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Integrating Green Logistics and Business Intelligence Models to Achieve Sustainable Development Goals

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ABSTRACT

This research article discusses the application of green logistics within the context of models of business intelligence (BI) as the basis for applying the Sustainable Development Goals (SDGs) within the realm of worldwide logistics firms, specifically in Jordan, Gulf countries, the UAE, Saudi Arabia, Kuwait, Qatar, and Oman. The total population surveyed comprised 368 respondents who were administered computerized online forms for administrative posts within large logistics sectors, specifically transportation, storage, and supply chain management. The application of SmartPLS 4 software was adopted to examine and validate the assumed structural equation models. In a concluding analysis, the efficient use of business intelligence software has a positive result on the application of green logistics, ensuring optimal resource management, better data-oriented decision-making, and lessened concerns with respect to the environment. The efficiency of such software leads to increased productivity, reduced expenses, reduced negative effects on the environment, and compliance with worldwide sustainability standards of sectors, with this research article providing support for models of sustainability facilitated by BI. Theoretically, this research supports further research on the relationship between digitized logistics practices and environmentally ideal behavior, providing a management perspective on application in developing models for sustainability. This research concludes that business intelligence is a significant factor within the strategic fulfillment of Sustainable Development Goals (SDGs). It provides such goals to provide intelligent, green logistical support, which improves overall organizational effectiveness alongside greater environmental accountability.

1. INTRODUCTION

Recent literature on sustainable logistics reveals a persistent conflict; while green logistics initiatives—such as emission reduction, resource optimization, and waste minimization—are vigorously promoted, empirical evidence has demonstrated inconsistent environmental benefits [1]. Research studies have demonstrated that high implementation costs, regulatory barriers, and a lack of technological preparedness often limit their effectiveness [2, 3]. At the same time, studies about the concept of business intelligence (BI) point to the fact that it can be used to improve decision-making and efficiency in the operations of the business [4]. However, the evidence linking BI to sustainability outcomes remains incomplete. There are studies where indirect benefits are experienced as a result of supply chain integration, but BI alone, as a result of mediation and moderation, cannot ensure environmental or social impact [5, 6]. The following contradictions cause some critical questions: in what cases do BI systems maximize the effects of green logistics, and under what circumstances do they not ensure the benefits?

This gap identifies a serious one in research. The majority of previous literature considers (green) logistics and BI as distinct streams rather than interactive entities [7]. The empirical studies usually concentrate on one country or one industry and do not observe the cross-country comparisons within the Middle East, especially in the Gulf and Jordan [8, 9]. In addition, the current literature is more likely to focus on the environmental or economic outcomes, not considering the comprehensive Sustainable Development Goals (SDGs), such as social, governance, and equity aspects. Many studies rely on qualitative or cross-sectional designs, which hinder the testing of complex structural relationships [2, 9]. Therefore, the literature is weak regarding the way in which incorporating BI with green logistics activities can be used to systematically deliver SDGs at the managerial levels in transportation, warehousing, and supply chain operations [4, 10].

However, a gap still exists in understanding how business

intelligence influences green logistics and how it, in turn, relates to comprehensive SDG outcomes. To date, research on these topics is categorized into separate areas that focus on narrow interpretations within either ecology or economics. Moreover, research on digital developments, policy frameworks, and interpretations of sustainability goals is even more limited among Middle Eastern nations, including Gulf nations and Jordan, compared to more commonly explored regions. Moreover, there is a preponderance of cross-sectional and qualitative research methods that have limited causal dynamic interpretations. Hence, there continues to be a theoretical gap on how BI can be seen as enhancing and moderating the role of green logistics on SDG goals. As such, there remains an objective within this research project to empirically develop and validate an integrative research model based on BI and its role in strengthening and enhancing the role of green logistics in reaching SDG goals among logistical businesses within Jordan and Gulf nations.

2. LITERATURE REVIEW

2.1 Green logistics

The Green Logistics theory is an extension of traditional supply chain management, incorporating the concept of environmental sustainability into the decision-making process. The main assumption is to minimize carbon emissions, energy use, and waste during transportation, warehousing, and distribution [9, 11, 12]. However, modern research points to several issues: a lack of consistency in the empirical findings, technological obstacles, and different regulatory environments do not contribute to the implementation of green practices. Furthermore, the traditional models tend to consider the environmental performance as a supporting goal, not a strategic priority, which restricts its efficiency [2, 6]. The recent theoretical advancements offer the idea of integrating process optimization with sustainability metrics, and it is implied that the data-driven strategy is the key to reaching quantifiable environmental results [13]. The theory of green logistics is still on the way to a more complex and dynamic scheme that integrates the efficiency of operations with environmental concern [9].

2.2 Business Intelligence models

BI offers a theoretical framework that can enhance the relationship between information processing and knowledge management, ultimately improving environmental performance in logistics operations [14]. The theory itself has its roots in the decision support and information systems literature, to collect data, analyze it, and build predictive models to enhance organizational performance [10, 15]. Its contemporary theoretical development includes sustainability-related applications and a focus on how analytical tools can support environmental and social decision-making [16]. However, current challenges include inadequate data quality, a lack of integration with sustainability objectives, and organizational resistance to adopting new technologies [4, 17]. Contemporary BI systems suggest that the insights based on data can be used to conduct proactive planning, real-time monitoring, and performance optimization, so BI can be treated as a strategic facilitator linking operational practices and sustainable results [18, 19].

2.3 Sustainable Development Goals

SDGs paradigms focus on the integration of a holistic approach to economic, environmental, and social aspects in organizational strategies [2, 7]. In the field of logistics and supply chains, the SDG theory is used to figure out how operational choices affect global sustainability goals [3, 4]. Several obstacles impede optimal progress. A piecemeal application of tactics, no standard for measurements, and a lack of implementation for full digital monitoring systems all contribute to the complexity [12]. Contemporary theory suggests that to align the organizational routines with SDGs, systemic coordination, dynamic capabilities, and knowledge-based decision-making are required [20, 21]. The theory of the SDG system is slowly transitioning towards an appreciation of technology and smart systems in its operationalization, with achievement of the targets not only a matter for policy commitment but also one for strategic and data-driven management across fields of performance [22, 23].

3. HYPOTHESES DEVELOPMENT

The latest literature on green logistics highlights the fact that it can be used to lessen environmental footprints by ensuring eco-efficient transportation, sustainable packaging, and efficiency in energy use [2, 6]. Nonetheless, the impact of empirical outcomes and related results is usually inconsistent because contextual, technological, and regulatory issues prevent the complete achievement of sustainability results [14, 24]. Certain studies state that, despite adopting green practices, there are slight changes in the environmental performance that can cast doubt on their applicability when they are practiced alone [8].

Theoretical perspectives, especially the resource-based view, propose that companies with sustainability integrated in the logistics business may acquire a long-term competitive edge and evolve the environmental, social, and economic aspects of Sustainable Development Goals (SDGs) [12, 14]. Taking into account these issues and theoretical considerations, the hypothesis is the following:

Hypothesis 1: *Green logistics positively affect SDGs.*

According to the emergent literature, the adoption of green logistics in itself should not be considered adequate in meeting tangible sustainability results [3]. BI models have the critical analytic potential to track the environmental performance, enable optimal resource placement, and aid in strategic decision-making. But the problem of data quality, inadequate integration, and resistance to the system by managers has curtailed the efficiency of the BI in achieving the goal of full sustainability [10].

From a theoretical perspective, a knowledge-based perspective implies that green logistics will produce useful operational and environmental information that can be systematically exploited using BI systems [15, 16]. Based on these theoretical and empirical discussions, we develop the following hypothesis:

Hypothesis 2: *Green logistics positively affects the business intelligence model.*

Research indicates that BI systems boost data-driven decision-making, predictive analytics, and real-time monitoring, which are critical in the realization of SDGs [18, 19]. However, studies also indicate that when BI is not integrated into organizational strategies, the sustainability will

only have a scattered contribution, and its absence may lead to minimal or irregular outcomes [7, 25]. The companies find it challenging to connect BI knowledge and insights to the environmental, social, and economic performance indicators, which leaves a gap in the complete achievement of SDGs [25].

According to the dynamic capabilities theory, BI will help organizations to feel, capture, and utilize opportunities to achieve sustainable results [4, 7]. Taking into account these theoretical and practical issues, the study put forth the following hypothesis:

Hypothesis 3: *Business intelligence model positively affects SDGs.*

Although Green Logistics and BI are on the path to sustainability, research reveals that when not combined, the effect is, at best, partial with uneven outcomes [6]. It has been revealed that applying eco-efficient logistics with data-informed decision-making systems generates synergy that improves resource management, real-time observation, and alignment of such processes with different dimensions of the SDGs [7, 21]. The existing literature is devoid of a holistic approach, further widening the existing knowledge gap on the combined effect [4].

The organizational systems theory supports the idea that the alignment of work practices with intelligent analysis tools enhances strategic capabilities and performance [26]. On the one hand, this theoretical and empirical merger generates the following hypothesis:

Hypothesis 4: *Green logistics and business intelligence models positively affect SDGs.*

4. METHODOLOGY

4.1 Research design and sample

This study utilized a quantitative, cross-sectional approach to examine the amalgamation of environmentally sustainable logistics practices and data analytics frameworks in promoting the achievement of sustainable development objectives (SDOs) within logistics firms in Jordan and the Gulf region. The research was focused on leading firms in the transport, storage, and distribution sectors, with much emphasis on personnel in the administrative and management sphere who were diversified enough to give both strategic and functional aspects.

Various logistics and transport organizations in Jordan and the Gulf conducted the research. In Jordan, the participants were Global Shipping & Logistics, Golden Ways for Logistics, Target Logistic Services, Nile International Freight Services, and Naouri Group. In the Gulf, the companies were NAQEL Express (Saudi Arabia), Trukkin (UAE, GCC), Transking Logistics (UAE), TTL Logistics (Kuwait), and Asyad Group (Oman). These companies were chosen according to their importance in their markets and their ability to implement sustainable operational methods and business intelligence instruments. A sample of 368 subjects was taken to achieve a satisfactory sampling of different sizes and types of organizations. Data was collected by means of stratified sampling [11].

An initial investigation was carried out using a group sample of 30 organizations of a similar nature with respect to the personnel sample. This initial enquiry was carried out to fine-tune the instrument method of enquiry, to test the clarity and understandability of the instruments, and to evaluate, in relative terms, the nature, effectiveness, and reliability of both tests. The calculation of Cronbach's alpha tests for the individual constructs indicated the achievement of internal cohesion, which was greater than or equal to 0.70. Furthermore, the initial scoring of the instrument proved that it was adaptable for a transnational inquiry or teaching instrument that could be used to ascertain whether the subjects targeted were willing to answer questions concerning the relative integration of environmentally conscious logistics and business intelligence for sustainable endeavors [11].

4.2 Measurements

The researchers employed established and validated metrics specifically designed for the context of sustainability and green logistics initiatives. The research employed standardized questionnaires to collect our data. These surveys were developed around three significant areas, which are Green Logistics (GL), Business Intelligence Model (BIM), and Sustainable Development Goals (SDGs). In particular, with respect to green logistics, our surveys included a set of relevant questions (GL1-GL6), which considered, e.g., resource-conscious transportation and environmentally responsible storage systems, as well as environment-focused management practices within supply chains [8, 18]. For the business intelligence model, we are also interested in exploring the usage of data within organizations from this particular perspective. The research process pertaining to the gathering, incorporation, forecasting, and use of the predictions from the data obtained for making organizational decisions was specifically investigated in depth from the researchers' perspectives (BI1-BI6) [12, 17]. Lastly, the study surveyed organizational performance within the scope of environmental sustainability and economic feasibility, as well as societal accountability in relation to Sustainable Development Goals. Items from SDG1 to SDG6 are considered with a parallel aim to assess all three sustainability themes comprehensively [2, 4, 10]. By applying a simple five-point Likert scaling tool, with responses varying from "strongly disagree" to "strongly agree," we made sure to use a consistent measurement on all five points for all scales. Lastly, to validate the relevance, aptness, and usefulness of our survey tool, we chose to apply it for assessment purposes to experts within the concerned fields, who are bound to examine all questions for precision, aptness, and relevance to our set research goals to make sure that we are actually measuring what we are set to research.

4.3 Procedures

The authors (BI1–BI6) particularly investigated in-depth with regard to the cost of gathering, integrating, and making decisions with the use of data, as well as the application of predictive analytics. Lastly, about the Sustainable Development Goals, we assessed the organizational performance with respect to the sustainability goal of taking care of the environment and becoming economically viable, as well as being socially responsible. Our research survey included the SDG1 to SDG6 questions in undertaking the comprehensive assessment of the sustainability factors. For all the questions, we opted to use a simple five-point Likert-type scale, with the responses ranging from "strongly disagree" to "strongly agree." Lastly, to ensure that our survey instrument is valid, reliable, and fit-for-purpose, we described our

instrument that is going to be assessed by experts in the respective fields, who are set to assess each of the questions with respect to the clarity and relevance, as well as alignment with our research goals.

4.4 Analysis

The data were examined with Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4 software to look at the complicated relationships between latent constructs and to allow for the idea that distributions are not normal. The first step in the analysis was to look at the measurement model. Following on from this series of tasks enabled confirmation of the indicators in terms of Cronbach's alpha, composite reliability values, and convergent validity measured by Average Variance Extracted (AVE). The discriminant validity was initially assessed based on the Fornell-Larcker criterion and a detailed investigation of cross-loadings. To assess how well our hypothesized relationships would hold, the structural model was then tested. Hold. In particular, the direct effect of green logistics on SDGs, the effect of green logistics on business intelligence (BI), the effect of BI on SDGs, and the possible mediating role of BI in the relationship between green logistics and SDGs were investigated. A bootstrapping method of 5,000 resamples was used to detect the statistical significance of the path coefficients [11, 27].

5. RESULTS

Table 1 presents the demographic data and analysis of the participants. The majority of the respondents are male (62.5%), which means that this can be considered a sign of gender inequality in the research population. Most respondents are within the age group of 35 to 44 (43.5%). And when it came to educational attainment, most have a master's degree (45.7%). This adds to the observation that the research population is highly educated and experienced. The different attributes, such as age, educational attainment, and work experience, aptly define the perspectives of the managers on the implementation of environmentally responsible logistics practices as well as business intelligence systems in the identified logistics firms [11].

Table 1. Demographic characteristics of the sample

Demographic	Category	Frequency	Percentage
Gender	Male	230	62.5
	Female	138	37.5
Age	25–34	120	32.6
	35–44	160	43.5
	45+	88	23.9
Education Level	Bachelor's	150	40.8
	Master's	168	45.7
	PhD	50	13.5
Years of Experience	1–5	90	24.5
	6–10	140	38.0
	11–20	98	26.6
	21+	40	10.9

The values are shown in Table 2. The mean values of the scores on all the variables are high, indicating that most respondents consider eco-friendly logistics, business analytics, and SDGs to be highly important. It is also relatively well balanced, with the values of skewness and kurtosis being within the normal range. This is an enabling factor for conducting Structural Equation Model analysis via SmartPLS 4 in the following step of research [27].

Table 2. Descriptive statistics of study variables

Variable	Mean	Stand. D	Skewness	Kurtosis
GL	4.12	0.56	-0.31	2.88
BI	4.05	0.61	-0.27	2.92
SDGs	4.18	0.59	-0.21	3.01

Table 3. Reliability, validity, and factor loadings of constructs

Const.	Measurement	Loading	α	CR	AVE
GL	GL1: Low-emission transportation	0.812	0.87	0.90	0.62
	GL2: Energy-efficient logistics	0.845			
	GL3: Sustainable fuel usage	0.827			
	GL4: Environment-friendly distribution	0.834			
	GL5: Green logistics practices	0.819			
	GL6: Logistics carbon reduction	0.828			
BIM	BI1: Data integration capability	0.803	0.86	0.89	0.61
	BI2: Analytical reporting accuracy	0.821			
	BI3: Decision support effectiveness	0.837			
	BI4: Advanced data visualization	0.845			
	BI5: AI-driven intelligence	0.829			
	BI6: Performance monitoring capability	0.836			
SDGs	SDG1: Environmental sustainability outcomes	0.812	0.88	0.91	0.64
	SDG2: Economic sustainability performance	0.826			
	SDG3: Social sustainability impact	0.835			
	SDG4: Resource efficiency improvement	0.842			
	SDG5: Circular Economy contribution	0.827			
	SDG6: Long-term sustainability goals	0.833			

The study also observes that Table 3 shows significant statistical evidence for the measurement tool. Collectively, the results have robust psychometric properties. The factor loadings of all measurement items were also significantly greater than the standard, hence specifying greater convergent validity thresholds than the cut-off point of 0.70. The internal consistency reliability for all constructs exceeded the acceptable level of 0.70. The reliability of all the constructs is verified by the values of the composite reliability (CR), which were all above 0.70. Lastly, the average variability of all the

constructs recorded a value greater than 0.50, thus verifying the convergent validity of the measurement tool. Perhaps even more crucially, the scales, which comprised the three particular categories—Green Logistics (initiating such activities as a company's capacity to convey products to the destination efficiently, more durable storage facilities, and environmentally sound supply chain practices), BI (data collection and analysis as well as prediction techniques and infrastructures for data-driven decision making), and Sustainable Development Goals (tackling the environment, economy, and society)—were measured adequately in their corresponding indicators. This fine measurement framework allows for analysis of the structural model and formal testing of hypotheses as needed in the subsequent process [27].

Table 4. Discriminant validity (Fornell-Larcker criterion) construct

Variable	GL	BI	SDGs
GL	0.788		
BI	0.542	0.780	
SDGs	0.603	0.567	0.797

Check out Table 4 and go over the Fornell-Larcker test, and you'll find our concepts in a wonderful place. Once again, the general concepts in the set have a higher square root of their AVE score compared to their correlation with any other concept in the set, which is the desired outcome. Overall, our result means that none of our ideas are too closely related to the others—no envelopes getting soup, no square pegs in round holes. So we're in an excellent condition to actually test our ideas without asking ourselves whether or not we're changing life [27].

Table 5. Path analysis results for direct hypothesis testing

Hypothesis	β	T-Value	P-Value	Decision
H1: GL → SDGs	0.41	6.28	0.00	Supported
H2: GL → BI	0.52	7.45	0.00	Supported
H3: BI → SDGs	0.35	5.12	0.00	Supported

Several construct relationships are positively and significantly associated with the central constructs (path analysis), as shown in Table 5. In particular, environmentally responsible logistics is a significant factor in the achievement of Sustainable Development Goals (SDGs) ($\beta = 0.41$, $p < 0.001$). There are also correlations established between the environmentally responsible logistics and BI ($\beta = 0.52$, $p < 0.001$) and between BI and SDGs ($\beta = 0.35$, $p < 0.001$). These observations indicate that environmentally aware logistical strategies and intentional use of business data yield significant and extensive effects on sustainability advancement. This evidence corroborates a theoretical framework of business intelligence as a crucial element that may facilitate the effective adoption of sustainable operational practices [11].

Figure 1 and Table 6 show the data on the mediating factor—business intelligence, which connects environmentally conscious logistics practices with SDGs. The result of the mediation analysis shows that there is a significant mediating effect on environmentally conscious logistics practices, with a value of $\beta = 0.58$, $p < 0.001$. The results confirm the argument that BI improves the effects of environmentally sustainable logistics strategies on the attainment of Sustainable Development Goals. This underlines the importance of embedding analytical, data-driven decision-making processes in both environmental and operational structures [11, 27].

Table 6. Mediation analysis results

Mediation Path	Indirect	T-Value	P-Value	Mediation
GL → BI → SDGs	0.58	4.76	0.00	Partial

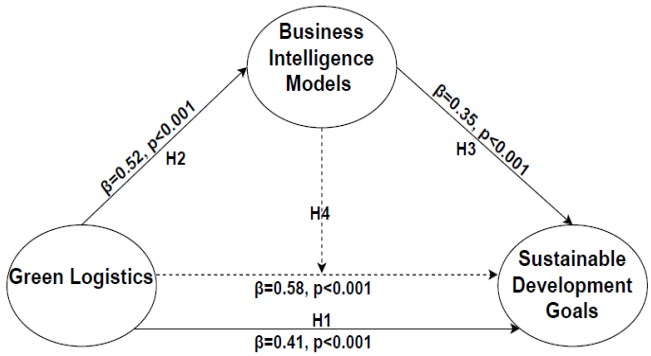

Figure 1. Illustrates the structural model

Table 7. Model fit indices

Fit Index	Value	Threshold
SRMR	0.065	< 0.08
d_ULS	2.315	—
d_G	1.487	—
Chi-Square	512.45	—
NFI	0.921	> 0.90

Table 7 shows an acceptable fit between the model and the data in this regard and how well-aligned it is, as evidenced by model fit indices. SRMR shows a value below the 0.08 threshold within a standard cut-off range, and NFI also scores above 0.90. These are the results that prove the stability and strength of the model. Accordingly, these results indicate that the Partial Least Squares Structural Equation Modeling (PLS-SEM) method would be appropriate for the analysis of the given hypotheses. The results also validate that the assumptions about the links between environmental logistics, corporate insight, and SDGs are adequately captured in the empirical data [11, 27].

6. DISCUSSION

An analysis of this research indicates that environmentally sensitive logistics can lead to the realization of the Sustainable Development Goals (SDGs). It follows that resource-efficient means of transportation, environmentally friendly storage options, and an environmentally smart supply chain are positively associated with betterment in environmental, economic, and social aspects. Although this linkage is supported by previous research, recent research has confirmed that findings tend to differ, which is generally attributed to a lack of adequate technological support within such organizations, a lack of adequate oversight, or a lack of emphasis on such factors [15, 27]. Regarding individuals, for example, it is obvious that such projects would find it difficult to produce quantifiable sustainability enhancements because

of certain organizational as well as contextual inefficiencies [3, 28]. Theoretical discrepancies, therefore, are provided with real-world experiences of a number of logistics organizations within Jordan and Gulf countries, thereby providing a consistent improvement within SDG concerning the environment. This, therefore, indicates that ecological logistics—a major pivot within the development of sustainability—assumes importance when treated, managed, and controlled properly [8, 29]. This explains how ecological logistic practices affect the practice of business intelligence models within organizations.

BI systems help organizations better understand their operational and environmental contexts so they can make informed decisions. BI systems help organizations better understand their operational and environmental contexts so they can make informed decisions [23, 30]. But recent scholarship has generated mixed reviews, with some arguing that because of data gaps, siloed approaches, and managerial failure, the existence of green business initiatives does not automatically translate into better BI systems [11, 22]. However, this study closely approximates this literature and empirically establishes how operational BI (e.g., business intelligence) can be effectively deployed successfully (in the present paper) when organized properly with integrated ecological logistics operations, which means that operational sustainability and managed systems integration are related [18, 24]. This paper supports the fact that the business simply cannot have BI systems implemented alone without developing sustainable logistics as a means of operation. Contemporary results highlight the importance of BI models in driving SDG development as new approaches to BI use real-time monitoring, predictive analytics, and driving objectives and strategic decision-making alignment in a sustainable but purposeful way to align BI models with these goals [20, 21]. Yet a few recent studies raise conflicting findings, claiming BI systems will become divorced from sustainability when management practices are misaligned or data quality is low [23, 30].

Incorporating the regional reactions of different logistics industries, the current study indicates that the success of BI is influenced by both IT resources and managerial commitment, which means that BI goes beyond being a technology solution and indicates that one of the main strategic weaknesses that BI fails to resolve is its absence, leading to no sustained response [11, 24]. This underscores the need for a more strategic alignment between the use of BI tools and the corporate social responsibility (CSR) of organizations [31, 32]. The findings of this study confirm that when the ecological logistics are integrated with the IT BI, there is a synergistic effect that provides better SDG performance than each entity working alone [4, 21]. There has been literature on integrations in the past, but these studies produced mixed results because of a lack of alignment with a comprehensive framework and poor collaboration across functions [2, 6, 31].

In doing so, the research fills this gap by empirically analyzing a sample of multinational logistics firms and demonstrating how coupling practices with intelligence-based systems brings enhancements in resource management and operational practice, through stronger sustainability reporting, for example. The results indicate that organizations need to embed sustainability strategies into basic operations rather than merely adding specific sustainability initiatives or programs for individual activities, which may result in sustainable outcomes in logistics [12, 14]. The combined impact of these variables on the objectives of the SDGs is clear from these papers [7]. It fills a research gap in the existing literature because few studies address the operational sustainability of data-driven decisions. It mediates the relationship between the influences of green practices on SDGs; it improves the processes of operations BI through its empirical evidence from top international logistics companies and adds empirical support to its processes [16, 20].

The outcomes contribute to the fields of sustainable logistics and digital management, highlighting the importance of strategic analysis and development. This paper contributes to knowledge in both sustainable logistics and digital management and highlights how logistics management departments need to develop a strategic approach towards sustainability. It provides logistics managers with tangible methods to enhance sustainability performance by adopting ecological logistics and BI systems [23, 33]. This paper aims to demonstrate the importance of data-informed monitoring and predictive analytics in influencing the competitiveness and eco-efficiency of operations [11, 31]. Businesses can use the results to make better use of their resources, keep their costs down, and follow international standards for sustainability [32, 34]. This paper could help governments make a policy that encourages logistics companies to adopt a sustainability policy that works together [2].

7. CONCLUSION

This research indicates that combining ecologically grounded logistical practices with business analytics practices might have an essential role within the development of the globally accepted sustainability goals of the logistics sector within Jordan and Gulf countries. The implementation of such eco-friendly practices in logistics is valuable in reaching environmentally positive performance when implemented individually; the implementation, with business analytics, improves strategic orientation and resource management, as well as the environmentally favorable position. Business analytics is vital within environmentally positive practices, as shown, with the potential to develop theoretical foundations.

The article can only support the work on logistics' links to sustainability and the development of digital technologies, and shows that the combination of digital technologies and sustainable practices is necessary if substantial positive change in sustainability outcomes is to be achieved. Finally, the researchers contend that organizations that adopt data-driven and sustainability-focused operations may, therefore, increase their competitive advantage and help achieve more ambitious global sustainability objectives.

However, there are some limitations to this study. First, the cross-sectional design of the study has restricted its ability to establish causality. Second, since the sample spans multiple countries, its focus on large and medium-sized logistics firms limits the applicability of the results to smaller companies. Moreover, self-report measures are used for data collection, which introduces the risk of bias. Ultimately, one should also be aware that associations may be informed by local contexts (e.g., local laws, technology, etc.), which will impact the generalization of the findings. Longitudinal studies are needed in future research to evaluate the causal relationship over time to extend the research.

The organization type, such as firm size and geographic setting, will likely be the focus of further research. A more

complete picture would be found in considering mediating variables (i.e., leadership styles, technology maturity, organizational culture, etc.). Future studies would also require studying how the convergence of cutting-edge technologies (Internet of Things and blockchain) and eco-friendly logistics and business analytics platforms can contribute to a better sustainability outcome. In another contribution, comparative studies between different industrial sectors may help confirm the wider applicability of the proposed holistic sustainability framework.

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