

9-11-2023

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ISSN 1943-7544

Pacific Asia Journal of the Association for Information Systems

Research Paper

doi: 10.17705/1pais.xxxxx

Volume xx, Issue x (202x)

Sustainable Decision Making in The Time of Uncertainty: Does Moral Intelligence Make It Different?

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Abstract

Background: *The cybersecurity has been pondered as a great concern for professionals, legislators as well as all decision-makers and effectiveness of accounting information system (EAIS) has long been well-acknowledged as the prerequisite organizational management. Against this backdrop, big data analytics capabilities (BDAC) will become a must-have element of any fruitful cybersecurity resolution and organizational EAIS to enable public sector to achieve sustainable decision-making (SDM) in operation within the time of uncertainty. This research aims at investigating the interconnection between BDAC and SDM. It also delves into the mediation mechanism of EAIS and cybersecurity risk management (CRM) in the linkage between BDAC and SDM. Outstandingly, it examines whether the interconnections between these aforementioned components varies resting on specific degree of moral intelligence (MI).*

Method: *The structural equation modeling is employed to investigate the statistical data captured from paper-and-pencil survey circulated to a convenience and snowball sample of 683 respondents in the Southern areas of Vietnam. Additionally, the multi-group analysis is applied to examine the moderating impact of MI.*

Results: *The results analysis substantiates the markedly positive interconnection between BDAC and SDM. Simultaneously, this interconnection is partially mediated by CRM and EAIS. One of the most noteworthy observations is the moderating role of MI as a catalyst in enabling public sector to achieve SDM.*

Conclusion: *The study's findings provide important, realistic, and useful theoretical contributions to the current literature on the issue, as well as beneficial inputs for practitioners. Accordingly, these findings recommend that practitioners and policy-makers can benefit from enhancing BDAC and EAIS as well as implementing CRM, which are proactive measures to achieve SDM. Also increasing MI of accountants as an effective solution to foster the advantages of big data analytics, accounting information system and CRM to succeed in SDM.*

Keywords: Accounting Information System, Big Data Analytics, Cybersecurity Risk Management, Decision-Making, Moral Intelligence.

This research article was submitted on November-2022 and under two revisions, accepted on May-2023.

Citation: Huy, P. Q., & Phuc, V. K. (202X). Sustainable Decision Making in The Time of Uncertainty: Does Moral Intelligence Make It Different? *Pacific Asia Journal of the Association for Information Systems*, XX(X), XX-XX. <https://doi.org/10.17705/1pais.XXXXX>
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Introduction

Risk and uncertainty have been well-acknowledged as innermost in the operational process and increased in post-disaster settings (Akinboye & Morrish, 2022). The situational perspectives differ notably between natural and human-made disasters (Akinboye & Morrish, 2022). Concretely, Grimm et al. (2012) argue that victims from human-made disasters such as terror attacks greater risk awareness whereas those from natural disasters like floods or pandemic are surrounded with uncertainty (Rosenberger, 2014). Therefore, sustainable decision-making (SDM) has been indispensable for the organizational operations in the aftermath of a crises (Morrish & Jones, 2020).

Almost all of countries are rapidly investing in information technology and transitioning to a digital environment (Merhi, 2022) to timely adapt to changing behaviors of customer (Hassandoust et al., 2016) and stakeholders in the context of the uncertainty which has been caused by pandemic. However, with the incessant advancements of information technology, cyber-offenders accordingly have increased complicated tactics to attack vulnerabilities in individual systems, organization networks as well as nation-states (Rassam et al., 2017). The public sector organizations typically procure gigantic volume of security relevant data namely log events of citizens, networks, and software applications for forensic analyses. Remarkably, the recent attacks are detected to be much more sophisticated (Rassam et al., 2017). The emergence of external attacks on organizations exposes the shortcomings of a compliance-driven, inward-looking approach to security management that depends on a technological 'shield' to protect against generic threats (Maynard et al., 2018). Unfortunately, the current approach fails to adequately address the requirement to improve decision-making at the organizational lower levels, i.e., the need to build security governance at the unit level and below (Maynard et al., 2018). As cybersecurity has been considered as a great concern for professionals, legislators, and, more broadly, all decision-makers, the cybersecurity risk management (CRM) has become the prerequisite of security management and prominently meaningful in seizing the entire security profile of organizations (Talet et al., 2014; Webb et al., 2014).

Against this backdrop, as proposed by Maciejewski (2016), the public sector organizations will obtain much more positive outcomes and benefits through big data adoption. Alternatively, big data analytics (BDA) would become a must-have element of any fruitful cybersecurity resolution owing to the demand of rapid processing of the high-velocity, high-volume data from a wide range of sources to determine anomalies or attack prototype as quickly as possible to minimize the vulnerability of the systems and enhance their resilience (Angin et al., 2019). It has recently drawn the attention of information security community owing to its promised capability in correlating security relevant data and captured insights efficiently at unprecedented scale (Rassam et al., 2017). Additionally, the application of advanced analytics and visualization of data could help the organizations become more vigilant which could lead to quicker decision-making at the time of active cybersecurity threats or attacks (Böhm et al., 2018; Rawat et al., 2019).

Aside from applying and developing data-driven capacities, organizations should take proper actions to deploy insights (Côte-Real et al., 2017) and scan for useful information for effective decision-making and organizational value. To do so, accounting information should be of high quality, relevant and helpful in the decision-making process (Septriadi et al., 2020). Nevertheless, currently, numerous organizations have not been capable of providing quality accounting information and useful for decision-making (Puspitawati, 2021).

During the COVID-19 pandemic, several organizations have coped large-scale challenges in term of their performance (Alsaad & Al-Okaily, 2021). The external environment has burgeoningly become very dynamic, featured by hyper high velocity and turbulence, which is depicted by Lutfi et al. (2017) as complicated, uncertain, volatile as well as ambiguous. With

respect to this, Lutfi et al. (2017) substantiated that the influence of the environmental uncertainty on organization affected to a large degree, be impacted by on the effectiveness of accounting information system (EAIS) and how it responded to such uncertainty in the environment. Succinctly put, with the emergence of COVID-19 pandemic, EAIS has severed as a critical role in the organizational operation (Al-Okaily, 2021). Therefore, with the emergence of COVID-19 pandemic, EAIS plays a crucial role.

Outstandingly, the post-disaster environments have been commonly inundated with negative concerns (Miles et al., 2016; Prasad et al., 2014). Due to the interconnectivity of computers and the simplicity with which many persons can access information systems recently, information systems have been placed at danger from accidental operator mistakes as well as man-made calamities (Talet et al., 2014). In this regard, numerous philosophers, thinkers, and scientists have formulated an interconnection between moral thoughts, attitudes, behaviors, reason and intelligence (Navarro et al., 2021; Odabaş, 2019). Moral intelligence (MI) has been considered as the totality of numerous various skills that could be related to moral attitudes and behaviors namely kindness, patience, tolerance, respect, conscience, personal control (Beheshtifar et al., 2011). As such, the public sector organizations with morally intelligent staff have an edge on those who have the staff with underdeveloped inner MI in succeeding in SDM.

This has incited the requirement to rethink and formulate a new and in-depth insight of how to leverage the BDAC, to tap higher potential of CRM and EAIS to ensure sustainable development. Starting from these considerations, an analysis on how BDAC can build up the CRM and EAIS as well as how MI can enhance these processes represent the main motivations in the current research and casts light on chances for theoretical and practical contributions. Additionally, this theoretical gap inspires the intriguing research questions as follows:

RQ1. *How are BDAC, CRM and EAIS related to SDM?*

RQ2. *What is the impact of MI on the interconnections between the abovementioned components?*

The current manuscript offers several contributions for the academic and practitioner communities through bridging several gaps rested on the examination of the overall observations and key insights. On the theoretical facet, this research is undertaken with the purpose to give accurate and most detailed on how the BDAC implementation can foster the SDM in the context of environmental uncertainty. In doing so, the obtained findings of this research bridge the gaps pertaining to the dearth of in-depth investigation on BDA application in public sector organizations (Desouza & Jacob, 2017; Mullich, 2013). Concretely, the current research sheds light on the direct structural relationship between each component in the hypothesized model prior to demonstrating the indirect impact of BDA on SDM through the mediators including EAIS and CRM. In doing so, the observations of this research fulfill the number of studies focusing on the role of EAIS in the context of environmental uncertainty. Accordingly, the BDA adoption will provide accounting information system with robust capabilities of generating accurate prediction on future sales, potential risks, forecasting financial distress as well as inspecting financial fraud (Gepp et al., 2018; Omitogun & Al-Adeem, 2019). Through effectively implementing big data and predictive analytics capabilities, organizational accounting information system can handle with numerous critical businesses matters as well as optimize organizational operations.

As the significance of data-driven cybersecurity has also drawn the concerns of academician and practitioner community (Rawat et al., 2019; Walton et al., 2021), the outcomes of this research cast light on the fact that the useful information in real time can be discovered to detect system vulnerabilities and attacks to formulate security solutions accordingly with the

support of BDA (Angin et al., 2019). On the other hand, the proliferation in cybersecurity threats and the challenges for organizations to safeguard their information technology assets have caused adherence to organizational security control processes and procedures to become a paramount matter which need to be sufficiently tackled (Onumo et al., 2021). As the advances in information technology have largely altered communications and organizational transactions between the organizations and their key stakeholders, CRM also enables to solve problems in term of information assurance faced by accountants in adapting to the accounting information system. With the support of CRM, the accounting information system adoption can generate much more reliable, comprehensive, and relevant information, so that it can enhance the transparency and accountability which, in turn, enable the organization financial management to become better. The observation of this study also handles with the interlink between EAIS and SDM. With the occurrence of COVID-19 pandemic, the EAIS has been well-acknowledged to play an imperative role in the organization (Al-Okaily, 2021). It has been commonly potential that EAIS will gain the quality of financial report and offer timely information to reinforce decision-making and planning within the entity, thereby preventing the errors and waste of valuable organizational resources (Al-Okaily et al., 2020; Lutfi et al., 2020). Moreover, EAIS also acts as core element in supporting the organization to seek for the stability and sustainable development through offering relevant information to minimize uncertainty in decision-making as well as boost better planning and control of organizational operations (Sari et al., 2019). Although MI has been relatively novel and has received far less research concern, investigating this notion can largely develop insights into human behaviors (Beheshtifar et al., 2011). The findings of the multi-group analysis highlight that there are differences pertaining to the degree of MI in the paths of the models were significant. This is because the accountant with high MI can understand and discern the principles, values, goals, and actions (Lennick & Kiel, 2011). Accordingly, they will have the capability to control and adopt primary moral values, where judgment and analysis of possible outcomes prior to behavior and action (Saleh, 2018). As such, the public sector organizations with morally intelligent staff thus have had an edge on those who have the staff with underdeveloped inner MI in organizational operation regarding to leveraging the BDA for CRM and enhancing EAIS for reaching the SDM in the environmental uncertainty.

On the practical facet, this manuscript's originality lay in its ability to provide practitioners with insightful information that will help them comprehend the importance of BDAC and the need to focus on BDAC adoption through the development of a framework that shows how BDAC can improve EAIS and CRM, which will increase SDM effectiveness. As a result, the research findings may also assist public sector organization leaders in better target planning and timely resource allocation in an effort to improve BDAC efficacy. The research's conclusions provide clear and comprehensive instructions to managers who want to increase MI among their personnel. Additionally, this research gave decision-makers a clear understanding of how to create rules and guidelines for the digital transition of public sector organizations. On the other hands, the findings of the current manuscript additionally suggest important actions for software or information technology providers in introducing contemporary strategies that best fit the expanding demands of potential customers.

The current research is split into the following disparate parts. The literature review in Part 2 briefly provides the theory foundations while Part 3 puts forward the hypotheses and elaborates the conceptual model. Resting on these points of views, the research methodology is introduced and discussed in Part 4, followed by Part 5, in which the statistical analyses are delineate and elucidated, whereas Part 6 casts light on the academic implications and managerial implications as well as the drawbacks and further scope of study respectively. Section 7 ends the research with presenting the conclusion.

Theoretical Understanding and Foundation

Theoretical Foundation

Resource-Based View Theory

The resource-based view theory founded by Barney (1991) is employed to illuminate the reason to which numerous entities have been operated efficiently and effectively as well as how an entity could operate more fruitfully. Management academics have paid close attention to the resource-based view (Dubey et al., 2019; Gunasekaran et al., 2017; Hitt et al., 2016). Concerning to resource-based view, both tangible and intangible resources are recommended to be employed to take their values and could enable the organization to reach the superior performance (Gunasekaran et al., 2017). Hinged on this theory, there have been also numerous research progresses in the field of big data implementation (Shan et al., 2019) as data are increasingly seen as a vital and intangible resource in the BDA context for improving the organizational performance (Ghasemaghaei, 2021; Ghasemaghaei et al., 2017). Admittedly, resource-based view is an important paradigm for researching how BDAC and organizational performance are related (Zhang & Yuan, 2023). According to rationale of resource-based view, the BDAC possesses the qualities of being valuable, rare, and inimitable; if properly organized, it gives an organization the essential fresh knowledge and insights, resulting in the organizational incremental and radical innovations, and subsequently innovation performance (Ciampi et al., 2020; Loebbecke & Picot, 2015; Wamba et al., 2017). Whilst the physical capital resources cover with software reinforced the entity to perform the accumulation and analysis of big data, the human capital resources reflect on the competence and expertise of data scientists utilized to conduct analysis and management of information pertaining to the organizational operations (Gunasekaran et al., 2017). Organizations must concentrate on their own resources in order to develop a distinctive core capacity system and improve their core competences, which depend on the accumulating and utilizing resources and learning capacities within the organization, in order to obtain a competitive edge (Shan et al., 2019). In the study of Yigitbasioglu et al. (2023), resource-based view is also used to highlight the function of an accountant as an advisor in the context of digital transformation. In the current research, a high MI accountant will typically adhere to accounting standards seriously and strictly. As a result, accountants acquire a wide range of information, skills, and MI, which are then blended in various ways depending on the duties undertaken. Human capital resources have the potential to create synergy through resource complementarity and interaction (Ployhart et al., 2014).

Contingency Theory

Contingency theory was discovered by researchers from Ohio State University in 1950 (Nohria & Khurana, 2010) which was applied in the studies focused on organizational issues due to its deep-rooted concepts in organizational literature (Sauser et al., 2009). According to Grötsch et al. (2013) and Schoonhoven (1981), contingency theory is dependent on internal and external input that involves action processes aiming at successful business strategies. The structure of an organization was widely acknowledged to depend on numerous factors namely nature of organizational work, market conditions, culture, the external environment as well as technology (Hanisch & Wald, 2012). Technologies are considered to make a significant contribution to the differences in such organizational attributes, formal structures are typically conglomerated or well-accorded with the use of various technologies according to the contingency aspect (Nohria & Khurana, 2010). Indeed, technology can be useful for spotting fraudulent and criminal deception, which are become more difficult to comprehend, follow, expose, and avoid. This is relevant to fraud prevention and detection (Shonhadji & Maulidi, 2022). On the other hand, risk and operational continuity management become critical factors to be customized to the circumstances in the setting of uncertainty (Sugianto et al., 2023). Because risk management increases organizational immunity to risk, it is thought to be a

fundamental factor in the development of business resilience and sustainability (Ueda, 2012). Through a case study on the contingency theory standpoints on risk management at local government, Woods (2009) casted light on the contingency influences of risk management upon strategies and information technology, external environment as well as organizational size.

Building on that line of thinking, organizations attempt to increase their performance by enhancing fit and crystal-clear strategic alignment with operational settings, which results in a positive overall managerial outcome (Mcadam et al., 2019). In this regard, the implementation of accounting information system and CRM is considered to enable public sector organization to reach the SDM during operation in the context of uncertainty.

Conceptual Respects

Big Data and Big Data Analytics

As proposed by Goes (2014), big data was identified as the gigantic volumes of multitudinous observational data employed for decision-making. In the meanwhile, Cao et al. (2015) argued that BDA has been the instrument of ascertaining and reaching huge measures from big data for reinforcing decision-making process. As such, BDAC has been broadly acknowledged as an advanced type of technologies and architectures which have been shaped up to economically extract value from very great volumes of a series of data by facilitating high velocity procurement, breakthrough and/or analysis (Mikalef et al., 2018). Numerous academic notes have advocated that BDAC consisted of the such three elements as BDA management capability, BDA technology capability and BDA talent capability (Akter et al., 2016).

Big data and BDA have the potential to improve the government sector by enabling a better understanding of current issues, the outside world, and citizen requirements to support efficient policy and service formulation and implementation. According to Elgendy and Elragal's (2016) research, big data analytics are crucial for helping decision-making.

Sustainable Decision-Making

Decision-making has been pondered as the process of making a selection from a large number of alternatives to reach a desired outcome (Eisenfuhr, 2011). In this regard, this notion contained three main components namely the decision-making concerning to making a selection from a series of options, decision-making regarding to more than simply a final selection from among alternatives. Eventually, the desired outcomes reflected on the conceptualization involving a goal causing from the mental activities that the decision maker engaged in to achieve a final decision (Lunenburg, 2010). With respect to the decisions' sustainability, it has been supposed to be the quality as well as the values of the decisions made by the individuals that resulted in certain results or consequences (Alzoubi & Snider, 2020; Zybin & Bielozorova, 2021).

As proposed by Jarah et al. (2023), the decision-making of leaders in organizations is largely impacted by the accounting information system.

The Effectiveness of Accounting Information System

Accounting information system has been well-recognized as a computer-based software adoption to input and process financial data (Al-Hattami et al., 2021) as well as manage and control issues related to the organizational financial and economic operations (Grande et al., 2011) to process into information, and distributed to the end users (Hall, 2010). As such, its components comprise of the such three primary subsystems as Transaction Processing;

General Ledger and Financial Reporting as well as the management reporting (Hall, 2010). As accounting information system has been pondered as the integration in harmony of data input system, data processing system, data storage system as well as the financial statement system to gained the productivity of accounting work, the EAIS can only be reached when each ingredient could operate in an effective manner (Huy & Phuc, 2020a).

While accounting information system has been viewed as a successful strategy for managing both internal and external change (Al-Okaily et al., 2020; Ha, 2020) as well as boosting and enhancing organizational performance, a lack of cybersecurity could result in security breaches and attacks on the organizational records (Hashim & Razali, 2019).

Cybersecurity Risk Management

Cybersecurity is argued to reflect on the confidentiality, integrity, and availability of computing resources as well as data into a consistent procurement of policies, technologies and techniques to thwart the emergence of an attack (Berman et al., 2019). Along this line, Sarker et al. (2020) advocate that cybersecurity is specified as the integration of technologies, procedures and operations that are framed to safeguard the information systems and networks from threats or unauthorized access from the internal or external sources. Broadly speaking, organizational cybersecurity mentions on the exertion which is taken by the organizations to defend the organizational assets from threats or attacks internal and external to the organization (Dalal et al., 2022). In the meanwhile, risk management is considered as an iterative process which is configured by the such five main phases as identification, analysis, measurement, tackling and monitoring and control of risks (Wang et al., 2010). It also focuses on the interconnection between organizations and the external environment in which they operate through underlining the organizational coordination to foster and control an organizational operations pertaining to risk activities (Themsen & Skærbæk, 2018). Taken together, CRM not only comprises of ameliorating internal controls but also covers with a series of determinants from strategy, IT governance, management decisions, human behaviors, crises resilience/business continuity, and technical resolutions to actual fulfillment and practices (Janvrin & Wang, 2019).

Nevertheless, based on standpoint of Jiang (2022), it should be noted that employee computer fraud is a costly and important problem for all firms. In light of this, MI reflects on the ability to discern between good and wrong; this requires having strong ethical convictions and acting in accordance with them as well as acting with integrity and dignity.

Moral Intelligence

The MI is specified as the mental capability of an individual to identify how common human principles should be adopted to the values, goals as well as actions of that individual (Lennick & Keil, 2005). Accordingly, MI is assessed not only through thoughts, values as well as beliefs but also through how far they can be deployed (Kanoğlu, 2019; Yakut & Yakut, 2021). Different put, MI is the transmutation of moral values into practices and is the entirety of numerous disparate skills that can be linked to moral attitudes and behaviors (Yakut & Yakut, 2021). MI can be understood as carrying out the right things at the right time and for the right rationale (Yaghoobi et al., 2018).

Substantiation of Research Hypotheses

There have been abundant academic remarks which deepened the analysis on the advantages of BDA adoption for accounting information system. Concretely, the BDA adoption will provide accounting information system with robust capabilities of generating accurate prediction on future sales, potential risks, forecasting financial distress as well as inspecting

financial fraud (Gepp et al., 2018; Omitogun & Al-Adeem, 2019). Alternatively, BDA offered early indexes of the potential drawbacks and vigor within the organizations for taking essential actions. On the other hand, BDA will enable accountants to detect some hidden tendencies and prototypes which lied in financial and non-financial data. This feature can support the organization in minimizing information asymmetry and hence perking up the validation of the accounting information system output. Moreover, BDA adoption in accounting information system will allow this system to produce information available on a real-time cornerstone (Gepp et al., 2018). Notably, BDA is regarded as a facilitator of organizational agility since it enables organizations to detect market changes and make more informed and timely decisions (Hyun et al., 2020). Indeed, organizations can lower costs, improve the quality and functionalities of their products and services by evaluating massive amounts of linked data (Yu et al., 2022). Hinged on the discussion and theorization above, this research speculates the hypotheses as follows.

- H1.** BDAC instigates an effect on EAIS in a significant and positive manner.
- H2.** BDAC instigates an effect on SDM in a significant and positive manner.

Analytics can allow network leaders predominantly in the tracking and surveillance of real-time network streams as well as real-time uncovering of the malicious and suspicious prototypes to upgrade all traditional security techniques. Among these, BDA which has been well-acknowledged as a large-scale information processing and analysis has become a propitious capability in analyzing and correlating security in term of data in efficient and effective manner (Cardenas et al., 2013). Undeniably, BDA will become a must-have element of any effective cyber security resolution owing to the demand of rapid processing of the high-velocity, high-volume data from a wide range of sources to determine anomalies and attack archetypes as rapidly as possible to minimize the vulnerability of the systems and enhance their resilience (Angin et al., 2019). BDA can provide a series of security dimensions in network management which have produced an enormous revolution in the realms of security management, fraud prohibition and governance, risk, and compliance (Kabanda, 2021). Along the same line of reasoning, the current study speculates the hypothesis as follows:

- H3.** BDAC instigates an effect on CRM in a significant and positive manner.

Given that an effective information technology security requires the effective CRM which offers proper systems of monitoring (Talet et al., 2014), the CRM has been considered as the prerequisite of security management and has been enormously meaningful in comprehending the whole organizational security profile (Talet et al., 2014; Webb et al., 2014). Admittedly, accounting information system adoption has been acknowledged to help the organization to gain the quality of financial reporting as well as enable the organization to predict and assess operations risk (Grande et al., 2011; Salehi et al., 2010). Although accounting information system has been pondered as a fruitful approach of tackling with internal and external changes (Al-Okaily et al., 2020; Ha, 2020) through analyzing records and transactions to generate valuable information for organizational preparation, controlling, and operations as well as boosting and enhancing the organizational performance, a deficiency of cybersecurity could lead to security breaches and attacks on the organizational records (Hashim & Razali, 2019). With the support of CRM, the accounting information system can improve its internal control structures (Trabulsi, 2018), its efficiency and process effectiveness, which thus, in turn, achieved the SDM. Additionally, Maynard et al. (2018) found that information security governance has an impact on the quality of strategic decision-making. Logically, the above evidence results in a hypothetical statement that:

- H4.** CRM instigates an effect on EAIS in a significant and positive manner.
- H5.** CRM instigates an effect on SDM in a significant and positive manner.

Accounting information system has been well-acknowledged as the hearts of almost all of organization, without which system would not have been integrated, coordinated or monitored (Alshirah et al., 2021). It has also been considered as an approach employed in accounting to assist in the preparation, supervision, and monitoring of the organizational economic operations by leaders (Fitriati & Mulyani, 2020). These controls will facilitate the organization to defend assets, give rise to accurate information, and deploy operations efficiently and effectively (Guragai et al., 2017). As such, the more accounting information system has been made use, the better internal control measures would become (Sajady et al., 2008). Accounting information system are also advocated to enable the organization to handle the management of short-term issues comprising of revenue and expenses through offering useful information to enhance the control process (Mitchell et al., 2000). Once the short-term concerns were overcome, the organizational leaders can place their concentration on combining operational considerations with long-term strategic goals. Aside from this, the accounting information system application has also been substantiated to substantially influence the produced accounting information quality. In this regard, the accounting information system application in the operational management of the organization would support strategic decision-making on the basis of accounting information quality (Lutfi et al., 2020). Taken together, accounting information system has been recognized as a paramount regulatory mechanism for effective decision management (Fitriati & Mulyani, 2020; Ghasemi et al., 2019). These valuable findings motivate the current research to formulate the hypothesis as follows.

H6. EAIS instigates an effect on SDM in a significant and positive manner.

EAIS will provide timely information and financial reporting, flawless and proper accounting information and generate reliable financial records for effective decision-making (Khassawneh, 2014). The notion of big data has been emerged as novel challenges occurred in analyzing, archiving, sharing, dispatching, and processing enormous datasets across organizations. It is apparent that BDA can ameliorate the quality of information, buttressing integrated reporting more fruitfully, the data which is adopted in reports would become more precise (Janssen et al., 2017). All these advantages of BDA can revamp the EAIS which in turn will lead to ameliorate the decision-making process and the organizational performance. From the abovementioned descriptions, the hypothesis in the current study is postulated as follows.

H7. EAIS acts as a mediator on the interconnection between BDAC and SDM.

With the constant advancements of information technology, cyber-criminals accordingly conduct sophisticated tactics to attack vulnerabilities in individual systems, organization networks as well as nation-states (Rassam et al., 2017). Prevalingly traditional security analysis techniques have failed to perform efficiently and effectively with large-scale of data and typically created high false alarms particularly when the public sector organizations have transformed to cloud architecture and gathered more data. Indeed, the application of advanced analytics and visualization of data can help the organizations become more vigilant which could lead to quicker decision-making (Böhm et al., 2018; Rawat et al., 2019). In correspondent with the points demonstrated above, the hypothesis of this study is considered as follows.

H8. CRM acts as a mediator on the interconnection between BDAC and SDM.

As proposed by Hu and Vasilakos (2016), almost threats and attacks have been conducted from leaking personal information to devastation of services and even attacking large-scale systems. This is because the interconnectivity of computers and the effortlessness with which several individuals may reach information systems as well as the information systems have been placed at hazard from accidental operators' mistakes and man-made calamities (Talet et al., 2014). Building on the perspectives of Jiang (2022), employee computer fraud is an

expensive and serious issue for all of organizations. As such, all of organization must build a deep situational awareness of the threat environment, as well as the capability to address the complex and growing security threats that exist inside it (Maynard et al., 2018). Against this backdrop, MI mentions on the capacity to differentiate between right and wrong; it entails having vigorous ethical beliefs and performing consistent with these beliefs, as well as performing with integrity and dignity. As such, the organizational staff who possesses MI will be likely to act in a manner which is in appropriate with their individual ethical norms. Moral conation is the capability to believe an individual is morally responsible and behave in a moral custom, even when facing with obstacles. Additionally, the cognition moral development is verified to be positively linked to ethical decision-making (Ashkanasy et al., 2006). When the business environment has become uncertainty, organizational labor force would be coped with ethical decisions and the more adept they were at tackling these, the more accomplish they would become. As such, the public sector organizations with morally intelligent staff thus have had an edge on those who have the staff with underdeveloped inner MI in organizational operation regarding to leveraging the BDAC for CRM and enhance EAIS for reaching the SDM in the environmental uncertainty. In connection with the statement above, the following final hypotheses are creatively put forward as follows

- H9a.** MI acts as a moderator on the interconnection between BDAC and EAIS.
- H9b.** MI acts as a moderator on the interconnection between BDAC and SDM.
- H9c.** MI acts as a moderator on the interconnection between BDAC and CRM.
- H9d.** MI acts as a moderator on the interconnection between CRM and EAIS.
- H9e.** MI acts as a moderator on the interconnection between CRM and SDM.
- H9f.** MI acts as a moderator on the interconnection between EAIS and SDM.

The research model which focuses on the impact which BDAC induce on EAIS, CRM, and SDM, and presents one MI moderator that adjusts to the interconnections of those aforementioned components in public sector organization, is depicted in Figure 1.

Research Methodology

Operationalization and Purification of the Measured Variables

A questionnaire survey is leveraged as the research approach in the current research. The survey method has been felicitous for capturing data in a context in which the variables examined are related with organizations as well as professional practices (Hair et al., 2017). Remarkably, there has been lack of readily available secondary database on digital transformation within public sector organizations, especially in developing nations like Vietnam's. The survey questionnaire items are formulated through reviewing of the literature and utilizing relevant ideas acquired from the previous works. Initially, the questionnaire items are formulated by the double translation protocol technique (Harkness, 2011). As the questionnaire in this study is established in divergent contexts – both culturally and environmentally, a pretest with 6 experts is implemented to minimize unanticipated complexity (Alreck & Settle, 1995). Grounded on the feedback of experts, the questionnaires and several items are subsequently revised and rewritten where suitable. Subsequently, a pilot survey is implemented to authenticate the validity as well as reliability of the scale. As such, 30 respondents with similar idiosyncrasies to the survey population are demanded to partake in the small-scale pilot test. The outcomes of the pilot analysis demonstrate that all variables within an acceptable degree of 0.70 for Cronbach's alpha scores (Sekaran, 2003). On account of the possible discrepancies in respondents, the questionnaires gathered from the small-scale pilot survey are not included in the main survey.

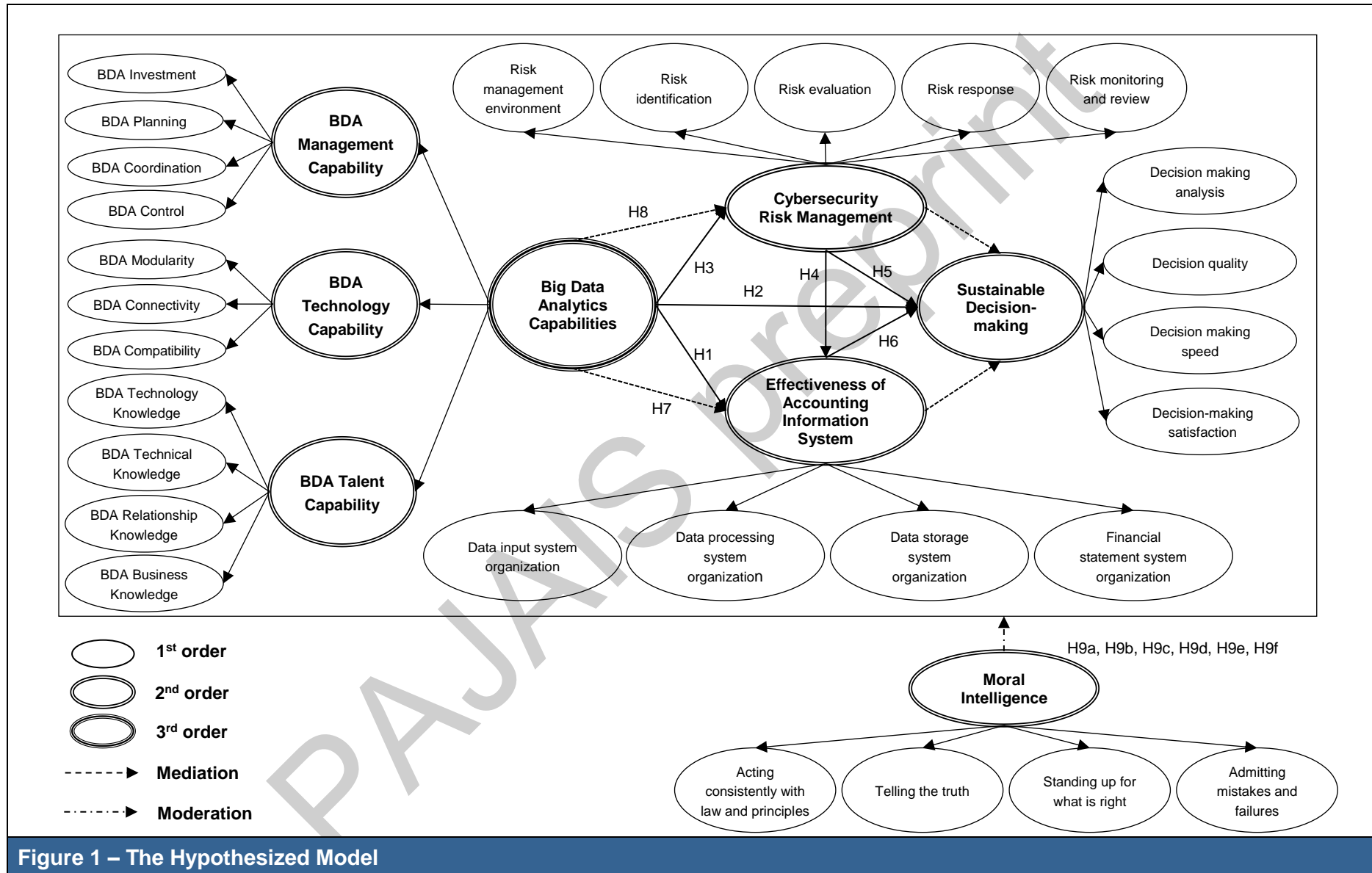


Figure 1 – The Hypothesized Model

Big Data Analytics Capabilities

The first-order construct of BDAC is reflected by three second-order constructs namely BDA Management Capability; BDA Technology Capability; BDA Talent Capability were inherited from the contributions of Akter et al. (2016); Kim et al. (2012). More concretely, BDA management capability refers to data scientists' ability to handle routine matters in order to manage BDA resources based on the needs and preferences of organizations (Akter et al., 2016). According to current studies, the four basic components of BDA management capabilities are (1) BDA planning, (2) BDA investment, (3) BDA coordination, and (4) BDA control (Akter et al., 2016; Kim et al., 2011; Kim et al., 2012; Kiron et al., 2014). Alternatively, BDA technical competence is defined as an organization's technological capability (hardware, software, applications, data, and networks) that enables data scientists to rapidly upgrade, manage, and support the organization's mandatory system components (Akter et al., 2016). Many scholars, including (Akter et al., 2016; Kim et al., 2012; Kiron et al., 2014), have indicated that the following critical components contribute to the perception of BDA technological capability namely (1) Connectivity, (2) Compatibility, and (3) Modularity are all important considerations. The BDA talent capability is defined as the data scientists' ability (skills and knowledge) in using analytical technology to conduct activities linked to BDA (Akter et al., 2016; Kim et al., 2012). Researchers proposed four important factors that will help the organization to create BDA talent capability namely (1) technical capabilities, (2) technology management skills, (3) business skills, and (4) relational skills (Akter et al., 2016; Kim et al., 2012; Kiron et al., 2014).

Cybersecurity Risk Management

The first-order construct for identified the risk management covers with five second-order constructs inherited from the combination of the works of Ariffin (2009), Dioubate et al. (2022) and Renault et al. (2018) namely Risk management environment, Risk identification, Risk evaluation, Risk response, Risk monitoring and review. More concretely, Risk management environment in this study refers to process of systematically determine credible environmental threats, estimating the likelihood of occurrence and severity of potential effects, and controlling the resulting degree of risk. The criteria employed to evaluate Risk management environment were originated from the contribution of Dioubate et al. (2022) and Renault et al. (2018). Risk identification in this study refers to the process of determining what, where, when, why, and how something can impact the organizational capacities to operate. The criteria employed to evaluate Risk identification were sprung from the contribution of De Bakker et al. (2011); Dioubate et al. (2022); Kloss-Grote and Moss (2008). Risk evaluation in this study refers to the process of comparing the significance of each risk and ranking them in term of prominence and consequence. The criteria employed to evaluate Risk evaluation were proceeded from the contribution of Dioubate et al. (2022); KarimiAzari et al. (2010); Nieto-Morote and Ruz-Villa (2011); Öztaş and Ökmen (2005). In this study, Risk response refers to risk mitigation techniques, preventative treatment, and contingency plans that are developed based on the estimated value of each risk. The criteria employed to evaluate Risk response were arisen from the works of De Marco and Timur (2013) and Dioubate et al. (2022) In this study, risk monitoring and review refers to repeating and continuously monitoring processes to ensure maximum coverage of known and undiscovered risks. The criteria employed to evaluate Risk monitoring and review were originated from the works of Dioubate et al. (2022); Hwang and Lim (2013); Kamau and Mohamed (2015); Renault et al. (2018); Spikin (2013).

Effectiveness of Accounting Information System

The first-order construct for identified the EAIS includes four second-order constructs comprising of Data input system, Data processing system, Data storage system, and Financial statement system. More concretely, the effectiveness of Data input system in this study refers to greatly complying with the regulations and requirements of the document system

organization specified in the Law on Accounting and fitting with the organizational features. Data input system items were stemmed from the contributions of Uyar et al. (2017). The effectiveness of Data processing system in this study refers to design of the account system, the method of data recording, the way of data entry and assignment of processing work. Data processing system criteria were originated from the devotions of Romney and Steinbart (2006) and Sori (2009). The effectiveness of Data storage system in this study refers to the system of accounting books and devices and means of data storage and storage methods must satisfy the following requirements of Law on Accounting and fitting with the organizational features. Data storage system items were derived from the works of Sajady et al. (2008). The effectiveness of Financial statement system in this study refers to the process of produce high quality financial information of financial statement system. Financial statement system criteria were generated from those suggested by Sori (2009) and Uyar et al. (2017).

Sustainable Decision-Making

SDM is modeled as a second-order construct and assessed concerning to regarding the following four reflective indicators namely Decision-making analysis; Decision quality; Decision making speed and Decision-making satisfaction. More concretely, Decision-making analysis in this study mentions on a structured method for making optimal choices in the face of ambiguity. Decision making analysis was inherited from the works of Leidner and Elam (1993, 1995). Decision quality in this study is defined as the rationality of a decision at the moment it is taken. Decision quality was emanated from the findings of Jarupathirun and Zahedi (2007). Decision making speed in this study refers to the ability to make a beneficial choice quickly toward the amount and complexity of issues that need to be addressed. Decision making speed was sprung from the contributions of Leidner and Elam (1993, 1995). Decision satisfaction in this study describes the emotional and cognitive responses to individual decision and its effects. Decision-making satisfaction was arisen from the observations of Sanders and Courtney (1985).

Moral Intelligence

MI is modeled as a second-order construct which was stemmed from the contribution of Lennick and Kiel (2008). In this research, MI is evaluated regarding the following four reflective indicators namely Acting consistently with law and principles; Telling the truth; Standing up for what is right; Admitting mistakes and failures. More concretely, Telling the truth in this study refers to the act of communicating information that is accurate, honest, and factual. It involves being transparent and straightforward in one's communication, and avoiding misrepresentation, deception, or falsehood. The measurement items for evaluating Telling the truth were stemmed from the contributions of Lennick and Kiel (2008). In this study, Standing up for what is right refers to the act of taking a principled stance on an issue or situation, even in the face of opposition or adversity. It involves advocating for ethical values and principles, and taking action to uphold them, regardless of personal or professional consequences. The measurement items for evaluating Standing up for what is right were stemmed from the contributions of Lennick and Kiel (2008). In this study, Admitting mistakes and failures refers to the act of acknowledging errors, misjudgments, or shortcomings in one's actions or decisions. It involves taking responsibility for one's mistakes, being accountable for their consequences, and learning from them to improve future performance. The measurement items for evaluating Admitting mistakes and failures were stemmed from the contributions of Lennick and Kiel (2008). In this study, Acting consistently with law and principles refers to the act of conducting oneself in accordance with legal requirements, ethical standards, and moral principles. It involves adhering to established rules and regulations, and upholding ethical values and principles, even in the face of pressure or temptation to do otherwise. The measurement items for evaluating Acting consistently with law and principles were stemmed from the contributions of Lennick and Kiel (2008).

Sampling Procedure and Establishing the Database of Target Population

The statistical data of this research is collected by means of two sampling units. The underlying sampling unit is organizations, and organizational accountants are the secondary sampling unit. Due to the fact that the results of empirical studies conducted in this region can serve as valuable references for almost all of the public sector organizations not only in Vietnam but also in the rest of the Asian countries, the public sector organizations located in the Southern areas of Vietnam were chosen for the current study (Huy & Phuc, 2020b). Alternatively, one plausible reason for this selection lied in the paramount roles of accountants in their organizations in implementing the accounting information system. Outstandingly, the accountants would become prerequisite for the auspicious outcome due to the progressive permeation of digital technologies (Zybery & Rova, 2014). On the basis of these considerations, the accountants were chosen as the study's participants. With the approval of each province's department of finance in Vietnam's Southern regions, the list of public sector organizations was obtained. Each public sector organization provides all of the data that was used for this study's analysis, which is completed by a single contributor. Prior to the official interviews, the intended participants are contacted by phone to clarify the research's goals, ensure their anonymity, and gauge their interest in participation.

The primary data in the current study are captured through a paper-and-pencil questionnaire because the email survey is proved not to produce a sufficient response rate (Zhang et al., 2019). Additionally, given that the self-reported measures were advocated to provide more valuable information in emerging economies (Anwar, 2018), the subjective measures are employed in the current research. The questionnaires are distributed in person to participants by the researchers. Concerning to sampling, owing to the complicatedness of reaching the permission from every organization, the convenience and snowball sampling were applied in the current research to capture the data due to the limitation of permission from all organizations (Kim et al., 2022). To increase the response rate, a follow-up plan was strengthened using telephone reminders.

Based on the standpoints of numerous scholars, the sample-to-variable ratio prefers from 5:1 (minimal) to 10:1 (optimal) sample-to-item ratio is proper to determine the sample size (Hair et al., 2010). On the suggestion of Comrey and Lee (1992), a sample size below 50 is deemed extremely weak, ranges from 51 to 100 is comparatively weak, varies from 101 to 200 is relatively adequate, differs from 201 to 300 is good, fluctuates from 301 to 500 is exceedingly good, whereas a sample scale of larger than 500 is recognized to be excellent. As proposed by Hair et al. (2022), the responses suffer from more than 15% missing items will be excluded from the dataset. Therefore, all the responses suffered from 15% of missing data would be eliminated. Thus, a total of 800 questionnaires was distributed to accountants of public sector organizations in the Southern area of Vietnam from the end of March 2022 to the middle of August 2022. There were 683 valid questionnaires captured with the response rate of 85.38 percent. A thorough overview of the demographic data gathered from the survey is illustrated in Table 1. The statistical information on respondent age and experience is accurate, however the responders' demographic profile shows bias in terms of gender and educational attainment. In actuality, this sort of dominance is a typical trend in the accounting business in developing areas like Vietnam's southern provinces (Pham & Vu, 2022).

Table 1 – Demographic Characteristics of Survey Respondents

Items	Frequency	Percentage
Gender of respondent		
Male	175	25.62
Female	508	74.38
Age of respondent		
Under 30	23	3.37
30 – Under 40	523	76.57
40- Under 50	129	18.89
Above 50	8	1.17
Experience of respondent (years)		
Under 10	23	3.37
10 - Under 20	523	76.57
20 – Under 30	129	18.89
Over 30	8	1.17
Education		
Undergraduate	650	95.17
Postgraduate	33	4.83

Statistical Analysis and Calculations

All the calculations for research model nomological validity in the current study were executed with the support of the SPSS v26 and AMOS v26 through two-step analytic approach. Concretely, the measurement model evaluation was implemented for investigating the reliability and validity of the measures. Subsequently, the structural model was examined to determine the goodness of fit of the model and hypothesis testing as well. Moreover, the multi-group SEM analysis was also carried out to scrutinize the moderating impacts of MI.

Interpretation Analytical Observations and Discussions

Common Method Bias

Common method variance reflects on overlapping variability caused by collection procedures rather than genuine relevance between structures (Pang et al., 2021). Because the research employs a single questionnaire method of data collecting, common method variance may occur depending on the context and characteristics of the project research. A systematic error is specified as common method variance. In this regard, Harman's single-factor test can be used to detect common method variance (Pang & Ruan, 2023). Harman's single-factor test examines the outcomes of an exploratory factor analysis to examine if the first extracted factor can elucidate more than 50% of the variance (Aguirre-Urreta & Hu, 2019). The Harman's single-factor test is implemented in this research by conducting exploratory factor analysis (EFA) on the entire set of investigated measurements and employing varimax rotation (Fuller et al., 2016). The statistical output of EFA reveals that the greatest single factor explained 23.812% of the variance. To put it different, none of the explainable variables has a factor load greater than 50%, indicating that common method bias is not a matter in this study.

Constituting the Convergent Validity

The convergent validity reflected the extent to which two or more measurement instruments for a single factor correlated which was examined through investigating the reliability and validity utilizing the Cronbach's alpha, factor loading, composite reliability (CR) as well as average variance extracted (AVE) (Kim & Oh, 2020).

As proposed by Tavakol and Dennick (2011), the Cronbach's alpha was employed to evaluate the internal consistency of a scale. The Cronbach's alpha has been deemed as a most common examination for reliability of latent variables (Bryman & Bell, 2011). As such, the Cronbach's alpha arbitrary score of 0.70 or higher was an adequate measure of internal consistency (Taber, 2018). Alternatively, the Corrected Item - Total Correlation is another crucial indicator. This value represents the correlation between each observed variable and the remaining variables in the scale. The observed variable is better if it has a higher value of Corrected Item - Total Correlation and a stronger positive correlation with other variables on the scale. A decent scale, according to Cristobal et al. (2007), is one where the observed variables have a Corrected Item - Total Correlation value of 0.3 or higher. Thus, it is required to take into account removing the observed variable while running the Cronbach's Alpha reliability test if the Corrected Item - Total Correlation coefficient is less than 0.3. The corrected item-total correlation value for all of the observed variables in the current study was reported to be larger than 0.3, indicating that the observed variables were of higher quality.

Concerning to the separate measurement items, the factor loadings should be greater than 0.70, illustrating evidence of convergent validity (Asif et al., 2019). The AVE statistics should be more than the suggested value of 0.5 to meet the criterion for convergent validity establishment (Fornell & Larcker, 1981). In addition, the CR was employed to assess each concepts' reliability hinged on standardized loadings as well as measurement errors for each item (Corsini et al., 2019). The CR statistics should be higher than the 0.70 threshold value (Hair et al., 2019) to demonstrate a perfect of internal consistency (Manzoor et al., 2019). Taken together, the statistical verification of these criteria in Table 2 ascertained that the constructs reflected the good reliability and validity.

Table 2 – Results Summary of Convergent Validity and Construct Reliability				
Construct	Convergent validity		Construct reliability	
	Factor Loadings Ranges	AVE	Cronbach's Alpha	Composite Reliability
Big Data Analytics Capabilities				
BDA Management Capability				
BDA Investment	0.786 - 0.896	0.512	0.837	0.838
BDA Planning	0.783 - 0.888	0.575	0.843	0.844
BDA Coordination	0.815 - 0.879	0.579	0.890	0.891
BDA control	0.822 - 0.882	0.598	0.888	0.900
BDA Technology Capability				
BDA Modularity	0.788 - 0.897	0.581	0.856	0.857
BDA Connectivity	0.815 - 0.878	0.509	0.834	0.835
BDA Compatibility	0.720 - 0.886	0.516	0.838	0.840
BDA Talent Capability				
BDA Technology knowledge	0.734 - 0.837	0.521	0.846	0.847
BDA Technical Knowledge	0.728 - 0.851	0.532	0.895	0.896
BDA Relationship Knowledge	0.717 - 0.859	0.524	0.870	0.872
BDA Business Knowledge	0.759 - 0.878	0.513	0.898	0.899
Effectiveness of Accounting Information System				
Data input system organization	0.749 - 0.892	0.550	0.850	0.851
Data processing system organization	0.745 - 0.840	0.526	0.873	0.875
Data storage system organization	0.784 - 0.874	0.505	0.880	0.882
Financial statement system organization	0.762 - 0.866	0.526	0.873	0.874
Cybersecurity Risk Management				
Risk management environment	0.766 - 0.878	0.611	0.844	0.845
Risk identification	0.724 - 0.845	0.631	0.882	0.883
Risk evaluation	0.757 - 0.874	0.560	0.864	0.866
Risk response	0.794 - 0.848	0.527	0.875	0.877
Risk monitoring and review	0.817 - 0.857	0.571	0.845	0.846
Sustainable Decision-Making				
Decision making analysis	0.733 - 0.848	0.516	0.878	0.879
Decision quality	0.750 - 0.869	0.541	0.894	0.895
Decision making speed	0.747 - 0.873	0.570	0.867	0.868
Decision-making satisfaction	0.776 - 0.858	0.593	0.859	0.861
Moral Intelligence				
Acting consistently with law and principles	0.775 - 0.851	0.529	0.898	0.899
Telling the truth	0.751 - 0.848	0.530	0.868	0.870
Standing up for what is right	0.764 - 0.884	0.542	0.865	0.867
Admitting mistakes and failures	0.731 - 0.854	0.544	0.867	0.869

Formulating Discriminant Validity

Discriminant validity was gauged to determine whether the constructs elucidated unique variance in the respective constructs as well as the constructs were not overlapping with each other (Degong et al., 2018). Discriminate validity was examined by testify whether the square root of AVE was higher than the values of the inter-construct correlations; the diagonal was greater in all cases than the correlations among the constructs (Tsou et al., 2019). Additionally, all the inter-construct correlation values should be below 0.80 (Campbell & Fiske, 1959) or the intercorrelations should be significantly distinct from 1.0 (Phillips & Bagozzi, 1986). As the results on correlation matrix met these requirements, all the constructs in the proposed model illustrates discriminant validity for the empirical data. The detailed information on discriminant validity result is contained in Appendix A.

Fitting the Hypothesized Model

Numerous model fitness indexes were adopted to determine the fitness of the data namely Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), goodness of fit index (GFI), and Tucker-Lewis index (TLI). Alternatively, the chi-square/df absolute index was also employed to evaluate the quality of the measurement model and structural model. On the basis of the statistical outcomes, the anticipated models were substantiated to fit the gathered data as all of the recorded indicators adhered to broadly accepted thresholds. The detailed information on the fitness indexes of the measurement model and structural model is contained in Appendix B.

Investigating the Structural Model

Direct Effect

The outcomes of significance tests for paths of the hypothesized model delineated in Table 3. The first set of main hypotheses postulated that BDAC demonstrated a marked impact on EAIS (H1: $\beta = 0.494$; $p = 0.000$), SDM (H2: $\beta = 0.230$; $p = 0.000$), and CRM (H3: $\beta = 0.604$; $p = 0.000$). In the meanwhile, CRM illustrated a significant impact on EAIS (H4: $\beta = 0.347$; $p = 0.000$) and SDM (H5: $\beta = 0.399$; $p = 0.000$). As expected, the paths linking EAIS and SDM (H6: $\beta = 0.252$, $p = 0.000$) was significantly positive. Thus, H1-H6 were buttressed.

Mediating Effect

On the standpoints of Cheung & Lau (2007), the partial mediation emerged solely when both direct and indirect effects were substantially or the full mediation took place when the indirect effect was considerable whereas direct effect was inconsiderable. The outcomes in Table 3 that both EAIS and CRM acted as the mediators on the interconnection between BDCA and SDM.

Table 3 – Structural Coefficients (β) of the Hypothesized Model								
Hypothesis No.	Hypothesized path			Standardized	S.E.	C.R.	P	Inference
<i>Direct effect</i>								
H1	BDAC	→	EAIS	0.494	0.040	2.983	0.000	Buttressed
H2	BDAC	→	SDM	0.230	0.038	2.536	0.000	Buttressed
H3	BDAC	→	CRM	0.604	0.043	2.398	0.000	Buttressed
H4	CRM	→	EAIS	0.347	0.039	2.047	0.000	Buttressed
H5	CRM	→	SDM	0.399	0.032	2.099	0.000	Buttressed
H6	EAIS	→	SDM	0.252	0.045	3.389	0.000	Buttressed
<i>Indirect effect</i>								
H7	BDAC → EAIS → SDM			0.124	-	-	0.005	Buttressed
H8	BDAC → CRM → SDM			0.241	-	-	0.009	Buttressed

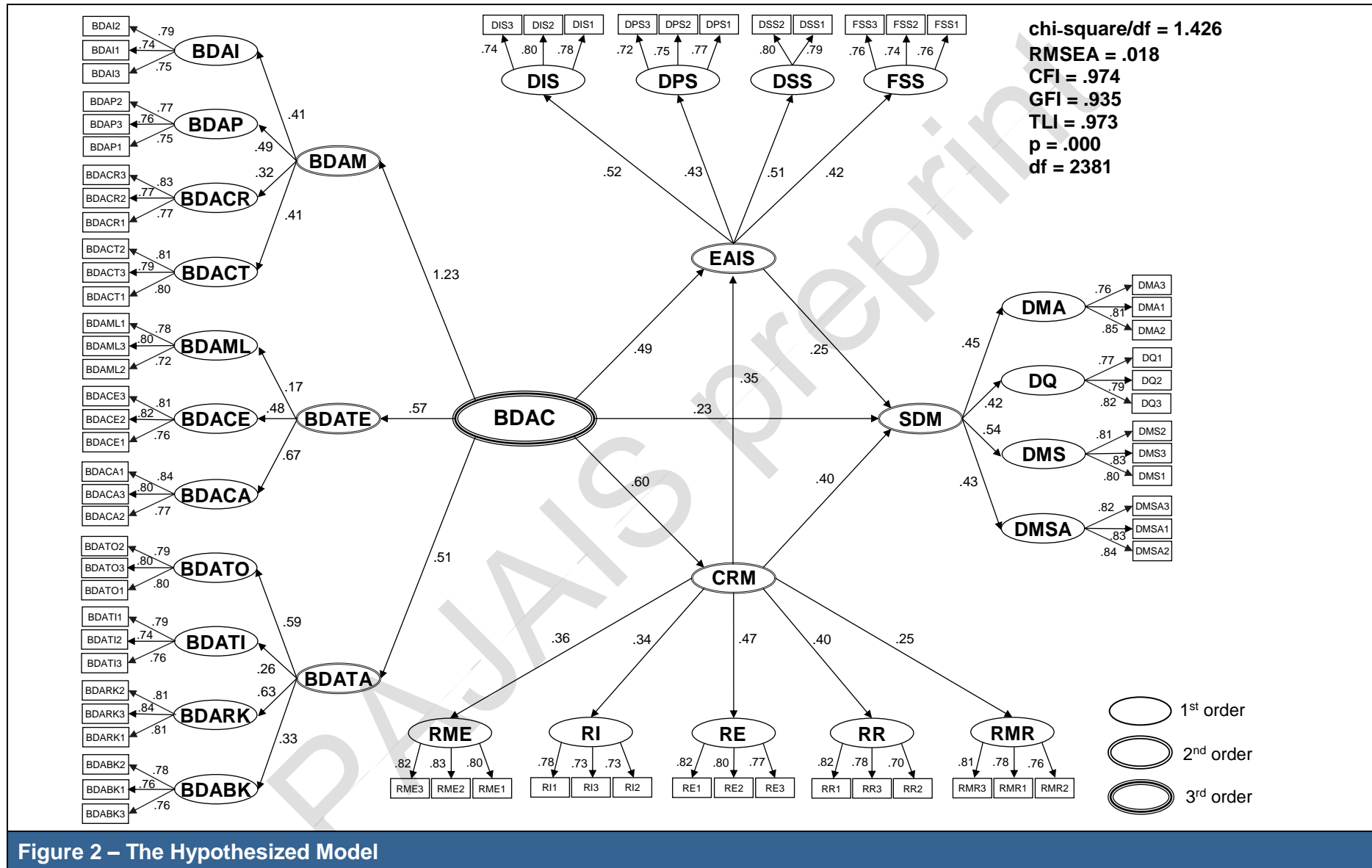


Figure 2 – The Hypothesized Model

Moderating Effect

The primary sample of this study is divided into two sub-samples prior to utilizing the multi-group analysis, according to the median split recommended by Sharma et al (1981). It is considered as an appropriate technique since the median will not be susceptible to outliers (Alves et al., 2018; Iacobucci et al., 2015), and the sub-sample in each group will be assured to avoid biased outcomes (Hair et al., 2017; Matthews, 2017). Sub-samples for multi-group research, on the other hand, have traditionally been obtained using a median split, resulting in two sub-samples stamped as "high" and "low" (Alves et al., 2018; Norlander et al., 2005). As such, the respondents in this research are divided into two sub-groups based on the moderator variable - MI.

The two sub-groups are labeled "high MI" and "low MI." Given that the comparison on structural path coefficients can only be performed if the model is shown to be structurally dissimilar (Salzberger et al., 2014), establishing measurement equivalence is critical. Simultaneously, it is important mentioning that measurement error could be increased if measurement invariance is not established; this can result in biased outcomes (Type II errors) (Matthews, 2017). As a result, any differences in model estimation parameters between the two sub-groups must be verified to ensure that they are not the result of differences in substance or perceived inequalities in the significance of the measurements defining the model for these groups. If the complying p-value for the Chi-square discrepancy and df discrepancy obtained are significant, the path exhibits moderating impact created in light of the moderator. Based on the data analysis in Table 4, the Chi-square discrepancy (Δ Chi-square = - 29.869) and the df discrepancy (Δ df = -6) are statistically significant at $p < 0.05$ between the Variance Measurement and the Partial Measurement Invariance models, indicating that the vigor of the path coefficient did indeed differ between the two sub-samples (Hair et al., 2010). Alternatively, the pertinence of the multi-group SEM investigation is assessed using goodness-of-fit indices namely TLI, CFI, GFI, and RMSEA as recommended by Bollen and Long (1993). As a result, the variance measurement method is chosen for the conclusion on the difference of in the research models' component of the two median samples. Table 4 clearly reveals that the fit indices of the two models exhibit an excellent model fit.

Table 4 – Differences in Compatible Indicators between Variance and Partial Invariance Measurement

Model	Chi-square	df	p-value	TLI	CFI	GFI	RMSEA
Variance Measurement	5959.597	4762	0.000	0.969	0.970	0.895	0.013
Partial Measurement invariance	5989.466	4768	0.000	0.968	0.969	0.894	0.014
Differences	- 29.869	- 6	0	0.001	0.001	0.001	-0.001

Given that non-standardized estimations should be centered in multi-group analysis (Kline, 2015), the path-by-path difference comparison was further done via a pairwise comparison with the coefficients (Hair et al., 2014). On the basis of the outcomes in Table 5, the parameter coefficients for the group with high MI were substantiated to be higher than those for the group with low MI. Hence, H9A-H9F were buttressed.

Table 5 – Research Findings on the Moderating Role of Moral Intelligence

Hypothesis No.	Hypothesized path			Low MI (n=319)				High MI (n=364)				Difference between parameters (High MI - Low MI)		Inference
				Standardized	SE	CR	P	Standardized	SE	CR	P	Standardized	P	
H9A	BDAC	→	EAIS	0.728	0.022	2.209	0.379	0.200	0.052	2.780	0.008	-0.528	-0.371	Buttressed
H9B	BDAC	→	SDM	0.146	0.019	1.451	0.135	0.347	0.057	2.269	0.010	0.201	-0.125	Buttressed
H9C	BDAC	→	CRM	0.547	0.029	1.328	0.264	0.706	0.038	2.131	0.000	0.159	-0.264	Buttressed
H9D	CRM	→	EAIS	0.111	0.078	1.203	0.122	0.678	0.041	2.011	0.000	0.567	-0.122	Buttressed
H9E	CRM	→	SDM	0.214	0.082	1.314	0.077	0.239	0.082	2.012	0.001	0.025	-0.076	Buttressed
H9F	EAIS	→	SDM	0.366	0.084	1.061	0.068	0.392	0.077	2.495	0.005	0.026	-0.063	Buttressed

Discussion

The statistical findings regarding the relationship between BDAC and EAIS in the current study shed light on the critical function of BDAC in promoting EAIS. This evidence supports and broadens the conclusions of other research that examined the connection between accounting information systems, data analytics, and big data (e.g., Huerta & Jensen, 2017; Villa et al., 2021; Wang, 2021). BDA is increasingly being used in process safety and risk management (Goel et al., 2017). Building on the perspective of Kabanda (2021), BDA can offer a number of network management security dimensions that have significantly changed the way that security management, fraud prevention, risk management, and compliance are handled. The current study also offers statistical evidence in favor of the notion that BDAC could enhance and improve the CRM. In doing so, these discoveries expand upon the perspectives of earlier academic works by Araz et al. (2020); Choi et al. (2017); Dicuonzo et al. (2019); Goel et al. (2017); Yang et al. (2022). Also, this study highlights how significantly and positively BDAC and SDM are related. The results of various researchers, including Awan et al. (2021), Elgendy and Elragal (2016), Li et al. (2022), and Saggi and Jain (2018), are in agreement with the observations that are made. This corroborates the finding from past studies that the BDA practices are required to make big data relevant for decision-making (Munesh & Mittal, 2014). According to some previous researchers, BDA is one of the instruments that can help decision-makers develop intuitions, evaluate business performance, establish competitive advantages, and boost enterprise value (Saggi & Jain, 2018).

Remarkably, the statistical data supports and enlarges on similar reported results about the contribution of CRM to helping organizations attain EAIS (i.e., Nusa, 2018). In this regard, a crucial element and helpful contributor to raising the caliber of accounting information system is risk assessment's effectiveness (Nusa, 2018).

In conformity with our predictions, the reported findings about the function of CRM and EAIS as the partial mediators in the relationship between BDAC and SDM are supported by the statistical data. Undoubtedly, BDA might improve the quality of information, supporting integrated reporting more successfully and improving the accuracy of the data used in reports (Janssen et al., 2017). In contrast, using advanced analytics and data visualization can make firms more watchful, which can speed up decision-making (Böhm et al., 2018; Rawat et al., 2019).

In line with our expectation, the statistical evidence props up and extends the moderating role of MI. One of the factors that may affect moral behavior is the MI structure (Mohagheghi et al., 2021). The MI is important and crucial because it influences other intelligences and guides them to valuable actions (Dortaj et al., 2021). According to the findings of Mahdavikhou et al. (2014), the accountants with higher MI have abilities to understand moral issues and comparing to low MI, the high MI makes it possible for accountants to recognize the moral and ethical situations in workplace. Additionally, it is clear that accountants with high MI have higher levels of responsibility, integrity, forgiveness and compassion because they are more adept at regulating their moral beliefs than accountants with low MI (Mahdavikhou et al., 2014). Organizations in today's dynamic and risky world must require their employees to uphold ethical standards and develop MI in order to stabilize their survival. Organizational work force has to deal with ethical decisions when the business climate had grown unpredictable, and the better they were at handling them, the more successful they would become. In order to use the BDAC for CRM and improve EAIS for reaching the SDM in the unpredictable environment, public sector organizations with morally intelligent personnel have an advantage over those who have staff with underdeveloped inner MI.

Final Consideration and Future Extensions

The theoretical contributions and practical implications along with avenues for future research were presented in the following sub-sections based on the results that were found.

Theoretical Implication

The investigation of BDAC as an enabler for the enhancement of EAIS and CRM which thus lead to the success in SDM within public sector organization in the context of uncertainty give rise to several implications in theory which acts as a springboard for up-coming academic works. Over the past two decades, technological advances have brought about a new age for businesses and governments (Grover et al., 2020; You et al., 2019). Big data and BDA have the potential to improve the government sector by enabling a better understanding of current issues, the outside world, and citizen requirements to support efficient policy and service formulation and implementation. According to Elgendy and Elragal's (2016) research, BDA is crucial for helping decision-making. The current research sheds light on the marked impact which BDAC induce on SDM in both direct and indirect manner. Concretely, BDAC is verified to induce indirect impact on SDM through the mediators including EAIS and CRM. These findings generate in-depth insights on the potential of BDAC and how to leverage BDAC for decision-making in a sustainable manner. Accordingly, the effective utilization on BDAC required a more holistic perspective on accounting information system and CRM. As proposed by Jarah et al. (2023), the decision-making of leaders in organizations is largely impacted by the accounting information system. Nonetheless, even though accounting information system has been viewed as a successful strategy for managing both internal and external change (Al-Okaily et al., 2020; Ha, 2020) as well as boosting and enhancing organizational performance, a lack of cybersecurity could result in security breaches and attacks on the organizational records (Hashim & Razali, 2019). In this regard, the value of more fine-grained insights on these issues will allow public sector to determine how to exploit the potential of BDAC to gain the EAIS and CRM as well as establish a set of organizational system structures and operational modes SDM. Such insights could be employed to upgrade EAIS and CRM which is critical for SDM in the context of uncertainty. More importantly, based on standpoint of Jiang (2022), it should be noted that employee computer fraud is a costly and important problem for all firms. As such, all of organization must build a deep situational awareness of the threat environment, as well as the capability to address the complex and growing security threats that exist inside it (Maynard et al., 2018). In light of this, MI reflects on the ability to discern between good and wrong; this requires having strong ethical convictions and acting in accordance with them as well as acting with integrity and dignity. In this manuscript, MI is depicted to enable public sector to handle several problems in term of security threats caused by organizational staff through gaining the awareness and practices to enhance MI among organizational employees. In doing so, the public sector organization with morally intelligent staff will have an edge on leveraging the BDAC for CRM and enhance EAIS for reaching the SDM in the environmental uncertainty.

Managerial and Policy Implications

Building on the managerial outlooks, the obtained observations of the current research provide numerous takeaway points of view to put into practice. The public sector organizations should warrant that the BDA implementation should be more than a technical project and should relate to organizational transformation initiative requesting analytics strategies, management reinforcements, and proactive and careful meticulous management to capture the entire potential of BDA. Consequently, the leaders in public sector organizations are inspired to enhance the awareness on these issues so that buttresses can be produced while establishing and evolving this system as well as gradually generating the transformation. Besides, the leaders in public sector organizations are recommended to formulate inclusive strategies

regarding to integrating accounting information system into modern information technologies through seminars celebration and expert consultations. On one hand, it was prerequisite that all leaders in public sector organizations should obtain well-defined insights of the best approaches to foster the organizational staff to participate and to be committed to risk management and moral matters. On the other hand, the leaders in public sector organizations should be proactive in supporting, inspiring, and handling the concerns and queries in term of the integration accounting information system into modern technologies from accountants to assure an internalization of vision. Since the training programs will perform as a preliminary step to facilitate the organizational staff how to fruitfully analyze data, with a target of shaping up and fostering collaboration between organizational departments (Chehbi-Gamoura et al., 2019), it has been also prerequisite that leaders in public sector organizations should center on intensifying the proficiency for the organizational workforce by means of proper training programs to keep them abreast of the state-of-the-art BDA programming systems. With respect to this, the accounting staff in public sector organizations should be proactive in partaking in training courses not only on advanced information technologies adoption but also on CRM. Simultaneously, the accounting department can participate in training programs to ameliorate and deepen their skills in data analytics as well as gaining their MI.

As information technology infrastructure is corroborated to demonstrate a significant impact on information security (Angst et al., 2017; Kong et al., 2010), an organization with good information technology resources will enable to meliorate information system security and minimize the number of security breaches and incidents. Thus, tangible resources namely BDA infrastructure, digital platform as well as other fundamental resources to deploy BDA projects should be concentrated. On the other hand, the organizational strategies should follow governmental policies and risk control to prevent any potential crises as well as to gain more stability for organizational operations. As such, all the leaders in public sector organizations are suggested to configure the internal processes and to minimize the potential causes of risk to obtain vigorous risk management plans. Owing to the imperative role in meliorating and developing the efficiency and effectiveness of modern information technologies implementation amongst all organizations, policymakers and Governmental influencers should formulate and promulgate policies as well as laws in term of information technology adoption, and simultaneously, take actions pertaining to budget allocation, reinforce and plan for deploying the information technology infrastructures. Lastly endeavors are also required by hardware and software developers or retailers to comprehend on the challenges to minimize weaknesses of inherent techniques on accounting information system for more state-of-the-art system evolvment in appropriate with the public sector organizations' idiosyncrasies.

Limitations and Avenues for Future Research

Although best endeavors have been performed to obtain the outcomes and recommendations with far-reaching effects, care should be exercised with the cognizance of the inherent drawbacks of this research when generalizing. Firstly, the hypothesized interconnections of this work were investigated with a cross-sectional design by capturing data at a single point of time; therefore, it could make difficulties in deducing causation interconnections between any two variables. This opened the door to even more in-depth research, such as longitudinal designs as the longitudinal data would be appropriate for testifying causation and yield more accurate data (Maxwell & Cole, 2007). Secondly, the respondents of the current study came from one region of Vietnam, which might not be a proper representative of the whole world comprising of emerging and developed markets. As such, follow-up studies from other areas as well as of a broader spectrum should be carried out as they posited a research gap. Thirdly, this study was approached predominantly through non-probability sampling which would made the representativeness of the sample become compromised (Masocha, 2018). Besides, even though the primary data procurement approaches and quantities met the statistical demands of large sample data (Naderi et al., 2018), there was limitation regarding to self-reported data

(Shields et al., 2011). Thus, additional investigations of the model utilizing greater and random samples with a proportional volume of respondents from a wide range of demographics should be performed by follow-up studies.

Conclusion

Even in the aftermath of the COVID-19, all of organizations and societies around the world are being impacted in unprecedented ways, adaptive approaches to dealing with change necessitate fundamental modifications in thinking (Van de Wetering et al., 2023). Risk and uncertainty have been well-acknowledged as innermost in the operational process and increased in post-disaster settings (Akinboye & Morrish, 2022). Therefore, SDM has been indispensable for the organizational operations in the aftermath of a crises (Morrish & Jones, 2020). On the other hand, with the incessant advancements of information technology, cyber-offenders accordingly increased complicated tactics to attack vulnerabilities in individual systems, organization networks as well as nation-states (Rassam et al., 2017). As cybersecurity has been considered as a great concern for professionals, legislators, and, more broadly, all decision-makers, the CRM has become the prerequisite of security management and prominently meaningful in seizing the entire security profile of organizations (Talet et al., 2014; Webb et al., 2014). Against this backdrop, BDA would become a must-have element of any fruitful cybersecurity resolution owing to the demand of rapid processing of the high-velocity, high-volume data from a wide range of sources to determine anomalies or attack prototype as quickly as possible to minimize the vulnerability of the systems and enhance their resilience (Angin et al., 2019). Aside from applying and developing data-driven capacities, organizations should take proper actions to deploy insights (Côte-Real et al., 2017) and scan for useful information for effective decision-making and organizational value. To do so, accounting information should be of high quality, relevant and helpful in the decision-making process (Septriadi et al., 2020).

From the viewpoints of resource-based view theory and contingency theory, the current study focuses on analyzing how BDAC can improve and enhance the CRM and EAIS as well as how MI can improve and foster these procedures. The statistical information obtained from a paper-and-pencil survey distributed to a convenience and snowball sample of 683 respondents in the Southern regions of Vietnam was analyzed using SEM. The outcome analyses highlighted how the suggested constructs were interrelated and strengthened one another. The study's findings contribute significant, realistic, and helpful theoretical contributions to the present literature on the subject, as well as relevant advice for practitioners. As a result, these findings suggest that practitioners and policymakers can benefit by improving BDAC and EAIS, as well as introducing CRM, which are proactive approaches to attain SDM. Increasing accountant MI as an effective option to nurture the benefits of BDA, accounting information systems, and CRM to succeed in SDM.

Acknowledgments

This research was supported and funded by the University of Economics Ho Chi Minh City (UEH), in Vietnam. Moreover, all authors in this research sincerely thank the anonymous reviewers for their useful comments and suggestions that improved the chapter's quality.

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Appendix A – Results Summary of Discriminant Validity

Table A – Results Summary of Discriminant Validity																												
	DM SA	TTT	DBA RK	RM E	DM S	BDA CE	BDA CA	DM A	AM F	SU WR	BDA TO	DQ	BDA CT	RE	BDA CR	ACL P	RM R	RR	DIS	BDA BK	BDA ML	BDA TI	BDA P	BDA I	FSS	DPS	RI	DSS
DM SA	1																											
TTT	-.078	1																										
DBA RK	.070	-.053	1																									
RM E	.097	-.018	.026	1																								
DM S	.296	-.085	.058	.134	1																							
BDA CE	.064	-.007	.154	.020	.057	1																						
BDA CA	.056	-.057	.162	.058	.071	.332	1																					
DM A	.111	-.061	.091	.196	.193	.074	.091	1																				
AM F	-.015	.090	-.015	-.032	-.119	-.049	-.093	-.075	1																			
SU WR	-.043	.149	-.016	-.063	-.032	-.004	-.009	-.065	.194	1																		
BDA TO	.037	.002	.404	.046	.059	.081	.093	.030	-.025	-.057	1																	
DQ	.224	-.042	.075	.094	.290	.026	.067	.143	-.113	-.081	.051	1																
BDA CT	.145	-.017	.185	.138	.158	.144	.218	.196	-.075	-.028	.139	.080	1															
RE	.169	-.103	.090	.146	.156	.093	.053	.176	-.051	-.076	.023	.093	.147	1														
BDA CR	.173	-.043	.132	.063	.133	.050	.133	.174	-.016	-.036	.079	.073	.238	.091	1													
ACL P	-.068	.101	-.091	-.066	-.145	-.029	-.040	-.106	.097	.183	.001	-.089	-.054	-.098	-.041	1												
RM R	.067	-.139	.048	.008	.094	.026	.026	.076	-.170	-.140	-.009	.046	.098	.100	.035	-.183	1											
RR	.106	-.054	-.009	.164	.086	.028	.049	.153	-.005	.002	.026	.063	.153	.268	.012	-.044	.089	1										
DIS	.105	-.178	.144	.146	.251	.139	.146	.183	-.164	-.111	.065	.174	.145	.138	.118	-.213	.156	.086	1									
BDA BK	.028	.034	.157	.057	.057	.132	.159	.090	-.001	.023	.174	.058	.142	.005	.079	-.063	-.001	.045	.130	1								
BDA ML	-.009	-.051	.120	.067	.047	.050	.098	.004	-.015	-.059	.116	.044	.076	.077	-.016	-.046	.040	.014	.087	-.002	1							
BDA TI	-.005	-.021	.119	-.009	.027	.092	.119	.104	.005	-.042	.166	.033	.052	.064	.074	-.091	.021	-.038	.042	.130	.122	1						

Table A – Results Summary of Discriminant Validity

	DM SA	TTT	DBA RK	RME	DMS	BDA CE	BDA CA	DMA	AMF	SUWR	BDATO	DQ	BDA CT	RE	BDA CR	ACL P	RMR	RR	DIS	BDA BK	BDA ML	BDA TI	BDA P	BDA I	FSS	DPS	RI	DSS
BDA P	.166	-.085	.165	.126	.201	.156	.258	.252	-.057	-.054	.144	.140	.217	.203	.175	-.162	.130	.121	.224	.156	.093	.068	1					
BDA I	.179	-.021	.138	.213	.192	.133	.140	.219	-.044	-.092	.156	.120	.122	.190	.114	-.062	.156	.156	.196	.106	.083	.081	.146	1				
FSS	.101	-.196	.109	.127	.172	.116	.114	.173	-.134	-.103	.064	.121	.073	.131	.143	-.170	.146	.126	.281	.063	.049	.111	.102	.124	1			
DPS	.057	-.138	.111	.110	.131	.063	.162	.163	-.143	-.157	.116	.170	.161	.123	.135	-.150	.051	.127	.120	.121	.090	.065	.127	.159	.232	1		
RI	.118	-.097	.058	.098	.162	.023	.050	.139	-.111	-.076	-.002	.155	.056	.125	.080	-.017	.142	.125	.157	.041	-.040	-.019	.094	.138	.105	.127	1	
DSS	.071	-.152	.243	.093	.134	.155	.217	.174	-.138	-.211	.121	.147	.165	.106	.139	-.172	.073	.102	.270	.197	.117	.188	.275	.140	.142	.294	.084	1

Note: BDA Investment = BDAI; BDA Planning = BDAP; BDA Coordination = BDACR; BDA control = BDACT; BDA Modularity = BDAML; BDA Connectivity = BDACE; BDA Compatibility = BDACA; BDA Technology Knowledge = BDATO; BDA Technical Knowledge = BDATI; BDA Relationship Knowledge = BDARK; BDA Business Knowledge = BDABK; Data input system organization = DIS; Data processing system organization = DPS; Data storage system organization = DSS; Financial statement system organization = FSS; Acting consistently with law and principles = ACLP; Telling the truth = TTT; Standing up for what is right = SUWR; Admitting mistakes and failures = AMF; Decision making analysis = DMA; Decision quality = DQ; Decision making speed = DMS; Decision-making satisfaction = DMSA; Risk management environment = RME; Risk identification = RI; Risk evaluation = RE; Risk response = RR; Risk monitoring and review = RMR.

Appendix B – Results of Measurement and Structural Model Assessment

Table B – Results of Measurement and Structural Model Assessment					
Fit indices	Suggested value	Measurement Model	Structural Model	Global Model fit	Reference
CMIN/DF	≤ 3	1.282	1.426	Yes	Kline (2015)
GFI	≥ 0.9	0.939	0.935	Yes	Cangur & Ercan (2015)
CFI	≥ 0.9	0.982	0.974	Yes	Cavazos-Arroyo & Puente-Diaz (2019)
TLI	≥ 0.9	0.979	0.973	Yes	Gefen et al. (2000)
RMSEA	≤ 0.05	0.014	0.018	Yes	Kline (2015)

About the Authors

Pham Quang Huy is an Associate Professors and Doctor with more than seventeen years of working experience as Advanced Lecturer in Public Sector Accounting at the School of Accounting and currently the Head of Public Accounting Department at the University of Economics Ho Chi Minh City in Vietnam. In addition to authoring numerous chapters for the books, he has written numerous papers in many reputed journals and presented talks at conferences both domestically and internationally. Mr Pham has extensive knowledge and is an expert in public sector governance, private sector accountancy, and corporate social responsibility also. Artificial intelligence, Big data, Blockchain, Cybersecurity, green economy, sustainable development fields are some of Pham's passions recently. He has been awarded the Young Scientific Talent in Vietnam issued by the Ministry of Education and Training together with Typical Young Teachers in Ho Chi Minh City for six consecutive years (i.e., from 2012 to 2017) as well as obtaining the Certified Public Accountant from the Ministry of Finance. Huy is a formidable force at work, inspiring others to put in the effort necessary to achieve with his upbeat outlook and boundless enthusiasm.

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