

Integrating Big Data Analytics Capabilities (BDAC), Artificial Intelligence (AI) and ESG Practices for Enhanced International Performance: A Conceptual Framework

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DOI: <https://doi.org/10.47772/IJRISS.2026.100700839>

Received: 29 July 2026; Accepted: 03 August 2026; Published: 13 August 2026

ABSTRACT

The increasing digitalization of global markets has enhanced the importance of big data analytics capabilities (BDAC) among firms seeking to enhance their international performance. Despite the growing recognition of big data analytics capabilities (BDAC), previous studies acknowledge the role of BDAC in improving firm performance; however, there is limited research focused on how BDAC can be integrated with ESG practices and artificial intelligence (AI) to enhance international performance. By addressing this gap, this study proposes a conceptual framework that integrates BDAC, AI, and ESG practices in order to explain how firms can enhance their international performance, especially in export-oriented contexts. Drawing upon the resource-based view (RBV) and dynamic capabilities theory, the framework proposes that the BDAC role is a strategic capability enabling firms to generate data-driven insights that support sustainability practices. In turn, the sustainability practices will enhance firms' international performance by strengthening competitiveness, and, in the lens of stakeholder theory, sustainability practices will build a good reputation and ensure the firms' compliance with the global market. Furthermore, the framework proposes that AI moderates the relationship between BDAC and sustainability practices by enhancing firms' ability to process complex data and automate the decision-making process. Therefore, by integrating insights from information systems, sustainability management, and international business literature, this study contributes to the emerging discourse on digitally enabled sustainable competitiveness. The framework proposes a quantitative method and analysis using PLS-SEM to empirically test the proposed conceptual framework. The proposed framework offers an integrative theoretical framework for studying BDAC, AI, and sustainability in international performance and will provide strategic guidance on leveraging analytics and AI to achieve sustainable and competitive international growth.

Keywords: big data analytics capabilities (BDAC), artificial intelligence (AI), sustainability practices, international performance. dynamic capabilities, digital transformation

INTRODUCTION

In today's globalized business environment, firm performance is increasingly influenced by the strategic integration of digital, environmental and organizational capabilities (Kourtzidiz & Tzeremes, 2020; Umu Rosyid et al., 2023) as well as internationalization capabilities. Exporting is the most common foreign market entry mode and often the first stage of internationalization which is employed by small and medium-sized enterprises (SMEs), due to its relatively low risk, high degree of flexibility and low commitment of resources (Gkypali et al., 2021). Many firms choose export for their first international entry mode. Exporting is the easiest and lowest-risk way to enter foreign markets. It needs the least facility allocation and has the lowest changes in the country marketing programs (Sadaghiani et al, 2011). Exporting continues to be the dominant internationalization strategy due to its lower risks and lower entry costs (Czinkota et al., 2009; Gkypali et al., 2021). Many firms opt

for exporting option to be the first strategy to enter the international market. However, the ability to succeed in the international market now depends on the organizational strategic resources and capabilities. It depends on organizational capabilities in leveraging digital technologies like big data analytics (BDA) and artificial intelligence (AI). These technologies are assumed to support sustainable, efficient and competitive operations (Chen et al., 2024; Jabir & Falih, 2022). AI facilitates corporate sustainable development, with a more significant impact on environmental governance and social responsibility (Chen et al, 2024).

Big Data Analytics Capabilities (BDAC) in Malaysian Organization

Big data has gained popularity among organizations to seize advantageous opportunities. Despite the growth in big data technologies and their availability, many companies and organisations in Malaysia remain reluctant to adopt them (Lee et al., 2023). Organizations are reluctant to adopt digital technologies like big data (BDA) and artificial intelligence (AI) due to the high resources and time investment required to hire skilled workers; they are usually faced by smaller-scale companies. Financial resources have also become crucial resources to invest in digital technologies (Saleh et al, 2019). In Malaysia, organisations are reluctant due to challenges based on legal, architectural, social and market factors (Lee et al., 2023), despite all the initiatives provided by the government.

The Malaysian government has launched several initiatives in recent years to digitalize Malaysian economic sectors. The government has introduced Malaysia Digital as the new national strategic initiative to encourage and attract companies, talents and investments while enabling Malaysian businesses and citizens to play a leading part in the global digital revolution and digital economy (MDEC, n.d.). This initiative also serves to create substantial digital economic spillover through equitable access to digital tools, knowledge and income opportunities nationwide.

In Malaysia, the manufacturing sector is a cornerstone of economic growth, contributing significantly to GDP and employment (Shukor et al., 2023). Malaysia's National Policy on Industry 4.0 (Industry4WRD) promotes the adoption of advanced Fourth Industrial Revolution (4IR) technologies, such as IoT, AI, and BDA, to boost productivity and sustainability (Mon & Giorgio, 2023). Digital transformation enables Malaysian manufacturers to optimize production processes, reduce costs, and align with Malaysia's National Policy on Industry 4.0 principles to maintain global competitiveness (MITI, 2023). Furthermore, Environmental, Social, and Governance (ESG) focused programmes under the 12th Malaysia Plan facilitate sustainable manufacturing, emphasizing green technologies, energy efficiency, and renewable energy adoption (MITI, 2023). These initiatives, along with digitalization, are essential for firms to meet evolving global demands and achieve long-term growth.

The role of BDAC is basically a firm's ability to transform big data into valuable insights (Mikalef et al., 2020). Leveraging BDAC helps firms formulate valuable decisions, detect threats, and sense changes in business conditions, thus enabling the firm to deploy accumulated knowledge to yield business value (Makhloufi et al, 2023). There are many empirical studies have shown that BDAC has a direct influence on firms' performance in terms of gaining a competitive advantage (Gupta and George, 2016). Despite widespread recognition of the essential role of BDAC in organizational success, a significant gap persists in leveraging BDAC effectively across Malaysian firms, especially medium and small enterprises, where adoption remains limited (Wahab et al., 2021; Sani et al., 2021) and there is still limited knowledge of the organizational aspects and challenges that are important when attempting to do so (Mikalef et al., 2019). While BDAC enables firms to derive actionable insights, optimize operations, and enhance decision-making, only a fraction of organizations successfully translate BDAC investments into impactful outcomes (NewVantage Partners, 2023). This gap undermines firms' ability to meet strategic goals such as sustainability practices and international performance, especially in global markets characterized by fierce competition and technological advancements (Vachkova et al., 2023). Although BDAC has been widely examined in operational and financial performance literature, considerably less attention has been given to international performance, particularly within export-oriented manufacturing firms operating in emerging economies. The mechanism explaining how BDAC creates international performance remains underexplored. This is where ESG becomes important in enhancing international performance.

Integrating BDAC is critical for advancing sustainability practices measured by Environmental, Social, and Governance (ESG) criteria. Firms with strong ESG practices demonstrate better financial outcomes, stakeholder trust, and global competitiveness (Chen S, 2024; Habib et al., 2023). However, managing sustainability-related data remains challenging without robust BDAC infrastructure, impeding firms from meeting ESG standards and developing sustainable business strategies (Chuah & Thurasamy, 2021). BDAC also plays a pivotal role in export performance by providing insights into market trends, consumer preferences, and regulatory compliance (Khalil et al., 2023). Export-oriented firms adopting sustainable practices achieve greater competitiveness and global presence (Aksoy et al., 2023; Wen et al., 2023). AI enhances data processing and ESG reporting quality, yet many firms fail to integrate AI effectively, limiting its benefits for sustainability and performance (Sipola et al., 2023).

Besides BDAC, artificial intelligence has risen as a groundbreaking tool with immense promise for the global business environment (Alshamsi et al., 2024). The role of cutting-edge technologies, such as big data processing, in the evolution of AI has formed a symbiotic relationship between AI and modern technologies that has not only enhanced AI's capabilities but also its application across various domains, thereby augmenting performance and capacities in numerous applications. (Oyeniya et al., 2024). Market expectations and sustainability challenges require advanced technologies like big data analytics (BDA) and artificial intelligence (AI) (Pesqueira & Sousa, 2024). Artificial intelligence is an effective decision-making tool, and it has been applied to many fields to monitor quality, plan production, improve decision-making processes, increase productivity, and gain sustainable competitive advantages. (Zhang et al., 2020). Hence, leveraging AI tools strengthens the firm's BDAC in enhancing ESG reporting, and the outcome will indirectly influence the firm's international performance.

This study proposes a framework by contributing the idea that BDAC influences organizations' international performance. It also proposes that AI moderates BDAC's relationship with sustainability practices and international outcomes. The study proposes the mediating role of sustainability practices in the BDAC-international performance link, aiming to offer insights into integrating BDAC and AI for sustainable decision-making and global competitiveness. This study addresses the following research questions: How do big data analytics (BDAC) influence firms' international performance through sustainability practices, and what role does artificial intelligence (AI) play in this relationship?

LITERATURE REVIEW

Theoretical Background

This study proposes to apply two underlying theories, which are dynamic capability (DC) and stakeholder theory (ST). Dynamic Capability (DC), an extension of RBV, focuses on a firm's ability to adapt resources in response to rapidly changing market conditions (Teece et al., 1997). This theory highlights the need for organizations to reconfigure resources, embrace innovation, and capitalize on emerging opportunities to maintain competitive advantages (Khalil et al., 2023). Big data analytics capabilities are a multidimensional construct that is operationalized through three interrelated dimensions: tangible resources, mainly technology resources held by the firm (Elia et al., 2022); the human skills, which emphasize the technical and managerial expertise to interpret data (Gupta et al., 2020; Mikalef et al., 2019) and the intangible resources that focus on the data-driven culture and organizational learning intensity that will promote data-driven decision-making (Ayadi et al., 2024). Therefore, these lower levels and ordinary capabilities will form the dynamic capabilities of the firms. Dynamic capabilities (DC) refer to the firm's ability to change, adjust, transform and reconfigure its resources into its abilities and build new capabilities to respond to business necessities (Helfat & Winter, 2011). A previous study argues that firms will be able to sustain and thrive under any market situation and build dynamic capabilities by sensing, seizing and transforming to maintain competitiveness even though going through changes to technologies, competitors and customers (Yoshikuni et al 2023). DC theory has been instrumental in explaining how BDAC supports sustainable practices and ESG implementation. Firms operating in dynamic environments leverage DC to integrate ESG principles, enhance sustainability disclosures, and address opportunities and threats effectively (Pesqueira & Sousa, 2024). This study applies DC theory to establish the relationship between BDAC and ESG practices, demonstrating how resource optimization and foster sustainability and performance in global markets (Bhatti et al., 2022).

Whereas, Stakeholder Theory (ST) underscores the importance of creating value for various stakeholders, including employees, communities, customers, shareholders, and the environment (Mahajan et al., 2023). It asserts that addressing stakeholders' legitimate needs is crucial for organizational success, growth, and sustainability (Rahman et al., 2023). This study leverages stakeholder theory to justify integrating ESG into firms' strategic decision-making. It positions ESG as a mechanism for enhancing stakeholder trust, achieving long-term sustainability, and balancing economic, social, and environmental objectives. By adopting a holistic stakeholder-focused strategy, firms can maximise value creation, safeguard their operational resilience, and maintain strategic alignment with global sustainability goals (Mahajan et al., 2023). The theory suggests that the firm needs to take into consideration the interests of its stakeholders, which refers to the individuals or groups who will be influenced by the actions of a firm (Freeman, 1984). The stakeholders will find a firm that they choose to work with legitimately when they conform to the stakeholders' expectations about their responsibility towards the organisation's environmental and social impact (Ho et al., 2024). Drawing on stakeholder theory (ST), previous studies state that ESG practices help firms improve their relationship with their stakeholders and, in turn, enhance the firms' performance (Ashrafi et al., 2020). Hence, the application of stakeholder theories shows why ESG practices lead firms to international performance. Managing its ESG practices will provide a good reputation and image towards stakeholders and indirectly offer better international business opportunities.

International Performance

International performance refers to a company's success in global markets, measured by financial metrics like international sales (Cabral et al., 2020), market share, and growth, as well as strategic goals like geographic market scope and innovation. The firms with a high degree of internationalization (DoI) exhibited high levels of international intensity, i.e., foreign sales to total sales (FSTS), and a diversified and wide geographical scope of their international sales, i.e., a correspondingly high number of countries and a high number of regions (Cabral et al., 2020). Basically, it emphasizes international objectives and the overall evaluation of international activity. International expansion will increased presence and importance within the international markets.

International performance reflects a firm's success in global markets through activities like exporting, international sales, and diversification (Gerschewski et al., 2015; Cabral et al., 2020). There are many international expansion strategies that can be chosen as the mode of entry. Mostly exporting has become the initial step of expansion. Exporting is the most common mode of international entry, offering cost-effectiveness and low risk (Hosseini & Dadfar, 2018; Morais & Ferreira, 2020). Effective export strategies are driven by factors such as marketing capabilities, government support, and technological advancements (Sirisuwat & Jindabot, 2012; Mai Xuan & Le Tan, 2024). Firms with strong export learning capabilities and managerial experience excel in turbulent global markets, as evidenced in studies on Iranian handmade carpets (Salehi & Jamshidi, 2022).

Key determinants of export performance include firm size, technological resources, and industry-specific factors. For instance, labor-intensive industries are often more export-oriented than capital-intensive ones, while R&D investment positively impacts export outcomes (Mohapatra, 2023). Government policies, such as tax incentives and export subsidies, also play a critical role in enhancing export performance by reducing barriers and stimulating international activity (Mohapatra, 2023; Mai Xuan & Le Tan, 2024). Innovation capabilities, including technological upgrades and product design improvements, are vital for achieving export success (Manjunatha, 2020). Additionally, export performance can be assessed using financial indicators like sales volume, export sales growth, and ROI, as well as non-financial metrics such as enterprise satisfaction with international operations (Ahammad et al., 2021; Christofi et al., 2024). According to Madsen and Moen (2018), the majority of measures are economic/financial (profitability, export sales/growth, export intensity), but also subjective/non-financial measures (satisfaction, goal achievement) are used in numerous studies. The studies he reviewed applied 50 different measures of export performance, out of which almost 80% were subjective measures, often expressed as managers' satisfaction with various aspects of their firm's export activities. This study focuses on the non-financial aspects of international performance, emphasizing firm satisfaction with international activities beyond export-specific outcomes (Mai Xuan & Le Tan, 2024). By integrating insights into firm performance and internationalization strategies, this research aims to explore the factors influencing global competitiveness and sustainable growth.

Big Data Analytics Capabilities (BDAC)

In this digital age, organizational resources encompassing tangible, intangible and human skills are pivotal in developing organizational capabilities, which are big data capabilities (BDAC) (Chong et al., 2023; Elia et al., 2022). These dimensions enable firms to harness data for improving decision making, business performance and sustainable growth (Garmaki et al, 2023; Hossain et al, 2022). BDAC empowers organizations to sense digital opportunities, adopt data-driven strategies and enhance market positioning through investments in analytics tools, personnel training and fostering a data-centric culture (Aziz & Wan Hussain, 2023; Wamba, 2017).

Tangible resources include basic infrastructure, technology, and data management systems critical for supporting big data initiatives (Gupta et al., 2020; Elia et al., 2022). Advanced technologies such as non-relational databases, middleware, and tools like Apache Hadoop enable firms to gather, analyze, and share large datasets efficiently (Khalil et al., 2023). Firms must allocate significant investments to develop robust technological infrastructures, which are essential for deriving actionable insights and sustaining competitive advantage (Gupta & George, 2016; Wamba et al., 2017).

A data-driven culture and organizational learning intensity are essential intangible resources for BDAC. A data-driven culture ensures data is used consistently for informed decision-making, while organizational learning enables firms to adapt strategies and integrate new insights (Ayadi et al., 2024; Almazmomi et al., 2022). These capabilities strengthen firms' ability to leverage big data for innovation and competitive advantage, with organizational readiness playing a critical role in aligning BDAC with firm performance (Binsaeed et al., 2023).

Human skills, comprising technical and managerial competencies, are foundational to BDAC. Technical skills include data extraction, machine learning, and statistical analysis, enabling personnel to transform data into actionable insights (Gupta et al., 2020; Mikalef et al., 2019). Managerial skills focus on interpreting and communicating analytical results effectively, enhancing decision-making and fostering collaboration across organizational levels (Shdifat et al., 2019). Each skill sets significantly impact operational, market, and financial performance (Gupta & George, 2016; Khalil et al., 2023). BDAC fosters sustainable business growth and competitive advantage by integrating advanced technologies, cultivating data-centric mindsets, and equipping personnel with essential analytical capabilities. These dimensions collectively enhance firms' ability to make strategic decisions, adapt to dynamic environments, and achieve operational and market success.

Previous empirical studies examined the impact of BDAC on firm performance in various study contexts. Most of these studies showed that BDAC has a direct influence on firms' performance in terms of gaining a competitive advantage (Garmaki et al, 2023). In this proposed study, the author suggests examining the impact of BDAC on international performance. This is to assess whether the available bundle of resources in the technology of a firm does affect organizational performance in the international market.

ESG Practices

Achieving the United Nations' Sustainable Development Goals (SDGs) requires environmental, social, and governance (ESG) programs in the pharmaceutical industry (Pesqueira & Sousa, 2024). Sustainable business practices focus on Environmental, Social, and Governance (ESG) factors, addressing the increasing pressure on organizations to balance economic goals with social and environmental responsibilities (Rahman et al., 2023). These practices enhance corporate legitimacy, fostering community trust and stakeholder support essential for long-term sustainability (Almeyda & Darmansyah, 2019). Therefore, ESG practices are important. As the industry moves toward a low-carbon economy, integrating ESG principles such as reducing emissions, developing a sustainable industry, and promoting inclusivity becomes crucial. Environmental, social, and governance (ESG) reporting is crucial for conveying a company's sustainability performance (Chen S, 2024). ESG disclosure serves as a critical tool for communicating sustainability performance, influencing innovation, workforce dynamics, and stakeholder relationships (Chen S, 2024; Ahmad et al., 2024). ESG reporting enhances transparency, stakeholder engagement, and sustainability performance. Disclosures related to ESG improve firms' competitive advantages, public reputation, and alignment with global regulatory frameworks (Wan Mohammad & Wasiuzzaman, 2021; Ahmad et al., 2024). Initiatives like the Sustainable Development Goals

(SDGs) and ESG indices have encouraged firms to adopt non-financial reporting, boosting transparency and reducing information asymmetry (Ahmad et al., 2024).

Artificial Intelligence (AI) as moderator

Artificial intelligence (AI) encompasses advanced tools such as natural language processing (NLP), machine learning (ML), cloud computing, blockchain, and digital platforms, designed to efficiently collect, process, analyze, and disseminate data (Chen S, 2024). AI systems perform tasks that typically require human cognitive abilities, including decision-making, problem-solving, and learning, enabling enhanced accuracy and operational efficiency across industries (Salim & Alsyouf, 2020; Alshamsi et al., 2024). These capabilities contribute to better information management and timely maintenance reports, supporting strategic decision-making (Oyeniyi et al., 2024). AI plays a transformative role in Environmental, Social, and Governance (ESG) reporting by streamlining the analysis and interpretation of complex data. NLP and ML algorithms enhance ESG reporting accuracy and efficiency, aligning disclosures with regulatory standards and improving data reliability by identifying inconsistencies (Riyath & Jariya, 2024; Chen, 2024). These technologies foster transparency by benchmarking reports against industry norms, enabling organizations to meet sustainability goals while aligning with broader performance objectives (Chen S, 2024). AI optimizes ESG practices by automating data collection, processing, and analysis, offering actionable insights and recommendations for sustainability strategies. It enhances ESG reporting by ensuring regulatory compliance and facilitating transparent communication, which strengthens stakeholder trust and aligns organizations with sustainability frameworks (Chen S, 2024). The increased precision in ESG reporting supports informed decision-making and contributes to more sustainable business practices (Riyath & Jariya, 2024). AI strengthens BDAC's ability to generate ESG outcomes.

Conceptual Framework Proposition

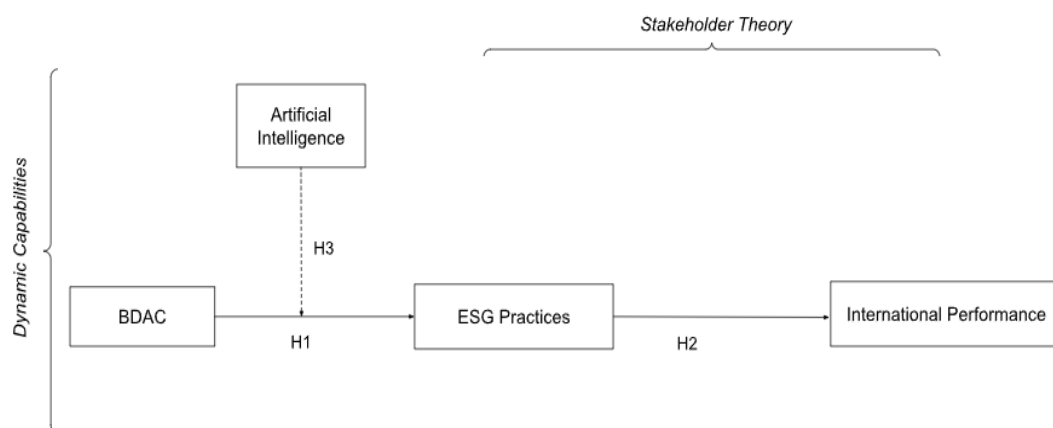


Figure 1: Conceptual Framework Proposition (Author's own work)

According to Figure 1, a conceptual framework was proposed based on drawing upon dynamic capabilities and stakeholder theory. This framework emphasises the impact of the big data analytics capabilities of an organization on its performance in entering the international market. By integrating stakeholder theory and dynamic capability theory, this framework aims to determine the impact of sustainability practices on firms and assess how these practices influence their international performance. Drawing on dynamic capabilities, which suggest that a firm's competitive advantage comes from its distinctive combinations of resources (Mikalef et al., 2019). BDAC serves as the foundation of the model, driving ESG practices towards international performance. BDAC impacts ESG practice with the moderating effect of artificial intelligence. The moderating effect of AI in BDAC enables firms to enhance sustainable business operations by providing predictive insights, automating complex analyses, and improving decision-making, problem-solving, learning, and reasoning capabilities (Chen, S., 2024; Haleem et al., 2023). These AI-powered capabilities improve the accuracy of ESG reporting, operational efficiency, and reporting quality (Alshamsi et al., 2024; Oyeniyi et al., 2024). Drawing upon stakeholder theory, it emphasises that firms utilizing BDAC and AI to manage their sustainability practices and

disclosures can enhance their value as sustainable businesses, fostering stakeholder trust and driving better firm performance. Therefore, the following proposition is developed.

This study proposed a few research hypotheses as follows:

H1: BDAC positively influences ESG practices.

H2: ESG practices positively influence international performance.

H3: Artificial intelligence moderates the relationship between BDAC and ESG practices.

Hypothesis Development

BDAC and ESG Practices (H1)

Increasing global demand for sustainable governance means organisations must, indirectly, embed ESG practices into their daily business processes. To achieve long-term resilience and a green transformation, the integration of ESG is crucial to respond to external regulations. Its effectiveness largely depends on whether firms possess data-driven strategic coordination capabilities (Sun & Lim, 2026). Big data is crucial in helping businesses to improve their performance and maintain a competitive advantage. BDAC contributes to improving decision-making processes and effective knowledge management, thereby positively impacting the company's overall performance (H.C.T. Dang et al., 2025). BDAC also helps to identify environmental and social risks, optimize governance and resource allocation, and enhance the transparency of nonfinancial disclosures (Ertz et al., 2025; Sun & Lim, 2026). Additionally, other benefits of BDAC include helping the organisation proactively integrate ESG, embedding sustainability principles in the value chain, and offering strong technological support for strategic ESG practices (Abdelhalim and Hassan, 2025; Sun & Lim, 2026). Therefore, the study proposes that:

H1: BDAC positively influences ESG practices.

ESG practices and international performance (H2)

ESG practices and their performance play important roles in fostering foreign direct investment. ESG performance increases the likelihood of companies engaging in foreign investment and also augments the scale of such investments, enhancing the competitive edge and alleviating financial constraints. ESG performance helps support competitiveness and mitigate financial constraints (Zhang and Lucey, 2022). In a stakeholder theory standpoint, the ESG performance of a company is a very important image to attract foreign investment, especially for those with significant institutional investor presence (Wang et al., 2026). Foreign direct investment is one of the international expansion modes of entry that can be embarked on by any company to establish an international presence.

International performance reflects a firm's success in global markets through activities like exporting, international sales, and diversification (Gerschewski et al., 2015; Cabral et al., 2020). According to Wang et al. (2026), ESG performance it verifies that robust ESG performance positively affects companies' foreign activities, which will lead to better international performance in attracting investors. The study also underscores that robust ESG performance holds greater significance for companies with high proportions of institutional investors, confirming the prominent role of ESG performance in settings sensitive to information and thus echoing their point from an empirical perspective (Yang et al., 2023).

According to Aydogmus et al. (2022), overall ESG is positively and significantly associated with firm value and firm profitability. Through the lens of stakeholder theory, shareholders, investors, creditors, governments, and other stakeholders expect firms to practice ESG. As they perform well in meeting sustainability expectations, the firms will be in the market's favour, be it domestically or internationally. When they meet and exceed these expectations, the market most likely rewards them. Therefore, the study proposes that:

H2: ESG practices positively influence international performance.**Moderating role of artificial intelligence (AI) (H3)**

AI serves as a critical moderating variable in the relationship between Big Data Analytics Capabilities (BDAC) and ESG practices. By analyzing large datasets, AI identifies trends and patterns, offering predictive insights that help firms to measure their environmental and social impacts effectively (Ahmad et al., 2023). The integration of AI tools enhances the transparency and accuracy of ESG reports by automating data analysis, which is essential for firms aiming to meet sustainability objectives and regulatory requirements (Riyath & Jariya, 2024). AI also leverages human skills, emphasizing the importance of equipping data analysts with expertise in AI applications. Skilled personnel can utilize AI to produce precise and transparent sustainability reports, bridging the gap between BDAC and ESG practices (Shdifat et al., 2019). By enhancing the interaction between data analytics and ESG frameworks, AI enables firms to optimize sustainability strategies, reduce carbon footprints, and improve organizational performance (Chen S., 2024). Therefore, the study proposes that:

H3: Artificial intelligence moderates the relationship between BDAC and ESG practices.**PROPOSED METHODOLOGY**

This study proposes to adopt a quantitative research design to empirically test the proposed conceptual framework. A cross-sectional survey approach will be used to collect data from firms involved in international business activities, particularly exporters. This approach is appropriate because the study aims to examine the relationships among big data analytics capabilities, ESG practices, artificial intelligence and international performance. The target population of this study will consist of manufacturing firms that are engaged in international activities. The manufacturing sector is selected because it plays a significant role in economic growth and is increasingly encouraged to adopt digital technologies and sustainability practices to remain competitive in global markets. A purposive sampling technique will be employed to ensure that respondents meet the study criteria. The selected firms must be involved in international activities, using digital technologies such as big data analytics and AI as well as implementing ESG practices. Senior managers who are knowledgeable about the firm's operations will be considered as the respondents. A single informant will lead to single-respondent bias, where one manager may not have equally accurate knowledge of all the variable elements. As BDAC represents an organisation-wide capability involving technological, human, managerial, and intangible resources, a single informant may not possess equivalent knowledge across all domains of the proposed framework. Therefore, this study suggests complementing the proposed cross-sectional design with multiple respondents within a single organization. The use of multiple respondents would reduce the potential common method bias. By obtaining predictor and outcome information from multiple respondents, the ability to infer the hypothesized relationship among the constructs is increased. Therefore, a multi-respondent approach could collect information from different managerial functions within the same organization. Respondents responsible for each of the domains in the framework proposed, such as information technology, data analytics or digital transformation managers, will be responsible for BDAC and AI constructs. Whereas the ESG constructs can be answered by the ESG or sustainability manager, the international business or export or senior managers may be responsible for the international performance construct. Responses from multiple informants within the same firm would enable the study to obtain construct-specific information from respondents who possess the most relevant knowledge and reduce excessive reliance on a single source of information. This is supported by Akter et al. (2016); the BDAC research conceptualizes BDAC as a hierarchical capability encompassing management, technology, and talent capabilities, reinforcing why the organizational BDAC is broader than the knowledge domain of one individual respondent. Additionally, this study suggests to apply time lagged design to capture the temporal sequence underlying the proposed relationships (Polyhart & Vandenberg, 2010). Since investments in BDAC and ESG may not materialize immediately because organizations require time to integrate analytical insights into managerial routines, sustainable initiatives and strategic decisions. Temporal separation would provide a stronger basis for examining whether earlier development of BDAC contributes to subsequent ESG integration. Then, the study will be able to look at whether improvements in ESG practices are subsequently associated with enhanced international performance. Furthermore, temporal separation is considered as a way to address common method bias by decreasing respondents' ability to infer a relationship between the constructs (Podsakoff et al, 2003).

Data will be collected using structured questionnaires. The questionnaires will be developed based on validated measurement items from previous studies. The collected data will be analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM). To empirically validate the proposed conceptual framework, this study proposes to utilize Partial Least Squares Structural Equation Modelling (PLS-SEM). This analysis tool is suitable for this study because the proposed framework involves multiple relationships, mediation, and moderation effects.

The study will test the three (3) hypotheses proposed. This variance-based approach is uniquely suited for this research based on several methodological requirements outlined by Hair et al. (2022). First, the primary objective of this study is, aiming to maximize the explained variance (R-squared) of the dependent variable (*International Performance*) by exploring the complex interplay of emerging digital and sustainability capabilities. Second, the structural model incorporates advanced complexity, characterized by simultaneous mediation pathways (*ESG Practices*) and a critical moderation effect (*AI Integration*); PLS-SEM handles such highly complex structural relationships without suffering from model estimation restrictions or convergence issues. Third, the framework incorporates *Big Data Analytics Capabilities (BDAC)*, which is best operationalized as a hierarchical, multi-dimensional construct comprising infrastructure, talent, and data culture. PLS-SEM offers superior flexibility in handling such higher-order constructs (HOCs) via the repeated indicators or two-stage approach. Finally, because digital transformation and ESG compliance parameters in global export markets are rapidly evolving, the data may not strictly follow a multivariate normal distribution. PLS-SEM's non-parametric distribution assumptions ensure robust parameter estimations even under conditions of data non-normality, making it the ideal analytical tool for this study.

To ensure ethical research practice, respondents will be informed about the purpose of the study, voluntary participation, anonymity, and confidentiality of their responses. No individual respondent or firm will be identified in the reporting of findings. This quantitative methodology will allow the proposed conceptual framework to be empirically tested and will provide evidence on how BDAC and AI can support ESG practices as well as enhance a firm's international performance.

CONCLUSION

In conclusion, this conceptual paper proposes a framework for understanding how big data analytics capabilities (BDAC), artificial intelligence (AI), and environmental, social, and governance (ESG) practices collectively influence an organization's international performance.

It provides a theoretical foundation for future empirical research, and this study aims to guide firms towards achieving sustainable competitiveness in global markets. By integrating two theoretical perspectives, the model provides a foundation for understanding how digital and sustainability capabilities shape global competitiveness. The framework calls for empirical testing and offers actionable insights for firms navigating the complexities of internationalization in the digital era.

Future Research Directions

The current framework proposes a generalized model for understanding the relationship between big data analytics capabilities (BDAC), ESG practices, and international performance; future research can refine and adapt this conceptual model to specific industry contexts.

Different industries may face distinct regulatory pressures, levels of technological use, and challenges in ESG reporting and disclosures. Refining the conceptual model based on industry-specific groups will provide a deeper understanding of how BDAC and AI tools can be strategically aligned with sectoral sustainability needs. This also allows for testing other moderating variables, such as digital maturity levels or regulatory stringency, as well as government initiatives and aid, which may differ across sectors. In addition, such refinements will help practitioners in targeted industries better operationalize BDAC strategies to align with ESG goals and improve international competitiveness within their unique operating environments.

This represents an important avenue for extending the framework in future research. Regulatory stringency may represent an important boundary condition influencing the relationship between ESG practices and international performance, and national digital infrastructure maturity may influence firms' ability to translate BDAC and AI into effective sustainability practices. Future studies could therefore extend the proposed framework by incorporating regulatory stringency and national digital infrastructure maturity as contingency variables.

ACKNOWLEDGEMENT

Upon completing this paper, AI assistance was used. ChatGPT 4.0, Grammarly, and QuillBot were used to enhance the clarity, coherence, and analytical depth of this paper; several AI-based tools were utilized during the writing and interpretation stages.

AI tools are used for supportive but non-substantive tasks. This includes idea generation or brainstorming, summarizing or paraphrasing text, and suggesting content structure or titles. Specifically, ChatGPT 4.0 was used for rephrasing and refinement of sentences; Grammarly assisted in improving grammatical accuracy and language flow, and QuillBot v33.12.1 was employed for paraphrasing and stylistic adjustments. All outputs generated through these tools were critically reviewed and edited by the authors to ensure academic integrity and accuracy.

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