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Enhancing Sustainable Development Through International Performance Indicators: The Role of Business Intelligence Techniques

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Abstract: Sustainable development has garnered significant attention due to its multifaceted benefits across social, economic, and environmental dimensions. This study investigates the influence of international performance indicators, specifically organisational agility, data science applications, and strategic partnerships, on the advancement of sustainable development initiatives. Additionally, the role of business intelligence (BI) techniques in augmenting this relationship is examined. A mixed-methods approach was employed, integrating both quantitative and qualitative analyses to comprehensively address the research objectives. A systematic review of the relevant literature was conducted, supplemented by data sourced from the World Bank, which was subsequently analysed using Power BI software. This global study encompassed diverse samples from various regions, ensuring a broad representation of perspectives. The findings reveal that the integration of organisational agility, data science applications, and partnerships, when enhanced by BI techniques, significantly accelerates the achievement of sustainable development goals (SDGs). It is concluded that leveraging these international performance indicators, alongside advanced data-driven methodologies, is critical for fostering a more sustainable future.

Keywords: International performance indicators; Organisational agility; Data science applications; Partnerships; Business intelligence (BI) techniques; Sustainable development goals (SDGs); Economic sustainability; Environmental sustainability

1. Introduction

Sustainable development is essential for developing nations as well as the future. It paves the way to environmental preservation, keeps poverty at bay, speeds up economic growth, helps navigate through the effects of climate change, and helps with long-term planning. Nations adopting sustainable development practices will be more likely to align their social, economic, and environmental concerns, creating opportunities for a future that is egalitarian, inclusive, and sustainable (Guo & Liu, 2022; Mio et al., 2020). Furthermore, sustainable development's ultimate objective is to balance achieving current and future generations' needs (Mio et al., 2020).

International performance indicators serve as tools to track the progress of sustainable development objectives. They are important in keeping sustainable development in check (Osborn et al., 2015; Sachs et al., 2022). These metrics act as a controller of the effectiveness of development initiatives and flag areas in need of enhancement. Companies can optimize these indicators to oversee their progress toward global SDGs. Furthermore, they are aiding data-driven decision-making and rethinking policy design (Qiu et al., 2024). Therefore, they contribute to enhancing sustainable development across social, environmental, and economic domains. In other words, they enable organizations to track their development initiatives' effectiveness and develop the needed areas (Chen et al., 2020; Mihardjo et al., 2019; Sachs et al., 2022).

Organizational agility is defined as a company's capacity to quickly and suitably accommodate changes in the environment, whether to its market, technology adaptability, or the needs of its customers (Mihardjo et al., 2019;

Mrugalska & Ahmed, 2021). Organizational agility depends on a culture of innovation, flexibility, and collaboration (Al Aqasrawi & Alafi, 2022; Mihardjo et al., 2019; Mrugalska & Ahmed, 2021). Organizational agility is a pillar when it comes to achieving sustainable development; it is what helps businesses to meet these challenges and generate long-term value for all stakeholders. This is achieved through the ability to adapt their business models, products, and services.

In a like manner, data science and artificial intelligence (AI) offer perspectives and answers to difficult environmental and social problems that help achieve sustainable development (Zhang et al., 2020). With the capability of data scientists to capture trends, patterns, and correlations within massive datasets, they influence policies and actions for sustainability. This is achieved by making informed decisions that lead to more effective and efficient solutions. For instance, using AI in environmental monitoring to track deforestation, water quality, and air pollution, as well as to monitor changes in the environment by analyzing satellite imagery and other data sources (Ahmad & Mustafa, 2022; Bharadiya, 2023; Fitriana et al., 2011; Zhang et al., 2020).

The partnership also can serve as a performance indicator. Collaboration on the scale of companies, governments, and non-profits can result in collaborative and creative solutions that have a more holistic impact than solo efforts. Accordingly, it speeds up the process and collectively accomplishes SDGs. For instance, local governments work alongside The Climate Alliance of European Cities to lower greenhouse gas emissions (Berrone et al., 2019; Shin et al., 2019).

BI was highlighted as a centerpiece in auditing the connection between performance indicators and sustainable development. This is achieved by facilitating improved decision-making processes based on the analysis of data related to environmental, social, and economic factors. Therefore, it enables organizations to identify opportunities to reduce their environmental footprint, promote social equity, and improve economic outcomes (Al Aqasrawi & Alafi, 2022; Berrone et al., 2019; Maulana & Wulandari, 2019).

The current literature fails to present a holistic view of how international performance indicators alongside BI would assist in achieving sustainable development. Therefore, this paper's foremost goal is to investigate the effect of using BI and international performance indicators to achieve sustainable development in several global locations, namely, the United States of America, Canada, Brazil, Australia, the European Union, Russia, China, Japan, Nigeria, Ghana, the United Arab Emirates, Qatar, Saudi Arabia, and Jordan. In this research, the performance indicators are represented by organizational agility, data science applications, and partnerships. The study objective is to provide a holistic understanding of the existing situation and promote sustainable development going forward. The study employed systematic reviews and the Power BI program to analyze and visualize the data.

2. Literature Review

2.1 Theories

2.1.1 International performance indicators

Organizational agility, in the context of international performance indicators of sustainability, plays a critical role. It helps smooth market transformation in a dynamic climate and industry 4.0 technologies (i.e., IoT, big data analytics). It enables companies to adopt and improve various operational aspects. Therefore, businesses develop resilience in the face of internal and external changes. Additionally, it facilitates alignment with corporate sustainability objectives, thereby enabling effective planning and management of sustainability goals. According to Worley & Jules (2020), companies need to foster the combination of skills and the focus on optimizing environmental, social, and governance outcomes alongside financial results. Hence, being agile contributes to achieving sustainable outcomes in an uncertain and volatile environment.

On the other hand, the optimization of data science leads to staying ahead of the competition and assists in tackling everyday problems (Awamleh & Bustami, 2022a). Moreover, the implementation of AI significantly impacts the global economy (Mazilescu, 2018). Data science-based applications, which include AI, revolutionized the ways of conducting business and extended its benefits to reach sustainability (Gotsch et al., 2023). Specifically, AI with the appropriate technological improvements can achieve up to 79% of SDGs across all areas. Within the economic area of sustainable development, AI technologies are interconnected with high productivity; the literature contemplates negative impacts mainly due to increased inequalities. However, technological advancement might significantly increase the economic gap due to emerging inequalities.

Joining data analytics and AI capabilities paves the way to achieve SDGs. This integration influences the success of the innovation process (sustainability design and commercialization), sustainable growth, and performance. However, Zhang et al. (2020) have identified a lack of evidence regarding the significance of big data analytics capability (BDAC) and artificial intelligence capability (AIC) in the service innovation process. There is a pressing need for more quantitative analysis of the global development of sustainability theory and observation (Takeda et al., 2023). It seems vital to rethink policy framework conditions to increase the sustainability-related impact of data science (Gotsch et al., 2023).

Partnership, as a definition, refers to a cooperative relationship between certain parties to accomplish a common objective. In business, partnerships can take a variety of shapes, including joint ventures, strategic alliances, and supplier alliances (Carbonara & Pellegrino, 2020; Khan et al., 2020). Hence, parties can utilize one another's capabilities and resources to achieve social, environmental, and economic success. It has become increasingly clear that collaboration is necessary to create a better, more resilient future. Therefore, it is important to digest the value of partnerships as an international performance indicator and BI in promoting environmental, social, and economic advancement. To stay ahead of the competition, organizations must develop resilience and the ability to adapt to environmental changes. Organizations can evaluate partnerships to foster economic, environmental, and social growth. Furthermore, BI can facilitate the development of successful collaborations, enabling informed decision-making that can boost efficiency, innovation, and profitability (Awamleh & Bustami, 2022b; Mio et al., 2020; Zwerenz, 2020).

2.1.2 Sustainable development

Sustainable development is a complex and dynamic concept; no country is entirely sustainable. However, studying and comparing social, economic, and environmental variables contributes to a country's commitment to sustainable practices (Osborn et al., 2015; Bali Swain & Yang-Wallentin, 2020). Sustainable development refers to incorporating social, environmental, and economic considerations into business practices to meet current and future needs (Apriantoro et al., 2024). In other words, creating enduring value while lessening negative impacts on the environment and society. In the context of organizations, sustainability is to balance profitability, social responsibility, and environmental stewardship through a variety of practices, including waste reduction, resource conservation, diversity and inclusion in the workforce, and ethical business conduct. The integration of sustainability and BI principles is linked with a good brand reputation and the ability to manage risks associated with climate change, natural disasters, and resource scarcity (Rehman et al., 2019). On the other hand, sustainability is about creating positive contributions to society, such as poverty reduction, responsible consumption, and gender equality, among others outlined in the United Nations Sustainable Development Goals (UNSDG) framework. Overall, sustainable development requires an encompassing viewpoint that takes into consideration economic, environmental, and social factors that realize long-term success consistent with meeting stakeholder expectations and regulatory requirements (Dzhengiz, 2020; Jasmi & Hassan, 2024).

2.1.3 BI technique

The core definition of BI is the practice of acquiring, manipulating, and interpreting data to attain valuable insights. It aims to drive informed decision-making in business operations. Specifically, BI optimizes advanced technologies and tools to process raw data and turn it into meaningful information. Therefore, it serves as a tool for strategic planning and enhances overall performance. Moreover, the analytical capabilities of the BI empower users with self-service analytics capabilities, which enable businesses to uncover patterns, trends, and opportunities within their data (Nilashi et al., 2023). Furthermore, BI helps organizations to enhance sustainable development by promoting the right decisions for supporting economic, social, and environmental (Goralski & Tan, 2020; Hysa et al., 2020; Pancić et al., 2023; Tavera Romero et al., 2021).

By comparing studies and underlining the trend of focus, these studies emphasize achieving sustainable development through organizational agility. Moreover, these studies explore different facets of this relationship. Specifically, its impact on environmental management Panda (2022), sustainable business performance Tufan & Mert (2023), and business model innovation (Mihardjo et al., 2019). However, there are still critical gaps that need to be addressed. The unification of the scope is one point. For instance, these studies focused on specific sectors or contexts (Mihardjo et al., 2019; Tufan & Mert, 2023), while other studies concentrate on a wider scope of the agility-sustainability link (Chen & Siau, 2020; Panda, 2022). Moreover, some studies offer more in-depth explorations of the underlying mechanisms (Al Aqasrawi & Alafi, 2022; Panda, 2022), while others do not. This leads to an unclear holistic understanding that this paper aims to enhance.

2.2 Research Hypotheses

2.2.1 Organizational agility, BI techniques, and sustainable development

Panda (2022) highlights that organizational agility indirectly contributes to sustainability by enabling organizations to adapt to evolving environmental demands. This adaptability can be seen in developing innovative, environmentally friendly products and services, reducing operating costs, and enhancing customer satisfaction. Tufan & Mert (2023) emphasize the importance of strategic agility for sustainable business performance, especially for Small and Medium Enterprises (SMEs). Strategic agility, coupled with sustainable leadership, helps SMEs achieve sustainability objectives through equitable resource allocation. (Al Aqasrawi & Alafi, 2022; Awamleh et al., 2024; Chen & Siau, 2020) indicates that the integration of BI systems and organizational agility can accelerate the pace of achieving sustainability. BI systems, when used in conjunction with effective decision-making processes, lead to significant benefits for sustainable development. As a result of the previous

contemporary studies, the study assumes the following assumption:

Assumption 1: There is a positive correlation between organizational agility, BI techniques, and sustainable development.

2.2.2 Data science and AI, BI techniques, and sustainable development

The literature consistently highlights the potential of data science, AI, and BI in advancing sustainable development. Moreover, the studies emphasize the role of data science in addressing challenges related to data scarcity (Nilashi et al., 2023), measuring SDG performance, and promoting a green economy (Gotsch et al., 2023). However, the scope of the mentioned studies varied from focusing on specific applications using empirical data (Gotsch et al., 2023) to providing broader frameworks for understanding the relationship between these technologies and sustainability (Zhang et al., 2020). On the other hand, some studies employed empirical data from specific sectors (Gotsch et al., 2023), while others rely on expert elicitation or literature reviews (Vinuesa et al., 2020). This also poses a need to have more empirical studies addressing this issue, which the current paper aims to do.

Gotsch et al. (2023) discusses the use of big data analytics and AI in supporting the transition to a green economy. By analyzing large datasets, organizations can identify opportunities to improve business processes and make informed decisions that promote sustainability. Nilashi et al. (2023) highlight how big data analytics can be used to address challenges in measuring the performance of SDGs. By using big data, organizations can track the progress of SDGs, identify areas where data quality and availability need improvement, and develop strategies to overcome these challenges. Zhang et al. (2020) focus on the relationship between BDAC, AIC, and sustainable innovation and performance. The findings suggest that BDAC and AIC directly enhance sustainable growth and performance. They also highlight the mediating role of sustainability design and commercialization processes in this relationship. As a result of the previous contemporary studies, the study assumes the following assumption:

Assumption 2: There is a positive correlation between data science and AI, BI techniques, and sustainable development.

2.2.3 Partnership, BI techniques, and sustainable development

The study literature acknowledges the value of partnerships and BI in promoting sustainable development as well as highlighting the role of collaboration in achieving shared sustainability goals. There was some contrasting; Rybnicek & Königsgruber (2019) specifically study university collaborations, while Gupta & Jiwani (2021) and Goralski & Tan (2020) offer broader perspectives on the role of sustainability partnerships. Moreover, Goralski & Tan (2020) out of all the mentioned studies provide concrete case study examples. This leaves a place for additional studies to address these gaps, which the current studio intends to do.

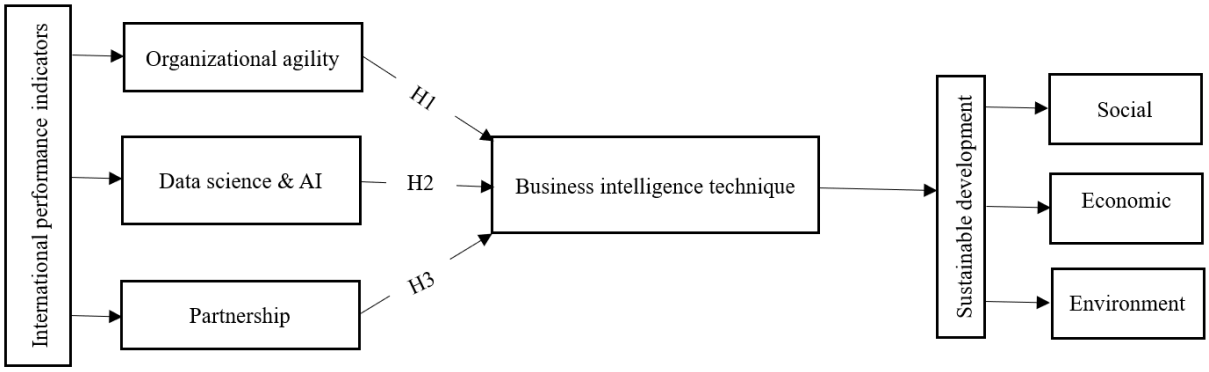

Figure 1. Research model

Rybnicek & Königsgruber (2019) explore the factors that contribute to the success of sustainable economic collaborations, highlighting the importance of partnerships, partner selection, knowledge sharing, government support, and the overall environment. The study underscores that partnerships facilitate social and environmental growth by fostering adaptability and creativity. Goralski & Tan (2020) and Mishra & Mishra (2022) assert that the strategic use of BI, alongside partnerships, has a proven positive impact on sustainable organizations across various dimensions, including economic, social, and environmental aspects. Combining partnerships with BI can accelerate progress toward SDGs. This integration helps address challenges related to job displacement and lack of human oversight, which are sometimes associated with BI implementations. Partnerships can create new job opportunities and ensure responsible and ethical decision-making in the context of automation and AI (Goralski & Tan, 2020; Yin & Fernandez, 2020). As a result of the previous contemporary studies, the study assumes the following assumption:

Assumption 3: There is a positive correlation between partnership, BI techniques, and sustainable development.

The study developed the research model (Figure 1) based on a literature review. It investigates the impact of international performance indicators (organizational agility, data science applications, and partnerships) on sustainable development. The model posits that BI techniques have a mediating effect on these relationships. Also, the study specified the research assumption as the following.

3. Methods

3.1 Design

The study employed a set of international performance indicators to gauge sustainable development. A thorough analysis of pertinent literature in the field was conducted, and a fair selection of 14 countries from diverse continents was made, with an equal distribution among them. The ultimate objective was to establish international performance indicators that would facilitate the attainment of sustainable development across social, economic, and environmental development. A sample of the following countries was taken, randomly distributed to include all continents of the world, with a global geographical and economic balance between developed and emerging countries. The World Bank data was used until 2022 in countries that represent unique regional and economic powers, allowing a comprehensive understanding of future trends in technology for social, economic, and environmental reasons in different continents and regions.

3.2 Population

The study included participants from all continents. The study carried out a thorough review of recent studies on the use of international performance indicators to achieve sustainable development by creating BI techniques. Furthermore, the study delved into reports utilized by the World Bank until 2022, to identify international performance indicators for social, economic, and environmental development. The study's participants were randomly selected from various countries, including the USA, Canada, Brazil, Australia, the European Union, Russia, China, Japan, Nigeria, Ghana, the UAE, Qatar, Saudi Arabia, and Jordan as pointed out in (Figure 2). Furthermore, the presentation of the analysis and visualized of the findings using the Power BI program to gain insights into the current situation and improve sustainable development for the future.

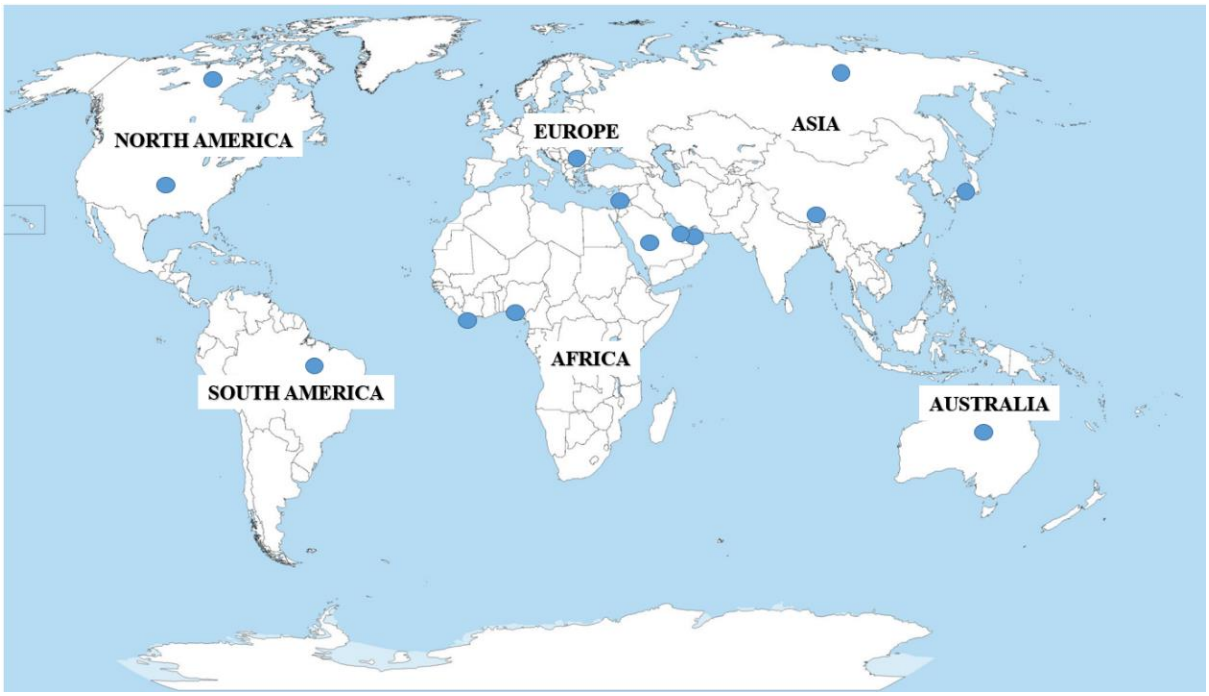

Figure 2. The study sample comprises fourteen countries from all continents (Power BI Desktop; World Bank, 2022)

3.3 Measurements

The measurement section of the current research is structured to match the measured international performance indicators of sustainable development, namely, social, economic, and environmental. The social factors emphasized the following dimensions: the number of individuals living below the poverty line, the total population, the annual population growth, the net migration rate, and the Human Capital Index (HCI), which is measured on a scale of 0-1. The economic indicator highlighted the following dimensions: current GDP, GDP per capita, annual GDP growth, total unemployment vs the labor force, and annual consumer price inflation. The environment indicator highlighted the following dimensions: CO_2 emissions per capita, the percentage of forest area, the population access to electricity, total annual freshwater withdrawals as a percentage of internal resources, the electricity production from renewable sources (excluding hydroelectric), the population using safely managed sanitation based on the World Bank until 2022, and the Dubai Government Excellence Program (2024).

3.4 Procedures and Data Analysis

The research employed a comprehensive approach that combines quantitative and qualitative analysis to yield valuable insights. On the one hand, the quantitative analysis provided a systematic review of the most recent studies in the field. Then, a cross-comparison of the results enriches the existing literature. On the other hand, Power BI software was utilized to process data from the World Bank up to 2022 to present insightful outcomes. Then, cross-examine the outcomes with the monetary outcomes to identify contributions that bridge gaps in prior literature.

4. Results

4.1 Systematic Review

4.1.1 A systematic review of the connections between organizational agility, BI techniques, and sustainable development

Several business challenges pose a threat to sustainable development, stemming from a failure to adhere to international performance indicators. Therefore, it directly impacts social, economic, and environmental growth. This is further compounded by the global impact of the COVID-19 pandemic on the entire community. To tackle these challenges, it is necessary to put in place theoretical and practical strategies that lead to technological advancement and close current gaps. In return, this will lead to the creation of intelligent institutions that can achieve sustainable development.

Panda (2022) offers proof that organizational agility indirectly enhances sustainability by empowering organizations to adjust to evolving environmental requirements. Specifically, several factors control organizational agility's impact on environmental management. Namely, the development of innovative products, services, and business models reduces operating costs, shapes brand reputation, and improves customer satisfaction. Organizational agility's dynamic capability is about optimizing customer feedback to develop environmentally friendly products and services. On the other hand, partner-related agility concerns collaborating with suppliers' environmental initiatives. Furthermore, operational agility refers to redesigning processes to meet environmental demands. The study also emphasizes agility's role in capturing stakeholders' demands and responding with incremental or radical innovations.

Tufan & Mert (2023) shed light on the sequential relationships between strategic agility and sustainable business performance within the context of SMEs. Their study revealed that sustainable business performance is driven by the correlation between strategic agility and sustainable competitive advantage. Another important lesson learned from their study is the process of achieving sustainable performance for SMEs.

From a sustainable leadership viewpoint, Lim & Ping (2018) emphasize achieving sustainable business objectives via strategic agility and sustainable leadership. The study pointed out that it is necessary to switch the focus to equitable resource allocation and organizational agility. Furthermore, Mihardjo et al. (2019) published evidence from Indonesia's ICT industry that shows CEO involvement and organizational agility lead to enhanced sustainability through operational efficiency as a cornerstone in business model innovation.

There is evidence from the literature that stresses the importance of BI and organizational agility to boost the internationalization speed toward sustainability (Chen & Siau, 2020). Similarly, Business BI systems, organizational agility, and decision-making processes have been proven to be connected (Al Aqasrawi & Alafi, 2022). Consequently, using businesses to implement BI systems in conjunction with decision-making processes leads the way to ultimate benefits. Furthermore, BI has a positive impact on strategic entrepreneurship, which includes traits such as creativity, innovation, mindset, and risk acceptance (Al Aqasrawi & Alafi, 2022; Awamleh et al., 2024).

Marhraoui et al. (2021) provide a framework for sustained business platforms. Their study explores the influence of IT innovation on sustainable performance. Their study reveals that organizational agility is the centerpiece in achieving sustainability and nurturing the BI process. Also, their study underscores the role of organizational agility in the era of Industry 4.0 via using proactive cultivation to harness Industry 4.0 technologies' potential (Mrugalska & Ahmed, 2021).

4.1.2 Systematic literature review on the connections between AI, data science, BI techniques, and sustainable development

This paper examines the intersections between employing big data analytics and AI applications to achieve a green economy. It's based on data collected from 295 start-ups that are using data science and aim for positive environmental impacts in Germany and the USA. It concludes that data science-driven applications (big data and AI) aid the green economy transition. This paper also points out the current challenges alongside the appropriate strategies to overcome these challenges. Specifically, most of the identified data science applications are found to improve the efficiency of business processes. Adjusting the policy framework is essential to maximize data science applications' impact on sustainability objectives. The study recommends changing the legal and regulatory framework conditions to suit the sustainability approach (Gotsch et al., 2023).

Research by Nilashi et al. (2023) touches on sensitive data challenges related to measuring the SDGs performance. The study points out that data scarcity poses a challenge in measuring the SDGs. Therefore, big data and analytics utilization assist in developing the assessment of SDG performance. In order to track the progress of SDG, companies are encouraged to use data quality and availability. Hence, big data has the potential to assess and control SDGs. However, there are data integration and standardization challenges to overcome. The study recommends using collaboration and coordination with other stakeholders for the effective deployment of SDGs. This is because the use of big data can enhance decision-making and provide solutions to environmental, social, and economic issues. It also recommends government agencies invest in data analysis tools and models to support SDG implementation. The use of big data analytics improves the monitoring of SDG indicators as well as overcoming the lack of quality and complete data (Nilashi et al., 2023).

The study of Vinuesa et al. (2020) argues that AI needs to be investigated and assessed to further understand its effect on the achievement of the SDGs. The study relies on a consensus-based expert elicitation process from previous literature to map the interlinkages of the SDGs. This study concluded that published evidence serves as an enabler rather than an inhibitor of the SDGs. Also, the study specified that AI applications are currently biased toward SDG issues within their native nations.

The study concluded that there is interest in studying how BDAC and AIC lead to sustainable innovation and performance. Also, it points out the mediating effects of the sustainability design and commercialization processes. The study findings highlight several intriguing points. First, BDAC and AIC go beyond increasing the proficiency of sustainability design and commercialization. It directly enhances sustainable growth and performance. Second, sustainability design and commercialization play a mediating role between data science applications and sustainable growth performance. Finally, the empirical analyses uncovered several cross-national differences in sustainability design: BDAC is more important than AI capability in the United States of America, while it is the other way around in China (Zhang et al., 2020).

4.1.3 Systematic literature review on the connections between partnership, BI techniques, and sustainable development

The systematic review of the literature by Rybnicek & Königsgruber (2019) addressed university collaborations in various countries. The study concluded that the success of sustainable economic collaborations is determined by several factors. These factors include partnerships, partner selection, the presented knowledge, government support, and the environment. Furthermore, with the assistance of collaboration between many stakeholders, the partnership promotes social and environmental growth through the ability to explore new opportunities and foster increased adaptability and creativity.

The appropriate use of BI goes hand in hand with the partnership, which has proven to improve sustainable organizations on different levels and different dimensions, i.e., economy, society, and environment (Gupta & Jiwani, 2021). Similarly, in their systematic review (Goralski & Tan, 2020), they examine the impact of AI on sustainable development and the achievement of the UNSDG. They investigate the potential of BI, a component of AI, to positively impact sustainable development across various sectors such as business, government, and society. Artificial and BI promote sustainable agriculture and guarantee food security through the ability to examine data on weather patterns, soil quality, and crop health to offer farmers real-time insights and suggestions for effective resource management, lowering waste, and boosting productivity (Dhamija & Bag, 2020; Goralski & Tan, 2020; Kristoffersen et al., 2021). Within the educational setting, business and intelligence programs advance the social and economic fronts by offering instructional platforms (Goralski & Tan, 2020; Mishra & Mishra, 2022). As for the environmental side, BI promotes environmental sustainability by analyzing massive statistics to recognize patterns, forecast environmental concerns, and improve resource management. BI is also linked to

improving environmental sustainability by using satellite photos to track wildlife, spot deforestation, and identify potential environmental concerns. This technology has been used in the United States, Australia, and other nations to safeguard their forests (Desha et al., 2019; Goralski & Tan, 2020; Parker, 2018).

Numerous case studies demonstrate how AI and BI can improve sustainable development and contribute to SDGs (Goralski & Tan, 2020; Hill, 2018; Mio et al., 2020). For instance, the smart water management system analyzes data from sensors to find leaks, forecast water demand, and enhance water distribution used in several regions, including Barcelona, Spain, and plenty of areas in the United States. This process of efficient water management depending on BI contributes to ensuring access to clean water and attaining one of the sustainable development objectives connected to clean water and sanitation (Goralski & Tan, 2020; Hill, 2018; O'Connor, 2017). Furthermore, BI can support the social and economic side of sustainable development by analyzing large amounts of data, making predictions to improve decision-making, and raising productivity, gross profit of organizations, and human capital (English & Hoffmann, 2018; Goralski & Tan, 2020; Tavera Romero et al., 2021).

The combination of partnership and BI increases access to sustainable development. Moreover, it helps avoid challenges that BI faces, such as job displacement and a lack of human oversight. Partnership supporting organizations to participate in BI-based new job opportunities and balance automation and human judgment to ensure responsible and ethical behavior (Goralski & Tan, 2020; Mio et al., 2020; Mofijur et al., 2021; Yigitcanlar et al., 2020; Yin & Fernandez, 2020).

Based on the theoretical discussion above, previous case studies, and systematic reviews, it is concluded that partnerships and BI leverage the advancement of the economy, society, and environment, which in turn leads to sustainable development. Therefore, we assume that partnerships and sustainable development have a positive relationship through the mediating role of BI.

4.2 Power BI Analysis

4.2.1 International performance indicators via using BI techniques to achieve sustainable development of social

According to Table 1, the World Bank published a report that details sustainable social development in several countries across continents. It specified that the highest water poverty is found in Nigeria, Jordan, and Ghana. Qatar has the highest living standards. Furthermore, the highest population percentages are found in China, the European Union, and the USA. In contrast, Qatar, the United Arab Emirates, and Jordan have the lowest population percentages. The latest annual population growth reveals that Nigeria, Ghana, and Canada have the highest growth rates, while Japan, China, and Qatar have the lowest. The European Union and the USA have the highest immigration rates, while China, Saudi Arabia, and Nigeria have the lowest. Lastly, the highest human power exploitation rates are for Australia, Canada, and the European Union, and the lowest goes for Nigeria, Ghana, and Saudi Arabia. Accordingly, Figure 3 shows the visualisation of the data from Table 1.

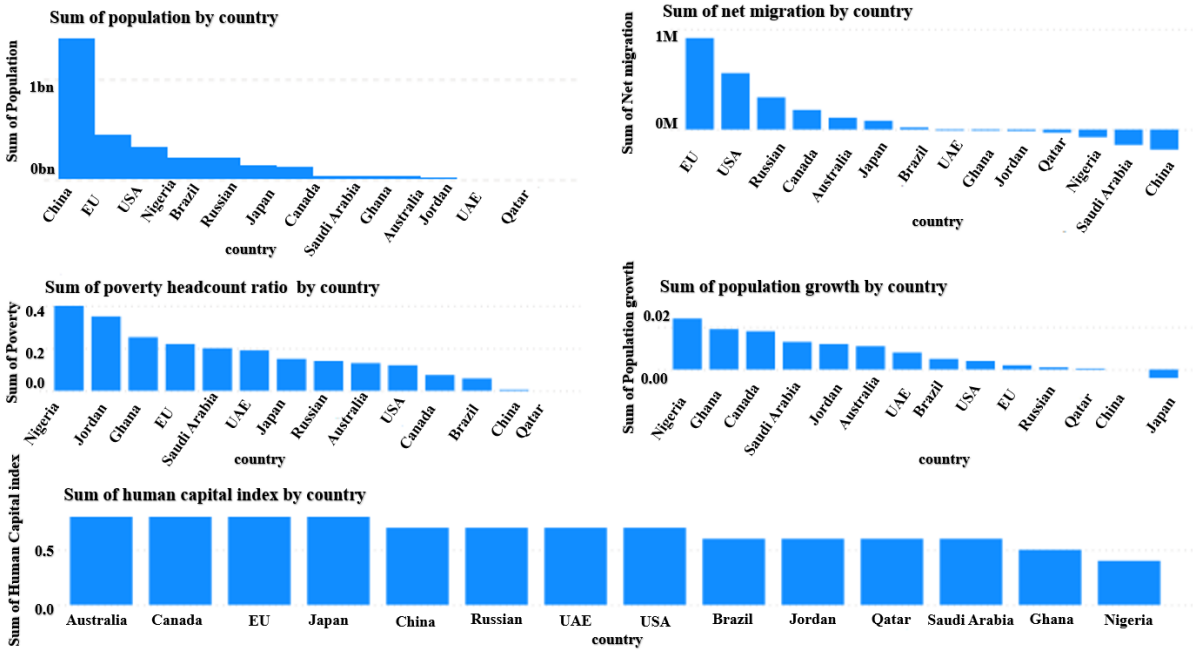

Figure 3. Indicators of sustainable development of social (Power BI Desktop; World Bank, 2022)

Table 1. International performance indicators via using BI technique to achieve sustainable development of social based on data from https://data.worldbank.org/country until (2022)

Country	Poverty Ratio	Population	Population Growth	Net Migration	HCI
Australia	0.13	25978935	0.01	117929	0.80
Brazil	0.06	215313498	0.01	20376	0.60
Canada	0.07	38929902	0.02	195181	0.80
China	0.00	1410000000	0.00	-200194	0.70
European Union	0.22	447956050	0.00	910755	0.80
Ghana	0.25	33475870	0.02	-11253	0.50
Japan	0.15	125124989	0.00	87584	0.80
Jordan	0.35	11285869	0.01	-14374	0.60
Nigeria	0.40	218541212	0.02	-76364	0.40
Qatar	0.00	2695122	0.00	-30801	0.60
Russia	0.14	143555736	0.00	320617	0.70
Saudi Arabia	0.20	36408820	0.01	-153883	0.60
UAE	0.19	9441129	0.01	-2762	0.70
USA	0.12	333287557	0.00	561580	0.70
Total	2.29	3051994689	0.11	1724391	9.30

Note: Indicators of sustainable development of social aspect (Power BI Desktop; World Bank, 2022)

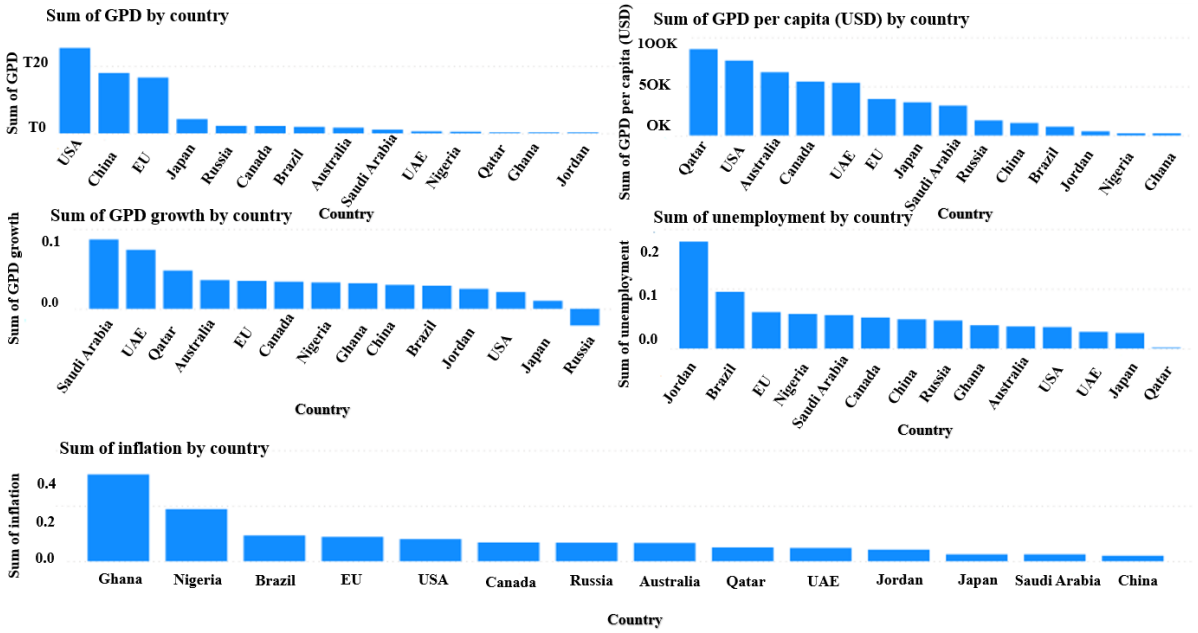

Figure 4. Indicators of sustainable development of economics (Power BI Desktop; World Bank, 2022)

Table 2. International performance indicators via using BI technique to achieve sustainable development of economics based on data from https://data.worldbank.org/country until (2022)

Country	GDP ($)	GDP per Capita ($)	GDP Growth ($)	Unemployment	Inflation
Australia	1680000000000	64,491.40	0.04	0.04	0.07
Brazil	1920000000000	8,917.70	0.03	0.10	0.09
Canada	2200000000000	54,966.50	0.03	0.05	0.07
China	17960000000000	12,720.20	0.03	0.05	0.02
European Union	16600000000000	37,149.60	0.04	0.06	0.09
Ghana	72840000000	2,175.90	0.03	0.04	0.31
Japan	4230000000000	33,815.30	0.01	0.03	0.03
Jordan	47450000000	4,204.50	0.03	0.18	0.04
Nigeria	477900000000	2,184.40	0.03	0.06	0.19
Qatar	237300000000	88,046.30	0.05	0.00	0.05
Russia	2240000000000	15,345.10	-0.02	0.05	0.07
Saudi Arabia	1110000000000	30,436.30	0.09	0.06	0.03
UAE	575530000000	53,757.90	0.07	0.03	0.05
USA	25400000000000	76,398.60	0.02	0.04	0.08
Total	74751020000000	484,609.70	0.47	0.76	1.17

Note: Indicators of sustainable development of economics (Power BI Desktop; World Bank, 2022)

4.2.2 International performance indicators via using BI techniques to achieve sustainable development of economics

Figure 4 visualise the data mentioned in Table 2, the highest GDPs were the USA, China, and the European Union, while the lowest GDPs were Jordan and Ghana. As for the highest annual GDP growth rates, Saudi Arabia, the UAE, and Qatar recorded the highest, while Russia and Japan recorded the lowest. The report also points to the highest unemployment rate for Jordan and Brazil, in contrast to Qatar, Japan, and the UAE, where the lowest unemployment rates were recorded. Finally, the report shows that Ghana, Nigeria, and Brazil had the highest annual consumer price inflation rates, while China, Saudi Arabia, and Japan had the lowest.

4.2.3 International performance indicators via using BI techniques to achieve sustainable development of the environment

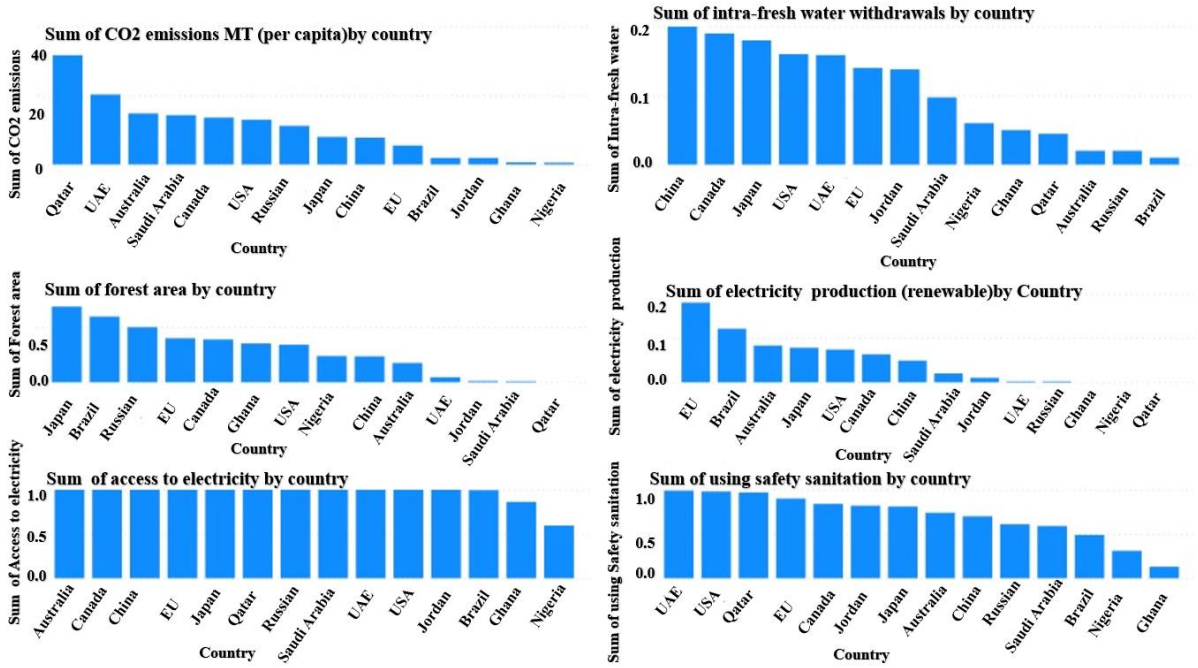

Figure 5. Indicators of sustainable development of environment (Power BI Desktop; World Bank, 2022)

Table 3. International performance indicators via using BI technique to achieve sustainable development of environment based on data from https://data.worldbank.org/country until (2022)

Country	CO_2 Emissions	Forest Area	Access to Electricity	IFW	ER	USS
Qatar	31.70	0.00	1.00	0.04	0.00	0.97
UAE	20.30	0.05	1.00	0.16	0.00	0.99
Australia	14.80	0.17	1.00	0.02	0.08	0.74
Saudi Arabia	14.30	0.01	1.00	0.10	0.02	0.59
Canada	13.60	0.39	1.00	0.19	0.06	0.84
USA	13.00	0.34	1.00	0.16	0.07	0.98
Russian	11.20	0.50	1.00	0.02	0.00	0.61
Japan	8.00	0.68	1.00	0.18	0.08	0.81
China	7.80	0.23	1.00	0.20	0.05	0.70
European Union	5.50	0.40	1.00	0.14	0.18	0.90
Brazil	1.90	0.59	1.00	0.01	0.12	0.49
Jordan	1.90	0.01	1.00	0.14	0.01	0.82
Ghana	0.60	0.35	0.86	0.05	0.00	0.13
Nigeria	0.50	0.24	0.60	0.06	0.00	0.31
Total	145.10	3.96	13.45	1.47	0.68	9.88

Note: IFW=Intra-freshwater withdrawals, ER= Electricity production, USS= Using safety sanitation.
Indicators of sustainable development of environment (Power BI Desktop; World Bank, 2022)

Figure 5 explains visually the data in Table 3, the World Bank report reveals that Qatar, UAE, and Australia have the highest CO_2 emissions per capita, whereas the lowest emissions were in Nigeria, Ghana, and Jordan. As for the forest area, Japan, Brazil, and Russia came first, while Qatar, Saudi Arabia, and Jordan came last. All the

studied countries recorded equal access to electricity as a percentage of the population except for Nigeria and Ghana. The European Union, Brazil, and Australia are leading in exploiting electricity production from renewable sources (excluding hydroelectric). On the other hand, Qatar, Nigeria, and Ghana are lagging in renewable energy production. China, Canada, and Japan have the highest freshwater withdrawals as a percentage of internal resources. The UAE and the USA have the best percentage of the population using safely managed sanitation services. In contrast, China, Nigeria, and Brazil are struggling to manage sanitation services carefully.

5. Discussion

The study played on the link between quantitative and qualitative analysis by using the systematic review as a qualitative analysis that analyzes contemporary studies and BI techniques as a quantitative analysis based on data from https://data.worldbank.org/country until 2022. It shares in linking international performance indicators (i.e., organizational agility, data science & AI, and partnership), BI, and sustainable development, which proved that organizational agility increases sustainable development performance by enabling countries to radically adapt to unexpected and rapidly changing environmental changes by adopting innovative products and improving operational efficiency, which reduces the poverty ratio, net migration, and inflation, and improves the employment rate. The study also showed that coupling organizational agility with BI systems helps to better support strategic decisions, which achieves opportunities to contribute significantly to economic and environmental development. For example, operational resilience enables the re-engineering of processes, which helps to achieve a green environment (e.g., intra-freshwater withdrawals, electricity production, and using safety sanitation). In this regard, strategic decisions can enhance the sustainable competitive advantage of developing countries. Integrating data science and AI into BI techniques helps in processing data quickly and efficiently, which achieves sustainable strategic goals that help achieve social, economic, and environmental developments combined with higher opportunities than before.

The study also confirmed that cooperation as a partnership between stakeholders through smart systems that help in using data effectively helps in overcoming sustainability challenges such as scarcity of resources and useless processes. Ultimately, the study results provided a comprehensive and insightful view of how countries embrace organizational agility, data science, and AI in partnership with the help of BI techniques to improve and sustain sustainable social, economic, and environmental outcomes in a way that helps in seizing strategies that keep pace with technological progress in a global and effective context.

This study examines organizational agility, data science, and partnership on the social, economic, and environmental dimensions of sustainability development. The study also illuminates how BI mediates this relationship. The aim of this study is to provide a global and holistic framework that can explain sustainable development. Therefore, the study sample is countries from all continents. The study findings revealed that all dimensions of the international performance indicators contribute to sustainable development. Moreover, the use of BI dramatically improves the relationship of the study variables.

This study's results indicate that organizational agility leads to achieving sustainability while boosting BI functions. This is confirmed by another study conducted in China (Su et al., 2022). The current study’s result pointed out that organizational agility positively impacts business sustainability, which is supported by another study (Perdana & Syah, 2023). Furthermore, BI positively impacts strategic entrepreneurship and its traits, such as creativity, innovation, mindset, and risk acceptance (Al Aqasrawi & Alafi, 2022). Moreover, organizational agility plays a crucial role in fostering this relationship. However, the role of BI in leveraging the organizational capability to support sustainable development might need further research. It is recommended that businesses implement BI systems, integrate them into decision-making processes, and invest in employee training to obtain the utmost benefits.

The current study’s results point out that international performance indicators such as data science applications affect sustainable development positively. Also, BI boosts relationships positively and significantly. This result is similar to the one mentioned by Zhang et al. (2020), who confirm that big data analytics, firm performance, and competitive advantage are positively related. This result supports the previous study’s outcome that concluded data science-based applications develop the traditional business routine and extend their benefits to reach sustainability (Gotsch et al., 2023).

This study's results confirmed a direct positive impact of that data science application on sustainable organizational performance and sustainable competitive advantage. This is compatible with another study’s conclusion that big data-backed BI and analytics are linked to significant improvements in decision-making processes and overall organizational performance (Zhang et al., 2020).

The transformative capability of big data drives the uncovering of valuable insights and drives innovation (McAfee et al., 2012). Furthermore, big data analytical capabilities positively impact sustainable organizational performance. Therefore, organizations can gain valuable insights into customer behavior, market trends, and operational inefficiencies by analyzing large and complex datasets. This enables them to make data-driven decisions (Awamleh et al., 2024). Hence, optimize resource allocation and improve operational efficiency, which

also contributes to sustainable development. However, further studies need to investigate the limitations of data science and AI applications on sustainable development.

In most observed cases, the identified data science applications are found to advance the efficiency of existing products and processes. This study concluded that data-driven applications (e.g., big data and AI) can support the transition to a green economy. This is in agreement with numerous case studies that demonstrate how AI and BI can improve sustainable development and contribute to SDGs (Goralski & Tan, 2020; Hill, 2018; Mio et al., 2020).

The use of big data can enhance decision-making that supports environmental, social, and economic issues. Therefore, government agencies should invest in data analysis tools and models to support SDG implementation. Also, they need to adjust their policies to suit international sustainability. Nilashi et al. (2023). In Canada, there is evidence of the use of data-driven approaches to optimize waste collection and recycling processes (Geng et al., 2014). Also, Kagermann et al. (2013) emphasize the role of data analytics and AI in transforming manufacturing processes toward sustainability. Data science-driven applications can support the development and implementation of sustainable business models. Analyzing market trends and consumer preferences identifies opportunities for sustainable product innovation and develops targeted marketing strategies. The empirical analyses uncovered several cross-national differences in sustainability design. For instance, big data analytic capability is more imperative than AI capability in the United States of America, while it is the opposite in China (Zhang et al., 2020). However, the pressing matter is addressing challenges related to data privacy, data quality, and the ethical use of data. Furthermore, future research is advised to explore the contribution of the processes of data science-driven applications to the green economy transition. Besides, future research might look into the barriers and limitations to data science application implementation.

Optimizing BI to navigate through automation and human judgment would lead to reasonable and ethical decisions. Adding partnership to this equation leverages the efficiency of the recruitment process, which leads to sustainable development (Goralski & Tan, 2020; Mio et al., 2020; Mofijur et al., 2021; Yigitcanlar et al., 2020; Yin & Fernandez, 2020). Similarly, the BI-backed partnership enables access to new knowledge and resources as well as improves the efficiency and effectiveness of sustainability initiatives. This is through the ability to track progress toward goals, identify areas for improvement, and measure the impact of their initiatives. (Govindan et al., 2020). Consequently, the integration of partnership and BI ensures high-quality, sustainable development. This relates to other evidence in the literature (Azizi et al., 2024; García-Sánchez et al., 2022).

6. Conclusion and Managerial Implications

6.1 Conclusion

This study examines the international performance indicators (organizational agility, data science applications, and partnership) for sustainable development as represented by its dimensions (social, economic, and environmental). Moreover, it sheds light on the intermediating effect of the BI techniques of the aforementioned relationship. This study employed qualitative and quantitative methods to present systematic review data as well as data from the World Bank. The result of this study revealed that organizational agility, data science application, and partnership, when integrated with BI, leverage sustainable development initiatives. The study specified some recommendations to facilitate sustainable development.

6.2 Theoretical and Practical Implications Section

This research contributes both theoretically and practically to the emerging field of BI-based environmental sustainability. Theoretical and practical benefits include knowledge advancement, conceptual clarity, and guidance for future research in the field through studying the relationships between BI and sustainable development and international performance indicators (organizational agility, AI, data science, partnership). From a theoretical standpoint, it enables researchers to identify their core components, relationships, and how they interact with each other, resulting in a more precise and nuanced understanding of the concepts involved. For instance, investigating how AI technologies may be used to address sustainability issues and how various performance metrics might work together to improve environmental, social, and economic sustainability offers a broader understanding of the possibilities of AI. Furthermore, the links between BI, data science, AI, organizational agility, partnership, and sustainable development are also explored in this study to expand knowledge and create new frameworks.

From a practical standpoint, this study offers the potential to shape business strategies, inform decision-making, and foster sustainable practices within organizations. Through the integration of AI, data science, and BI, organizations can make data-driven decisions and optimize process monitoring and evaluation by enabling the tracking of sustainability goals and performance metrics. Furthermore, considering the relationship between organizational agility and sustainable development with BI will support the provision of an efficient response to changing social, cultural, and environmental conditions. This will therefore make it easier to make strategic decisions, which will improve performance optimization and result in the development of laws that support ethical

business practices.

The road toward a successful SDG starts with the integration of BI methodologies and performance indicators. To do this, the organizations first need to identify the main objectives of the BI effort and ensure it is aligned with the organizational sustainable growth plan. Secondly, identify the data sources and gather pertinent data that will support the BI plan. Thirdly, select suitable alternative BI technologies and tools for analyzing and visualizing the data. Fourthly, set a plan for employee education and training on the application of BI tools and methodologies for sustainable development (Bali Swain & Yang-Wallentin, 2020; Goralski & Tan, 2020; Osborn et al., 2015; Tsalis et al., 2020).

6.3 Limitations

The current study was limited to the development possibilities of international performance indicators via using BI techniques to achieve sustainable development and did not take into account other international performance indicators, as other indicators may be revealed in later studies. However, further studies need to investigate the limitations of data science and AI applications on sustainable development. The study was also limited to a sample of 14 countries around the world, including developed and developing countries.

Author Contributions

"Conceptualization, Fawwaz Tawfiq Awamleh, Yousef Ahmad Alarabiat and Ala Nihad Bustami; methodology, Fawwaz Tawfiq Awamleh; software, Fawwaz Tawfiq Awamleh.; validation, Fawwaz Tawfiq Awamleh, Yousef Ahmad Alarabiat. and Ala Nihad Bustami.; formal analysis, Fawwaz Tawfiq Awamleh. and Yousef Ahmad Alarabiat; investigation, Fawwaz Tawfiq Awamleh.; resources, Yousef Ahmad Alarabiat and Ala Nihad Bustami; data curation, Yousef Ahmad Alarabiat and Ala Nihad Bustami; writing—original draft preparation, Yousef Ahmad Alarabiat; writing—review and editing, Ala Nihad Bustami; visualization, Fawwaz Tawfiq Awamleh.; supervision, Yousef Ahmad Alarabiat; project administration, Fawwaz Tawfiq Awamleh; funding acquisition, Yousef Ahmad Alarabiat and Fawwaz Tawfiq Awamleh. All authors have read and agreed to the published version of the manuscript." The relevant terms are explained at the CRediT taxonomy.

Data Availability

The corresponding author can provide the data that were utilized to support the research findings upon request.

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Conflicts of Interest

The authors declare no conflict of interest.

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