalin, N. (2017). Green governance and sustainability reporting in Kazakhstan's oil, gas, and mining sector: Evidence from a former USSR emerging economy. *Journal of Cleaner Production,* 164, 389–397. https://doi.org/10.1016/j.jclepro.2017.06.203

Makadok, R. (2001). Toward a synthesis of the resource-based and dynamic-capability views of rent creation. *Strategic management journal*, 22(5), 387-401.

Makhdoomi, U. M. (2018). Top Management Commitment and Diversity Challenges in Telecom Sector Top Management Commitment and Diversity Challenges in Telecom Sector. *Asian Journal of Managerial Science*, 7(1), 53–56.

Makhloufi, L., Yaacob, N. A., & Yamin, F. M. (2018). Investigation on the Relationship between IT and Core Competency on the Sustainable Competitive Advantage of Malaysian SMEs. *Journal of International Business and Management,* 1(September), 1–15.

Malaysia Prime Minister's Department, E. P. U. (2017). Malaysia Sustainable Development Goals Voluntary National Review 2017. In High-level Political Forum.

Mamat, T. N. A. R., Saman, M. Z. M., Sharif, S., & Simic, V. (2016). Key success factors in establishing end-of-life vehicle management system: a primer for Malaysia. *Journal of Cleaner Production*, 135, 1289-1297.

Mandal, S. (2018). An examination of the importance of big data analytics in supply chain agility development: A dynamic capability perspective. *Management Research Review,* 41(10), 1201–1219. https://doi.org/10.1108/MRR-11-2017-0400

Manetti, G., & Bellucci, M. (2016). The use of social media for engaging stakeholders in sustainability reporting. *Accounting, Auditing & Accountability Journal.*

Markus, A., & Swift, T. (2019). Corporate governance and the impact to the R&D lab. *Journal of Strategy and Management.*

Marquis, C., & Qian, C. (2014). Corporate social responsibility reporting in China: Symbol or substance?. *Organization science,* 25(1), 127-148.

Marsden, J. H., & Wilkinson, V. A. (2018). Big data analytics and corporate social responsibility: Making sustainability science part of the bottom line. IEEE International Professional Communication Conference, 2018-July(June), 51–60. https://doi.org/10.1109/ProComm.2018.00019

Marsh, H. W., Hau, K. T., Balla, J. R., & Grayson, D. (1998). Is more ever too much? The number of indicators per factor in confirmatory factor analysis. *Multivariate behavioral research*, 33(2), 181-220.

Marshall, L. L., & Cali, J. (2015). They protect us from computer fraud: Who protects us from them? SafeNet, inc.: A case of fraudulent financial reporting. *Issues in Accounting Education*, 30(4), 353-372.

Martínez, J. B., Fernández, M. L., & Fernández, P. M. R. (2016). Corporate social responsibility: Evolution through institutional and stakeholder perspectives. *European journal of management and business economics,* 25(1), 8-14.

Martin-Rojas, R., Garcia-Morales, V. J., & Gonzalez-Alvarez, N. (2019). Technological antecedents of entrepreneurship and its consequences for organizational performance. *Technological Forecasting and Social Change,* 147(May 2017), 22–35. https://doi.org/10.1016/j.techfore.2019.06.018

Masud, M., Kaium, A., Rashid, M., Ur, H., Khan, T., Bae, S. M., & Kim, J. D. (2019). Organizational strategy and corporate social responsibility: The mediating effect of triple bottom line. *International journal of environmental research and public health,* 16(22), 4559.

Matten, D., & Moon, J. (2008). "Implicit" and "explicit" CSR: A conceptual framework for a comparative understanding of corporate social responsibility. *Academy of management Review,* 33(2), 404-424.

Mauro, S. G., Cinquini, L., Simonini, E., & Tenucci, A. (2020). Moving from social and sustainability reporting to integrated reporting: Exploring the potential of Italian public-funded universities' reports. *Sustainability, 12*(8), 3172.

Maury, B. (2018). Sustainable competitive advantage and profitability persistence: Sources versus outcomes for assessing advantage. *Journal of Business Research,* 84, 100-113.

Mayfield, J., Mayfield, M., & Sharbrough, W. C. (2014). Strategic Vision and Values in Top Leaders' Communications. *International Journal of Business Communication, 52*(1), 97–121. https://doi.org/10.1177/2329488414560282

Mazzei, M. J., & Noble, D. (2017). Big data dreams: A framework for corporate strategy. *Business Horizons*, 60(3), 405–414. https://doi.org/10.1016/j.bushor.2017.01.010

McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D. J., & Barton, D. (2012). Big data: the management revolution. *Harvard business review*, 90(10), 60-68.

McPeake, J., Bateson, M., & O'Neill, A. (2014). Electronic surveys: how to maximise success. Nurse researcher, 21(3).

Meadows, D. H., Randers, J., & Meadows, D. L. (2013). The Limits to Growth (1972) (pp. 101-116). Yale University Press.

Mehrotra, M. (2016). Digital Era for ASEAN Conglomerates: Hype or Reality? Monitor Deloitte.

Memon, M. A., Cheah, J. H., Ramayah, T., Ting, H., Chuah, F., & Cham, T. H. (2019). Moderation analysis: issues and guidelines. *Journal of Applied Structural Equation Modeling,* 3(1), i-xi.

Memon, M. A., Ting, H., Cheah, J.-H., Thurasamy, R., Chuah, F., & Cham, T. H. (2020). Sample Size for Survey Research: Review and Recommendations. *Journal of Applied Structural Equation Modeling,* 4(2), i–xx. https://doi.org/10.47263/jasem.4(2)01

Men, L. R., & Tsai, W. S. (2016). Gearing toward excellence in corporate social media communications: Understanding the why and how of public engagement. In A. Hutchins, & N. Tindall (Eds.), Public relations and participatory culture: Fandom, social media, and community engagement (pp. 89–101). New York, NY: Routledge.

Merello, P., Barberá, A., & De la Poza, E. (2022). Is the sustainability profile of FinTech companies a key driver of their value?. Technological Forecasting and Social Change, 174, 121290.

Mia, L. and Clarke, B. (1999), "Market competition, management accounting systems and business unit performance". *Management Accounting Research*, Vol. 10 No. 2, pp. 137-58.

Mikalef, P., Boura, M., Lekakos, G., & Krogstie, J. (2019). Big data analytics and firm performance: Findings from a mixed-method approach. *Journal of Business Research,* 98, 261–276. https://doi.org/10.1016/j.jbusres.2019.01.044

Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. (2020). Exploring the relationship between big data analytics capability and competitive performance: The mediating roles of dynamic and operational capabilities. *Information and Management,* 57(2), 103169. https://doi.org/10.1016/j.im.2019.05.004

Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2018). Big data analytics capabilities: a systematic literature review and research agenda. *Information Systems and E-Business Management,* 16(3), 547–578. https://doi.org/10.1007/s10257-017-0362-y

Miklosik, A., Starchon, P., & Hitka, M. (2021). Environmental sustainability disclosures in annual reports of ASX Industrials List companies. Environment, Development and Sustainability, 23(11), 16227–16245. https://doi.org/10.1007/s10668-021-01338-8

Milne, M. J., & Adler, R. W. (1999). Exploring the reliability of social and environmental disclosures content analysis. *Accounting, Auditing & Accountability Journal.*

Mishra, P., & Yadav, M. (2021). Environmental capabilities, proactive environmental strategy and competitive advantage: A natural-resource-based view of firms operating in India. *Journal of Cleaner Production,* 291, 125249.

Mohammad, W. M. W., & Wasiuzzaman, S. (2021). Environmental, Social and Governance (ESG) disclosure, competitive advantage and performance of firms in Malaysia. Cleaner Environmental Systems, 2, 100015.

Mohd Fuzi, N., Habidin, N. F., Janudin, S. E., & Ong, S. Y. Y. (2019). Critical success factors of environmental management accounting practices: findings from Malaysian manufacturing industry. *Measuring Business Excellence,* 23(1), 1–14. https://doi.org/10.1108/MBE-03-2018-0015

Mokhtar, N. (2015). The extent of environmental management accounting (EMA) implementation and environmental reporting (ER) practices: Evidence from Malaysian Public Listed Companies.

Montabon, F., Sroufe, R., & Narasimhan, R. (2007). An examination of corporate reporting, environmental management practices and firm performance. *Journal of operations management, 25*(5), 998-1014.

Moorthy, K., T'ing, L. C., Wei, K. M., Mei, P. T. Z., Yee, C. Y., Wern, K. L. J., & Xin, Y. M. (2019). Is facebook useful for learning? A study in private universities in Malaysia. *Computers & Education,* 130, 94-104.

Morse, J. M. (2003). Principles of mixed methods and multimethod research design. Handbook of mixed methods in social and behavioral research, 1, 189-208.

Morsid, M. S. S., Jamaluddin, S. A., Hood, N. A., Shaadan, N., Wah, Y. B., & Annamalai, M. (2019). Haze alarm visual map (HazeViz): an intelligent haze forecaster. *Bulletin of Electrical Engineering and Informatics*, 8(1), 305-312.

Morsing, M., & Schultz, M. (2006). Corporate social responsibility communication: stakeholder information, response and involvement strategies. *Business ethics: A European review,* 15(4), 323-338.

Mucan, B., & Özeltürkay, E. Y. (2014). Social media creates competitive advantages: How Turkish banks use this power? A content analysis of Turkish banks through their webpages. *Procedia-Social and Behavioral Sciences*, 148, 137-145.

Müller, J. (2021). Social media users as a percentage of the total population Malaysia 2021, https://www.statista.com/statistics/883712/malaysia-social-media-penetration/ accessed on 7th April 2021.

Müller, O., Fay, M., & Vom Brocke, J. (2018). The effect of big data and analytics on firm performance: An econometric analysis considering industry characteristics. *Journal of Management Information Systems, 35*(2), 488-509.

Mummolo, J., & Peterson, E. (2018). Improving the interpretation of fixed effects regression results. *Political Science Research and Methods*, 6(4), 829-835.

Munodawafa, R. T., & Johl, S. K. (2019). Big data analytics capabilities and eco-innovation: a study of energy companies. *Sustainability,* 11(15), 4254.

Naeem, M., Jamal, T., Diaz-Martinez, J., Butt, S. A., Montesano, N., Tariq, M. I., ... & De-La-Hoz-Valdiris, E. (2022). Trends and future perspective challenges in big data. In Advances in Intelligent Data Analysis and Applications: Proceeding of the Sixth Euro-China Conference on Intelligent Data Analysis and Applications, 15–18 October 2019, Arad, Romania (pp. 309-325). Springer Singapore.

Nakao, Y., Kokubu, K., & Nishitani, K. (2019). Do Sustainability Reports Strategically Employ Rhetorical Tone？: An evidence from Japan. *Business Administration Kobe University,* 1(1).

Nazari, J. A., Herremans, I. M., & Warsame, H. A. (2015). Sustainability reporting: external motivators and internal facilitators. *Corporate Governance.*

Ngu, S. B., & Amran, A. (2018). Materiality disclosure in sustainability reporting: fostering stakeholder engagement. *Strategic Direction*.

Ning, X., Yim, D., & Khuntia, J. (2021). Online Sustainability Reporting and Firm Performance: Lessons Learned from Text Mining. *Sustainability,* 13(3), 1069.

Nitzl, C. (2018). Management accounting and partial least squares-structural equation modelling (PLS-SEM): Some illustrative examples. In Partial Least Squares Structural Equation Modeling (pp. 211-229). Springer, Cham.

Nitzl, C., & Chin, W. W. (2017). The case of partial least squares (PLS) path modeling in managerial accounting research. *Journal of Management Control,* 28(2), 137–156. https://doi.org/10.1007/s00187-017-0249-6

Nunnally, J. C. (1994). Psychometric theory 3E. Tata McGraw-hill education.

Nwagbara, U., & Reid, P. (2013). Corporate Social Responsibility Communication in the Age of New Media: Towards the Logic of Sustainability Communication. *Review of International Comparative Management,* 14(3), 400–414. https://doi.org/10.1055/s-0031-1295448

Olsen, W. (2011). Data collection: Key debates and methods in social research. Sage.

Oncioiu, I., Petrescu, A. G., Bîlcan, F. R., Petrescu, M., Popescu, D. M., & Anghel, E. (2020). Corporate Sustainability Reporting and Financial Performance. *Sustainability,* 12(10), 4297.

Orazalin, N., & Mahmood, M. (2018). Economic, environmental, and social performance indicators of sustainability reporting: Evidence from the Russian oil and gas industry. *Energy policy,* 121, 70-79.

Ortiz-Martínez, E., Marín-Hernández, S., & Santos-Jaén, J. M. (2022). Sustainability, corporate social responsibility, non-financial reporting and company performance: Relationships and mediating effects in Spanish small and medium sized enterprises. *Sustainable Production and Consumption.*

Osborn, D., Cutter, A., & Ullah, F. (2015). Universal sustainable development goals. Understanding the Transformational Challenge for Developed Countries.

Ouakouak, M. L., Ouedraogo, N., & Mbengue, A. (2014). The mediating role of organizational capabilities in the relationship between middle managers' involvement and firm performance: A European study. *European Management Journal,* 32(2), 305-318.

Özeltürkay, E. Y., & Mucan, B. (2014). How Turkish banks benefit from social media: analyzing banks formal links. *International Journal of Strategic Innovative Marketing,* 1(2), 120-129.

Pallant, J. (2020). SPSS survival manual: A step by step guide to data analysis using IBM SPSS. Routledge.

Palmer, I., King, A. W., & Kelleher, D. (2004). Listening to Jack: GE's change conversations with shareholders. *Journal of Organizational Change Management*, 17(6), 593–614

Panda, S. S., & Sangle, S. (2020). Stakeholder engagement as a dynamic capability. Business Strategy & Development, 3(2), 204-212.

Papadas, K. K., Avlonitis, G. J., Carrigan, M., & Piha, L. (2018). The interplay of strategic and internal green marketing orientation on competitive advantage. *Journal of Business Research,* 104, 632-643.

Papoutsi, A., & Sodhi, M. M. S. (2020). Does disclosure in sustainability reports indicate actual sustainability performance? *Journal of Cleaner Production*, 260, 121049. https://doi.org/10.1016/j.jclepro.2020.121049

Patelli, L., & Pedrini, M. (2015). Is tone at the top associated with financial reporting aggressiveness?. *Journal of Business Ethics*, 126(1), 3-19.

Pavlou, P. A., & El Sawy, O. A. (2010). The "third hand": IT-enabled competitive advantage in turbulence through improvisational capabilities. *Information systems research,* 21(3), 443-471.

Pei, D., & Vasarhelyi, M. A. (2020). Big data and algorithmic trading against periodic and tangible asset reporting: The need for U-XBRL. *International Journal of Accounting Information Systems,* 37, 100453.

Pejić Bach, M., Krstić, Ž., Seljan, S., & Turulja, L. (2019). Text mining for big data analysis in financial sector: A literature review. *Sustainability,* 11(5), 1277.

Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management,* 30(6), 467-480.

Pizzi, S., Moggi, S., Caputo, F., & Rosato, P. (2020). Social media as stakeholder engagement tool: CSR communication failure in the oil and gas sector. *Corporate Social Responsibility and Environmental Management.*

Pled, V. and Latridis, G.E. (2012), "Corporate social responsibility reporting: evidence from environmentally sensitive industries in the USA", *International Review of Accounting, Banking & Finance,* Vol. 4 No. 2, pp. 61-99

Plöckinger, M., Aschauer, E., Hiebl, M. R., & Rohatschek, R. (2016). The influence of individual executives on corporate financial reporting: A review and outlook from the perspective of upper echelons theory. *Journal of Accounting Literature, 37*, 55-75.

Plumlee, M., Brown, D., & Marshall, S. (2008). The impact of voluntary environmental disclosure quality on firm value. Available at SSRN 1140221.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., & Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology,* 88, 879–903

Polit, D. F., & Beck, C. T. (2010), "Generalization in quantitative and qualitative research: Myths and strategies", *International Journal of Nursing Studies,* Vol. 47 No. 11, pp. 1451-1458.

Popescu, F., & ALECSA, I. C. (2015). Gaining Competitive Advantage Using Social Media. Longer Allows Romanian Rural Tourism Industry To Ignore Presence On Social Media?. In Proceedings of the INTERNATIONAL MANAGEMENT CONFERENCE (Vol. 9, No. 1, pp. 513-522). Faculty of Management, Academy of Economic Studies, Bucharest, Romania.

Porter, M.E. (1980), Competitive Strategy: Techniques for Analyzing Industries and Competitors, The Free Press, New York, NY.

Porter, M.E. (1985), Competitive Advantage: Creating and Sustaining Superior Performance, The Free Press, New York, NY

Prado-Lorenzo, J., Rodríguez-Domínguez, L., Gallego-Álvarez, I., & García-Sánchez, I. (2009). Factors influencing the disclosure of greenhouse gas emissions in companies world-wide. Management Decision, 47(7), 1133–1157. https://doi.org/10.1108/00251740910978340

Pranjić, G., & Rekettye, G. (2019). Interaction of the social media and big data in reaching marketing success in the era of the fourth industrial revolution. International Journal of Business Performance Management, 20(3), 247-260.

Preece, D. (2018). Managing the adoption of new technology (Vol. 42). Routledge.

Prescott, M. E. (2014). Big data and competitive advantage at Nielsen. *Management Decision.*

Price, J. H., & Murnan, J. (2004). Research limitations and the necessity of reporting them. *American Journal of Health Education,* 35(2), 66.

Radhouane, I., Nekhili, M., Nagati, H., & Paché, G. (2018). The impact of corporate environmental reporting on customer-related performance and market value. *Management Decision.*

Radomir, L., & Moisescu, O. I. (2019). Discriminant validity of the customer-based corporate reputation scale: Some causes for concern. *Journal of Product & Brand Management.*

Rahim, N., & Omar, N. (2017). Online communication and sustainability reporting: The managerial issues. *Jurnal Komunikasi: Malaysian Journal of Communication*, 33(3).

Rahman, H. A. (2014). An Overview of Environmental Disaster in Malaysia and Prepa-redness Strategies. Iranian Journal of Public Health, 43(Supple 3), 17-24.

Ramananda, D., & Atahau, A. D. R. (2019). Corporate social disclosure through social media: an exploratory study. *Journal of Applied Accounting Research.*

Ramayah, T., Cheah, J., Chuah, F., Ting, H., & Memon, M. A. (2018). Partial least squares structural equation modeling (PLS-SEM) using smartPLS 3.0. *In An Updated Guide and Practical Guide to Statistical Analysis*. Pearson.

Ramayah, T., Yeap, J. A., Ahmad, N. H., Halim, H. A., & Rahman, S. A. (2017). Testing a confirmatory model of facebook usage in smartPLS using consistent PLS. *International Journal of Business and Innovation,* 3(2), 1-14.

Ramirez, P. G., & Hachiya, T. (2008). A comprehensive study on profits and sustainable competitive advantages. *Management Research News*, 31(9), 670–682. https://doi.org/10.1108/01409170810898563

Reilly, A. H., & Hynan, K. A. (2014). Corporate communication, sustainability, and social media: It's not easy (really) being green. *Business Horizons,* 57(6), 747–758. https://doi.org/10.1016/j.bushor.2014.07.008

Reilly, A. H., & Larya, N. (2018). External communication about sustainability: Corporate social responsibility reports and social media activity. *Environmental Communication,* 12(5), 621-637.

Remišová, A., Lašáková, A., & Kirchmayer, Z. (2019). Influence of formal ethics program components on managerial ethical behavior. *Journal of Business Ethics*, 160(1), 151-166.

Ren, J. F., Fosso Wamba, S., Akter, S., Dubey, R., & Childe, S. J. (2017). Modelling quality dynamics on business value and firm performance in big data analytics environment.

Rettab, B., Brik, A. B., & Mellahi, K. (2009). A study of management perceptions of the impact of corporate social responsibility on organisational performance in emerging economies: The case of Dubai. *Journal of business ethics, 89*, 371-390.

Reverte C. (2012). The impact of better corporate social responsibility disclosure on the cost of equity capital. *Corporate Social Responsibility and Environmental Management*, 19: 253–272. DOI: 10.1002/csr.273.

Reverte, C. (2009). Determinants of corporate social responsibility disclosure ratings by Spanish listed firms. *Journal of Business Ethics,* 88(2), 351–366. https://doi.org/10.1007/s10551-008-9968-9.

Revilla, M. A., Saris, W. E., & Krosnick, J. A. (2014). Choosing the number of categories in agree–disagree scales. *Sociological Methods & Research*, 43(1), 73-97.

Rialti, R., & Marzi, G. (2019). Ambidextrous Organizations in the Big Data Era: The Role of Information Systems. *Springer Nature*.

Rialti, R., Marzi, G., Caputo, A., & Mayah, K. A. (2020). Achieving strategic flexibility in the era of big data: the importance of knowledge management and ambidexterity. *Management Decision.*

Rialti, R., Zollo, L., Ferraris, A., & Alon, I. (2019). Big data analytics capabilities and performance: Evidence from a moderated multi-mediation model. *Technological Forecasting and Social Change,* 149, 119781.

Riantani, S., & Nurzamzam, H. (2015). Analysis of company size, financial leverage, and profitability and it's effect to CSR disclosure. *JDM (Journal of Management Dynamics)*, 6(2).

Ribarsky, W., Wang, D. X., & Dou, W. (2014). Social media analytics for competitive advantage. Computers & Graphics, 38, 328-331.

Richardson, H. A., Simmering, M. J., & Sturman, M. C. (2009). A tale of three perspectives examining post hoc statistical techniques for detection and correction of common method variance. *Organizational Research Methods*, 12(4), 762-800.

Riffe, D., Lacy, S., Fico, F., & Watson, B. (2019). Analyzing media messages: Using quantitative content analysis in research. Routledge.

Rim, H., Kim, J., & Dong, C. (2019). A cross-national comparison of transparency signaling in corporate social responsibility reporting: The United States, South Korea, and China cases. *Corporate Social Responsibility and Environmental Management,* 26(6), 1517–1529. https://doi.org/10.1002/csr.1766

Ringle, C. M., Sarstedt, M., Mitchell, R., & Gudergan, S. P. (2020). Partial least squares structural equation modeling in HRM research. *The International Journal of Human Resource Management,* 31(12), 1617-1643.

Ringle, C. M., Wende, S., and Becker, J.-M. (2015). "SmartPLS 3." Boenningstedt: SmartPLS GmbH, http://www.smartpls.com.

Rivera-Arrubla, Y. A., & Zorio-Grima, A. (2016). Integrated reporting, connectivity, and social media. *Psychology & Marketing, 33*(12), 1159-1165.

Rivera-Arrubla, Y. A., Zorio-Grima, A., & García-Benau, M. A. (2017). Integrated reports: Disclosure level and explanatory factors. *Social Responsibility Journal,* 13(1), 155–176. https:// doi.org/10.1108/SRJ-02-2016-0033

Rocha, J., Oliveira, S., Viana, C. M., & Ribeiro, A. I. (2022). Climate change and its impacts on health, environment and economy. One Health: Integrated Approach to 21st Century Challenges to Health, 253–279. https://doi.org/10.1016/B978-0-12-822794-7.00009-5

Rogelberg, S. G. (1999). Informed Decisions: Research Based Practice Notes. *Management,* 3, 12-0.

Romero, S., Ruiz, S., & Fernandez-Feijoo, B. (2019). Sustainability reporting and stakeholder engagement in Spain: Different instruments, different quality. *Business Strategy and the Environment, 28*(1), 221-232.

Rosário, A. T., & Dias, J. C. (2022). Sustainability and the Digital transition: A literature review. *Sustainability, 14*(7), 4072.

Rose, A. M., Rose, J. M., Suh, I., Thibodeau, J., Linke, K., & Norman, C. S. (2021). Why financial executives do bad things: The effects of the slippery slope and tone at the top on misreporting behavior. Journal of Business Ethics, 174(2), 291-309.

Roth-Cohen, O., & Avidar, R. (2022). A decade of social media in public relations research: A systematic review of published articles in 2010–2020. *Public Relations Review, 48*(1), 102154.

Rowley, J. (2014). Designing and using research questionnaires. *Management Research Review.*

Rudyanto, A., & Pirzada, K. (2020). The role of sustainability reporting in shareholder perception of tax avoidance. *Social Responsibility Journal.*

Rudyanto, A., & Siregar, S. V. (2018). The effect of stakeholder pressure and corporate governance on the sustainability report quality. *International Journal of Ethics and Systems.*

Ruggiero, P., & Cupertino, S. (2018). CSR Strategic Approach, Financial Resources and Corporate Social Performance: The Mediating Effect of Innovation. Sustainability, 10(10), 3611. https://doi.org/10.3390/su10103611

Ruhnke, K., & Gabriel, A. (2013). Determinants of voluntary assurance on sustainability reports: an empirical analysis. *Journal of Business Economics, 83*(9), 1063-1091.

Russom, P. (2011). Big data analytics. TDWI best practices report, fourth quarter, 19(4), 1-34.

Sabherwal, R., & Jeyaraj, A. (2015). Information technology impacts on firm performance: An extension of Kohli and Devaraj (2003). *MIS Quarterly: Management Information Systems,* 39(4), 809–836. https://doi.org/10.25300/MISQ/2015/39.4.4.

Saeidi, P., Saeidi, S. P., Sofian, S., Saeidi, S. P., Nilashi, M., & Mardani, A. (2019). The impact of enterprise risk management on competitive advantage by moderating role of information technology. *Computer Standards & Interfaces*, 63, 67-82.

Saeidi, S. P., Sofian, S., Saeidi, P., Saeidi, S. P., & Saaeidi, S. A. (2015a). How does corporate social responsibility contribute to firm financial performance? The mediating role of competitive advantage, reputation, and customer satisfaction. *Journal of Business Research,* 68(2), 341–350. https://doi.org/10.1016/j.jbusres.2014.06.024

Salge, T. O., & Vera, A. (2013). Small steps that matter: incremental learning, slack resources and organizational performance. *British Journal of Management*, 24(2), 156-173.

Salimi, N., & Rezaei, J. (2018). Evaluating firms' R&D performance using best worst method. *Evaluation and program planning*, 66, 147-155.

Saraite-Sariene, L., Alonso-Cañadas, J., Galán-Valdivieso, F., & Caba-Pérez, C. (2020). Non-Financial Information versus Financial as a Key to the Stakeholder Engagement: A Higher Education Perspective. *Sustainability,* 12(1), 331.

Sariol, A. M., & Abebe, M. A. (2017). The influence of CEO power on explorative and exploitative organizational innovation. *Journal of Business Research,* 73, 38-45.

Sarkar, S., & Searcy, C. (2016). Zeitgeist or chameleon? A quantitative analysis of CSR definitions. *Journal of Cleaner Production,* 135, 1423-1435.

Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students. Pearson education.

Savalei, V., & Bentler, P. M. (2009). A two-stage approach to missing data: Theory and application to auxiliary variables. *Structural Equation Modeling: A Multidisciplinary Journal,* 16(3), 477–497.

Saxton, G. D., Gómez, L., Ngoh, Z., Lin, Y. P., & Dietrich, S. (2019). Do CSR messages resonate? Examining public reactions to firms' CSR efforts on social media. *Journal of business ethics, 155*, 359-377.

Saxton, G. D., Ren, C., & Guo, C. (2020). Responding to Diffused Stakeholders on Social Media: Connective Power and Firm Reactions to CSR-Related Twitter Messages. *Journal of Business Ethics*, 1-24.

Schaltegger, S., & Wagner, M. (2006). Integrative management of sustainability performance, measurement and reporting. *International Journal of Accounting, Auditing and Performance Evaluation,* 3(1), 1-19.

Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2016). Business models for sustainability: Origins, present research, and future avenues.

Schiehll, E., & Kolahgar, S. (2020). Financial materiality in the informativeness of sustainability reporting. *Business Strategy and the Environment.*

Schilke, O., Hu, S., & Helfat, C. E. (2018). Quo vadis, dynamic capabilities? A content-analytic review of the current status of knowledge and recommendations for future research. *Academy of Management Annals,* 12(1), 390–439. https://doi.org/10.5465/annals.2016.0014

Schoemaker, P.J.H. (1990), "Strategy, complexity and economic rent", *Management Science,* Vol. 36 No. 10, pp. 1178-92.

Schroeck, M., Shockley, R., Smart, J., Romero-Morales, D., & Tufano, P. (2012). Analytics: The real world use of big data. iBM institute for Business Value—executive report. *IBM Institute for Business Value.*

Schroeder, L. D., Sjoquist, D. L., & Stephan, P. E. (2016). Understanding regression analysis: An introductory guide (Vol. 57). *Sage Publications*.

Schulz, S. A., & Flanigan, R. L. (2016). Developing competitive advantage using the triple bottom line: A conceptual framework. *Journal of Business & Industrial Marketing.*

Seddon, J. J., & Currie, W. L. (2017). A model for unpacking big data analytics in high-frequency trading. *Journal of Business Research*, 70, 300-307.

Sedgwick, P. (2014). Cross sectional studies: advantages and disadvantages. Bmj, 348.

Seele, P. (2017). Predictive Sustainability Control: A review assessing the potential to transfer big data driven 'predictive policing' to corporate sustainability management. *Journal of Cleaner Production, 153,* 673–686. https://doi.org/10.1016/j.jclepro.2016.10.175

Sekaran, U. (2003). Research Method For Bussiness: A Skill Building Approach 4 th ed New York. John Willey and Son inc.

Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill building approach. John Wiley & Sons.

Seles, B.M.R.P., de Sousa Jabbour, A.B.L., Jabbour, C.J.C., de Camargo Fiorini, P., Mohd- Yusoff, Y., Thome, A.M.T., (2018). Business opportunities and challenges as the two sides of the climate change: corporate responses and potential implications for big data management towards a low carbon society. *J. Clean. Prod.* 189, 763e774. 763-774.

Sellami, Y. M., Hlima, N. D. B., & Jarboui, A. (2019). An empirical investigation of determinants of sustainability report assurance in France. *Journal of Financial Reporting and Accounting.*

Shad, M. K., Lai, F. W., Fatt, C. L., Klemeš, J. J., & Bokhari, A. (2019). Integrating sustainability reporting into enterprise risk management and its relationship with business performance: A conceptual framework. *Journal of Cleaner production*, 208, 415-425.

Shad, M. K., Lai, F. W., Shamim, A., & McShane, M. (2020). The efficacy of sustainability reporting towards cost of debt and equity reduction. *Environmental Science and Pollution Research,* 27(18), 22511-22522.

Shamil, M., Shaikh, J., Ho, P.-L. and Krishnan, A. (2014), "The influence of board characteristics on sustainability reporting: empirical evidence from Sri Lankan firms". *Asian Review of Accounting*, Vol. 22 No. 2, pp. 78-97.

Shamim, S., Zeng, J., Shariq, S. M., & Khan, Z. (2019). Role of big data management in enhancing big data decision-making capability and quality among Chinese firms: A dynamic capabilities view. *Information and Management,* 56(6), 103135.

She, C., & Michelon, G. (2019). Managing stakeholder perceptions: Organized hypocrisy in CSR disclosures on Facebook. *Critical Perspectives on Accounting*, 61, 54-76.

Sheikh, K., & Mattingly, S. (1981). Investigating non-response bias in mail surveys. *Journal of Epidemiology & Community Health,* 35(4), 293-296.

Sheikh, S. (2019). Corporate social responsibility and firm leverage: The impact of market competition. *Research in International Business and Finance,* 48, 496-510.

Sheng, J., Amankwah-Amoah, J., & Wang, X. (2017). A multidisciplinary perspective of big data in management research. *International Journal of Production Economics,* 191(November 2016), 97–112.

SHIFT Communications. (2020, June 20). How Social Media Has Changed Traditional Media. Retrieved November 11, 2020, from https://www.shiftcomm.com/insights/social-media-changed-traditional-media/

Shin, T., & You, J. (2017). Pay for talk: How the use of shareholder-value language affects CEO compensation. *Journal of Management Studies,* 54(1), 88-117.

Short, J. C., & Palmer, T. B. (2008). The application of DICTION to content analysis research in strategic management. *Organizational Research Methods, 11*(4), 727-752.

Shuradze, G., & Wagner, H. T. (2016). Towards a conceptualization of data analytics capabilities. In 2016 49th Hawaii International Conference on System Sciences (HICSS) (pp. 5052-5064). *IEEE.*

Sierra, L., Zorio, A., & García-Benau, M. A. (2013). Sustainable development and assurance of corporate social responsibility reports published by Ibex-35 companies. *Corporate Social Responsibility and Environmental Management,* 20(6), 359-370.

Sigalas, C., & Pekka Economou, V. (2013). Revisiting the concept of competitive advantage: Problems and fallacies arising from its conceptualization. *Journal of Strategy and Management,* 6(1), 61–80.

Simanaviciene, Z., Kontautiene, R., & Simanavicius, A. (2017). Assumptions of Corporate Social Responsibility as Competitiveness Factor. *Montenegrin Journal of Economics, 13(3),* 149-160.

Singh, S. K., Chen, J., Del Giudice, M., & El-Kassar, A. N. (2019). Environmental ethics, environmental performance, and competitive advantage: Role of environmental training. *Technological Forecasting and Social Change*, 146(May), 203–211.

Singla, M. L., & Durga, A. (2015). How Social Media Gives You Competitive Advantage M. *Indian Journal of Science and Technology*, 8(S4), 90–95.

Sivarajah, U., Kamal, M. M., Irani, Z., & Weerakkody, V. (2017). Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*, 70, 263–286.

Smith, M. (2019). Research methods in accounting. SAGE Publications Limited.

Song, J., Lee, K., & Khanna, T. (2016). Dynamic capabilities at Samsung: Optimizing internal co-opetition. *California Management Review*, 58(4), 118-140.

Sotorrío, L.L., Sánchez, J.L.F., (2010). Corporate social reporting for different audiences: the case of multinational corporations in Spain. *Corporate Social Responsibility and Environmental Management* 17, 272e283.

Spence, C., Husillos, J., & Correa-Ruiz, C. (2010). Cargo cult science and the death of politics: A critical review of social and environmental accounting research. *Critical Perspectives on Accounting*, 21(1), 76-89.

Stanny, E., & Ely, K. (2008). Corporate environmental disclosures about the effects of climate change. *Corporate social responsibility and environmental management,* 15(6), 338-348.

Steenkamp, J. B. (2017). Corporate Social Responsibility. In Global Brand Strategy (pp. 209-238). Palgrave Macmillan, London.

Stewart, R. (2006). The places in between. Orlando, FL: Harcourt.

Stieglitz, S., & Dang-Xuan, L. (2013). Emotions and information diffusion in social media—sentiment of microblogs and sharing behavior. *Journal of management information systems,* 29(4), 217-248.

Stocker, F., de Arruda, M. P., de Mascena, K. M., & Boaventura, J. M. (2020). Stakeholder engagement in sustainability reporting: a classification model. Corporate Social Responsibility and Environmental Management, 27(5), 2071-2080.

Strand, R., & Freeman, R. E. (2015). Scandinavian cooperative advantage: The theory and practice of stakeholder engagement in Scandinavia. *Journal of business ethics*, 127(1), 65-85.

Sukamolson, S. (2007). Fundamentals of quantitative research. *Language Institute Chulalongkorn University, 1*(3), 1-20.

Sun, C. (2020). The research and evaluation of customer relationship management and social responsibility on competitive advantage. *Revista de Cercetare Si Interventie Sociala,* 69, 131–142.

Sun, E. W., Chen, Y. T., & Yu, M. T. (2015). Generalized optimal wavelet decomposing algorithm for big financial data. *International Journal of Production Economics*, 165, 194-214.

Surroca, J., Tribó, J. A., & Waddock, S. (2010). Corporate responsibility and financial performance: The role of intangible resources. *Strategic management journal,* 31(5), 463-490.

Sustainability Reporting guide 2nd Edition. (2018). file:///C:/Users/Fareyha%20Said/Desktop/Bursa%20Malaysia%20Sustainability%20Reporting%20Guide%20(2nd-Edition).pdf

Sutopo, B., Kot, S., Adiati, A. K., & Ardila, L. N. (2018). Sustainability Reporting and value relevance of financial statements. *Sustainability*, 10(3), 678.

Sydserff, R., & Weetman, P. (2002). Developments in content analysis: a transitivity index and DICTION scores. *Accounting, Auditing & Accountability Journal.*

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education,* 48(6), 1273–1296.

Tailab, M. M., & Burak, M. J. (2018). Is the rhetorical tone in a MD&A consistent with financial performance ?. *Journal of Finance and Accountancy*, 23, 1–18.

Taliento, M., Favino, C., & Netti, A. (2019). Impact of environmental, social, and governance information on economic performance: Evidence of a corporate 'sustainability advantage' from Europe. *Sustainability,* 11(6), 1738.

Tambe, P. (2014). Big data investment, skills, and firm value. *Management Science,* 60(6), 1452-1469.

Tan, K. Y., Wan Sallha, Y., Fairuz, M., & Salleh, M. (2020). Technological innovation and the adoption of internet financial and sustainability reporting.

Tang, K. H. D., & Al Qahtani, H. M. (2020). Sustainability of oil palm plantation in Malaysia. *Environment, Development and Sustainability,* 22(6), 4999-5023.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. International *Journal of Medical Education*, 2, 53–55.

Taylor, A., & Taylor, M. (2014). Factors influencing effective implementation of performance measurement systems in small and medium-sized enterprises and large firms: a perspective from Contingency Theory. *International Journal of Production Research,* 52(3), 847-866.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of mixed methods research*, 1(1), 77-100.

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and micro foundations of (sustainable) enterprise performance. *Strategic management journal*, 28(13), 1319-1350.

Teece, D. J. (2014). The foundations of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of firms. *Academy of management perspectives,* 28(4), 328-352.

Teece, D. J., Pisano, G. & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7): 509–33.

Teoh, S. H. (2018). The promise and challenges of new datasets for accounting research. *Accounting, Organizations and Society*, 68, 109-117.

Testarmata, S., Fortuna, F., & Ciaburri, M. (2018). The communication of corporate social responsibility practices through social media channels. *Corporate Board Role Duties and Composition,* 14(1), 34-49.

Thaker, H. M. T., Khaliq, A., Mand, A. A., Hussain, H. I., Thaker, M. A. B. M. T., & Pitchay, A. B. A. (2020). Exploring the drivers of social media marketing in Malaysian Islamic banks: An analysis via smart PLS approach. Journal of Islamic Marketing.

Thomas, C. J., Tuyon, J., Matahir, H., & Dixit, S. (2020). Analysis of corporate sustainability practice and impacts to corporate values in malaysia: data visualization approach. *International Journal of Accounting*, 5(30), 148-164.

Thompson, C. G., Kim, R. S., Aloe, A. M., & Becker, B. J. (2017). Extracting the variance inflation factor and other multicollinearity diagnostics from typical regression results. *Basic and Applied Social Psychology*, 39(2), 81-90.

Thomson, T. J., Angus, D., & Dootson, P. (2020, November 3). 3.2 billion images and 720,000 hours of video are shared online daily. Can you sort real from fake? Retrieved January 5, 2021, from https://theconversation.com/3-2-billion-images-and-720-000-hours-of-video-are-shared-online-daily-can-you-sort-real-from-fake-148630

TIME. (2019). 2019 annual report. download (bursamalaysia.com)

Ting, P. H. (2021). Do large firms just talk corporate social responsibility?-the evidence from CSR report disclosure. *Finance Research Letters*, 38, 101476.

Tiwari, K., & Khan, M. S. (2020). Sustainability accounting and reporting in the industry 4.0. *Journal of cleaner production*, 258, 120783.

Tiwari, S., Wee, H. M., & Daryanto, Y. (2018). Big data analytics in supply chain management between 2010 and 2016: Insights to industries. *Computers & Industrial Engineering,* 115, 319-330.

Tole, A. A. (2013). Big data challenges. Database systems journal, 4(3), 31-40.

Tong, X. F. (2017). A comparative review on company specific determinants for sustainability reporting in United Kingdom (UK) and Malaysia. In SHS Web of Conferences (Vol. 36, p. 00012). EDP Sciences.

Torres, L. B., Pagnussatt, T. B., & Severo, E. A. (2017). The Innovation as Source of Competitive Advantage in the Organizations: a Systematic Review of the Literature. *Revista Geintec-Gestao Inovacao E Tecnologias, 7*(4), 4028-4043.

Tourish, D. (2008). Challenging the transformational agenda: Leadership theory in transition?. *Management Communication Quarterly*, 21(4), 522- 528.

Treviño, T. (2016). Facebook as a new advertising channel for CSR campaigns. *International Journal of Business Environment, 8*(2), 176. https://doi.org/10.1504/ijbe.2016.076630

Trireksani, T., Djajadikerta, H. G., & Zhang, J. (2018). Perceived importance of corporate sustainability disclosure: Evidence from China. Disciplining the Undisciplined? *Perspectives from Business, Society and Politics on Responsible Citizenship, Corporate Social Responsibility and Sustainability*, 211-223.

Tsai, C. W., Lai, C. F., Chao, H. C., & Vasilakos, A. V. (2015). Big data analytics: a survey. *Journal of Big Data*, 2(1), 1–32.

United States Bureau of the Census, Software and Standards Management Branch, Systems Support Division, "Survey Design and statistical Methodology Metadata", Washington D.C., August 1998, Section 3.3.23, page 32.

Urbach, N., & Ahlemann, F. (2010). Structural equation modeling in information systems research using partial least squares. *Journal of Information Technology Theory and Application,* 11(2), 5–40.

Urbancova, H. (2013). Competitive Advantage Achievement through Innovation and Knowledge. Journal of Competitiveness, 5(1), 82–96. https://doi.org/10.7441/joc.2013.01.06

Vasylieva, T. A., Lieonov, S. V., Makarenko, I. O., & Sirkovska, N. (2017). Sustainability information disclosure as an instrument of marketing communication with stakeholders: markets, social and economic aspects.

Viglia, G., Pera, R., & Bigné, E. (2018). The determinants of stakeholder engagement in digital platforms. *Journal of Business Research*, 89(June), 404–410.

Vinzi, E. V., Chin, W. W., Henseler, J., & Wang, H. (2010). An Application of PLS in Multi-Group Analysis: The Need for Differentiated Corporate-Level Marketing in the Mobile Communications Industry. In *Handbook of Partial Least Squares: Concepts, Methods and Applications (Springer Handbooks of Computational Statistics) (2010th ed., pp. 486–514).* Springer Heidelberg Dordrecht London New York, Springer-Verlag Berlin Heidelberg: Springer.

Vogt, C., & Knapman, S. (2008). The anatomy of social networks, 46-51.

Vormedal, I. and Ruud, A. (2009), "Sustainability reporting in Norway – an assessment of performance in the context of legal demands and socio-political drivers", *Business Strategy and the Environment*,Vol.18 No. 4, pp. 207-222.

Wahab, S. N., & Olugu, E. (2018). Big Data Analytics Adoption in Malaysia Warehousing Industry Khalid S. Soliman International Business Information Management Association (IBIMA) (Issue November 2018).

Wamba, S. F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data'can make big impact: Findings from a systematic review and a longitudinal case study. *International journal of production economics, 165*, 234-246.

Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J. fan, Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research*, 70, 356–365.

Wang, C. H. (2019). How organizational green culture influences green performance and competitive advantage: The mediating role of green innovation. *Journal of Manufacturing Technology Management,* Vol. 30 Issue: 4, pp.666-683.

Wang, C., Yuan, T., Feng, J., & Peng, X. (2023). How can leaders alleviate employees' workplace anxiety caused by information overload on enterprise social media? Evidence from Chinese employees. Information Technology & People, 36(1), 224-244.

Wang, I. Z., & Fargher, N. (2017). The effects of tone at the top and coordination with external auditors on internal auditors' fraud risk assessments. *Accounting & Finance, 57*(4), 1177-1202.

Wang, Y., & Wiebe, V. J. (2016). Big Data Analytics on the characteristic equilibrium of collective opinions in social networks. In Big Data: Concepts, Methodologies, Tools, and Applications (pp. 1403-1420). IGI Global.

Wanner, J., & Janiesch, C. (2019). Big data analytics in sustainability reports: an analysis based on the perceived credibility of corporate published information. *Business Research,* 12(1), 143–173.

Wardayati, S. M., & Wulandari, S. A. (2014). Comparisons and Differences of Level Islamic Social Reporting Disclosure Islamic Banking in Indonesia and Malaysia.

Wardhani, J. V., Widianingsih, L. P., & Karundeng, F. (2019). The Effect Of Company Size, Profitability, Leverage, And Management Ownership Towards the level of corporate social responsibility (csr) disclosure. *Journal of accounting, entrepreneurship and financial technology (jaef),* 1(1), 32-48.

Webb, G. N. (2019). Variables, Control. In M. Allen (Ed.), The SAGE Encyclopedia of Communication Research Methods. SAGE Publications, Inc.

Welman, C., Kruger, F., & Mitchell, B. (2005). Research methodology. Oxford University Press Cape Town.

Wetzels, M., Odekerken-Schröder, G., & Van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS quarterly,* 177-195.

Whetman, Lancee L. (2017) "The Impact of Sustainability Reporting on Firm Profitability," *Undergraduate Economic Review: Vol. 14*: Iss. 1, Article 4.

Wiencierz, C., & Röttger, U. (2017). The use of big data in corporate communication. *Corporate Communications: An International Journal,* 22(3), 258–272.

Wiggins, R.R. and Ruefli, T.W. (2002), "Competitive advantage: temporal dynamics and the incidence and persistence of superior economic performance", *Organization Science,* Vol. 13 No. 1, pp. 82-105.

Wijethilake, C. (2017). Proactive sustainability strategy and corporate sustainability performance: The mediating effect of sustainability control systems. *Journal of Environmental Management*, 196, 569–582.

Wilden, R., Gudergan, S. P., Nielsen, B. B., & Lings, I. (2013). Dynamic Capabilities and Performance: Strategy, Structure and Environment. *Long Range Planning*, 46(1–2), 72–96.

Williams, B. R. (2015). Reporting on sustainability by Australian councils–a communication perspective. *Asian Review of Accounting*.

Williams, S., Terras, M., Warwick, C., (2013). What do people study when they study Twitter? Classifying Twitter related academic papers. *J. Doc.* 69, 384–410.

Witcher, B. J., & Chau, V. S. (2012). Varieties of capitalism and strategic management: Managing performance in multinationals after the global financial crisis. *British Journal of Management*, 23, S58-S73.

Wong, K. L., Chuah, M. H., & Ong, S. F. (2015). Are Malaysian companies ready for the big data economy? A business intelligence model approach.

World Bank Group. (2017). The Malaysia Development Experience Series - Open Data Readiness Assessment (ODRA) Report. May, 76. wbg.org/Malaysia

World Commission on Environment and Development, & Brundtland, G. H. (1987). Presentation of the Report of the World Commission on Environment and Development to the Commission of the European Communities, the EC and EFTA Countries... 5 May 1987, Brussels. World Commission on Environment and Development.

Wright, K. B. (2005). Researching Internet based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer Mediated Communication,* 10(3).

Wu, G. J., Tajdini, S., Zhang, J., & Song, L. (2019). Unlocking value through an extended social media analytics framework: Insights for new product adoption. *Qualitative Market Research: An International Journal.*

Wuttichindanon, S. (2017). Corporate social responsibility disclosure—choices of report and its determinants: Empirical evidence from firms listed on the Stock Exchange of Thailand. *Kasetsart Journal of Social Sciences,* 38(2), 156-162.

Xiao, X., Tian, Q., & Mao, H. (2020). How the interaction of big data analytics capabilities and digital platform capabilities affects service innovation: A dynamic capabilities view. *IEEE* Access, 8, 18778-18796.

Xu, W., Li, M., & Xu, S. (2023). Unveiling the "Veil" of information disclosure: Sustainability reporting "greenwashing" and "shared value". *PloS one, 18*(1), e0279904.

Yang, A., & Ji, Y. G. (2019). The quest for legitimacy and the communication of strategic cross-sectoral partnership on Facebook: A big data study. *Public Relations Review,* 45(5), 101839.

Yaqoob, I., Hashem, I. A. T., Gani, A., Mokhtar, S., Ahmed, E., Anuar, N. B., et al. (2016). Big data: From beginning to future. *International Journal of Information Management,* 36(6), 1231–1247.

Yasmin, M., Tatoglu, E., Kilic, H. S., Zaim, S., & Delen, D. (2020). Big data analytics capabilities and firm performance: An integrated MCDM approach. *Journal of Business Research,* 114, 1-15.

Yeo, A. C. M., & Carter, S. (2017). Segregate the Wheat from the Chaff Enabler: Will Big Data and Data Analytics Enhance the Perceived Competencies of Accountants/Auditors in Malaysia?. *Journal of Self-Governance and Management Economics,* 5(3), 28.

Yeo, A. C., & Carter, S. (2020). Consumer perception towards corporate social responsibility practices: a study of the Malaysian banking sector. International Journal of Mobile Learning and Organisation, 14(3), 307-321.

Yin, R. K. (2013). Case study research: Design and methods. Thousand Oaks, CA: Sage publications.

Ylijoki, O., & Porras, J. (2016). Perspectives to definition of big data: a mapping study and discussion. *Journal of Innovation Management,* 4(1), 69-91.

Young, S. and Marais, M. (2012), "A multi-level perspective of CSR reporting: the implications of national institutions and industry risk characteristics", *Corporate Governance: An International Review,* Vol. 20 No. 5, pp. 432-450.

Yu, H. C., Kuo, L., & Kao, M. F. (2017). The relationship between CSR disclosure and competitive advantage. *Sustainability Accounting, Management and Policy Journal,* 8(5), 547–570.

Yun, G. W., & Trumbo, C. W. (2000). Comparative response to a survey executed by post, e-mail, & web form. *Journal of Computer-Mediated Communication,* 6(1), 0.

Yusoff, H., Othman, R., & Yatim, N. (2013). Environmental reporting practices in Malaysia and Australia. *Journal of Applied Business Research (Jabr), 29*(6), 1717-1726.

Yuthas, K., Rogers, R., & Dillard, J. F. (2002). Communicative action and corporate annual reports. *Journal of Business Ethics,* 41, 141–157.

Zahid, M., & Ghazali, Z. (2015). Corporate sustainability practices among Malaysian REITs and property listed companies. *World Journal of Science, Technology and Sustainable Development.*

Zahid, M., Rahman, H. U., Ali, W., Khan, M., Alharthi, M., Imran Qureshi, M., & Jan, A. (2020). Boardroom gender diversity: Implications for corporate sustainability disclosures in Malaysia. *Journal of Cleaner Production*, 244, 118683.

Zahid, M., Rahman, H. U., Khan, M., Ali, W., & Shad, F. (2020). Addressing endogeneity by proposing novel instrumental variables in the nexus of sustainability reporting and firm financial performance: A step-by-step procedure for non-experts. *Business Strategy and the Environment,* 29(8), 3086-3103.

Zahid, M., Rahman, H. U., Muneer, S., Butt, B. Z., Isah-Chikaji, A., & Memon, M. A. (2019). Nexus between government initiatives, integrated strategies, internal factors and corporate sustainability practices in Malaysia. *Journal of Cleaner Production,* 241, 118329.

Zahraee, S. M., Golroudbary, S. R., Shiwakoti, N., Kraslawski, A., & Stasinopoulos, P. (2019). An investigation of the environmental sustainability of palm biomass supply chains via dynamic simulation modeling: A case of Malaysia. *Journal of Cleaner Production,* 237, 117740.

Zain, M. M. (1999). Corporate social reporting in Malaysia: The Current Status of the art and Future Prospects (Doctoral dissertation, University of Sheffield).

Zakaria, M., Aoun, C., & Liginlal, D. (2021). Objective Sustainability Assessment in the Digital Economy: An Information Entropy Measure of Transparency in Corporate Sustainability Reporting. *Sustainability,* 13(3), 1054.

Zakaria, M., Liginlal, D., & Aoun, C. (2018). Measuring corporate transparency in sustainability reporting: An information entropy-based approach. *The Business & Management Review,* 9(4), 487-487.

Zameer, H., Wang, Y., & Yasmeen, H. (2020). Reinforcing green competitive advantage through green production, creativity and green brand image: Implications for cleaner production in China. *Journal of Cleaner Production,* 247, 119119.

Zayid, S., Bakar, N. A. A., Valachamy, M., Abdul, N. S., Malek, S. Y., & Hassan, N. H. A. (2020). Formulation of big data analytics model in strengthening the disaster risk reduction. *Journal of Environmental Treatment Techniques,* 8(1), 481-487.

Zhang, Y. F., Ren, S., Liu, Y., & Si, S. B. (2017). Big data based analysis architecture of complex product manufacturing and maintenance process for sustainable production. *J. Clean. Prod,* 142, 626-641.

Zhao, R., Liu, Y., Zhang, N., & Huang, T. (2017). An optimization model for green supply chain management by using a big data analytic approach. *Journal of Cleaner Production*, 142, 1085-1097.

Zhao, Z., Meng, F., He, Y., & Gu, Z. (2019). The influence of corporate social responsibility on competitive advantage with multiple mediations from social capital and dynamic capabilities. *Sustainability*, 11(1), 218.

Zheng, L. J., Zhang, J. Z., Wang, H., & Hong, J. F. (2022). Exploring the impact of Big Data Analytics Capabilities on the dual nature of innovative activities in MSMEs: A Data-Agility-Innovation Perspective. Annals of Operations Research, 1-29.

Zhou, K. Z., & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal*, 31(5), 547-561.

Zizka, L. (2017). The (mis) use of social media to communicate CSR in hospitality: Increasing stakeholders'(dis) engagement through social media. *Journal of Hospitality and Tourism Technology.*