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RESEARCH ARTICLE

Digitalization practices, green supply chain management, and sustainability performance: evidence from UAE supply chain and logistics firms

Mohamed Adil[a] & *Misbah Sadiq[b]

[a]School of Management, Canadian University Dubai, United Arab Emirates.

[b]College of Business Administration, University of Al Dhaid, Sharjah, United Arab Emirates.

*Corresponding author email: misbah.jabranbutt@uodh.ac.ae

ABSTRACT

This study examines the structural mechanism connecting Digitalization Practices to Sustainability Performance within the UAE supply chain and logistics sector. Grounded in an integrated Technology-Organization-Environment (TOE), Resource-Based View (RBV), and Institutional Theory framework, we investigate the mediating role of Green Supply Chain Practices (GSCP) and the moderating boundary conditions of External Pressure and Organizational Support. Empirical data were gathered via a structured survey of 80 supply chain and logistics professionals across UAE-based enterprises. Structural relationships were evaluated using hierarchical regression, maximum likelihood mediation, and PROCESS moderation analyses. The results demonstrate that Digitalization Practices significantly drive both GSCP adoption and overall Sustainability Performance. Mediation analysis confirms that GSCP acts as a complementary partial mediator, transmitting a substantial portion of digitalization's impact to sustainability performance. Contrary to expectations, interaction effects for External Pressure and Organizational Support were non-significant. Rather than serving as boundary moderators, these institutional forces operate as direct, ceiling-level baseline drivers due to institutional saturation within the UAE's centralized regulatory environment. Methodologically, the study is bounded by its cross-sectional design, single-informant sampling, and modest sample size ($n = 80$). Managerially, findings indicate that standalone digital investments forfeit nearly half their potential sustainability value unless explicitly paired with green operational routines. Policymakers are advised to transition from general mandates toward targeted SME digital infrastructure grants.

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1. Introduction

The fast-paced development of digital technologies has completely changed the way global supply chains operate and provides businesses with new opportunities to achieve environmental sustainability and operational efficiency at once. The Internet of Things (IoT), artificial intelligence, cloud-based analytics and enterprise resource planning (ERP) systems are all strategic enablers of sustainable performance. The new technologies are bringing new ways for businesses to reduce emissions, decrease resource use and monitor environmental hazards in complex, multi-tiered supply networks (Bandara & Buics, 2024). In a world of more stringent regulations, more demanding customers and climate-related disruptions, the convergence of digitalization and sustainability is now one of the primary

strategic challenges for modern supply chain management. It's well understood and well-established empirically. Using ten years of Chinese firm-level data, Xue et al. (2025) show that supply chain digitalization significantly increases green total factor productivity and supply chain resilience is one of its key mediating factors. By modeling structural equations, Martínez Aguilar et al. (2025) showed that upstream digitization facilitates green supply chain practices by enhancing cross-partner cooperation and information processing capabilities. On a global level, digitization is taken up as a structural driver for sustainable trade expansion by the International Monetary Fund (2024) and World Trade Organization (2023). Le et al. (2025) found that the relationship between digitization and sustainable consumption habits is mediated by green supply chain management and thus digital investments can contribute to sustainability through green operational methods. However, little is known about the specific mechanisms through which digitalization generates sustainable results, particularly in the context of logistics in the Gulf Cooperation Council (GCC). Most of the research now focuses on the direct connection between digitalization and performance without considering the middle-level green supply chain pathways that digital tools follow to unlock sustainability value. This is a big problem because managers and policymakers are not prepared to tailor digitalization investments to create sustainable value if they do not have a clear pathway-level knowledge. The UAE presents a critical setting to address these gaps. Rapid digital transformation across global supply networks has positioned digital capabilities as essential enablers of operational efficiency and environmental sustainability. Top-down federal initiatives—such as the UAE Digital Economy Strategy, Net Zero by 2050 Strategic Initiative, and UAE Green Agenda 2015–2030—establish an environment where regulatory pressure and digital mandates are structurally centralized. The UAE logistics sector, anchored by major global infrastructure such as Jebel Ali Port and Al Maktoum International Airport, operates directly at the intersection of these strategic mandates. Compared to Western or East Asian settings where most prior research originates, this centralized institutional framework fundamentally alters how regulatory pressures and internal organizational dynamics influence firm-level digitalization. As Elnadi et al. (2025) note in similar vision-driven GCC economies, these unique boundary conditions remain empirically unexamined within UAE logistics.

To address key theoretical and empirical gaps, this study investigates how Digitalization Practices influence Sustainability Performance in UAE supply chain and logistics operations. We examine Green Supply Chain Practices (GSCP) as a core operational mediator while evaluating External Pressure and Organizational Support as potential moderating boundary conditions. This study contributes to the literature in three distinct ways: First, it moves beyond simple direct-effect models by quantifying the indirect transmission path of GSCP within GCC logistics. Second, it advances Institutional Theory by conceptualizing institutional saturation, explaining how centralized state mandates alter conventional moderating mechanisms into direct performance drivers. Third, it validates a multi-theoretical TOE-RBV-Institutional framework tailored to centralized, emerging-market trade hubs.

2. Theoretical framework

The integration of TOE, RBV, and Institutional Theory provides a cohesive, multi-theoretical lens tailored to vision-driven GCC economies. Rather than operating in isolation or competing, these three theoretical perspectives complement one another across distinct operational stages. The Technology-Organization-Environment (TOE) framework establishes the technological context, explaining how digital readiness lowers the operational friction

required to execute complex green practices. The Resource-Based View (RBV) conceptualizes digital platforms and green routines as bundled, non-substitutable organizational capabilities that drive triple-bottom-line performance. Finally, Institutional Theory accounts for the external coercive and normative isomorphic pressures that align corporate strategy with national sustainability agendas. In top-down economic models like the UAE, these theories work in tandem: TOE defines technological feasibility, Institutional Theory dictates strategic compliance direction, and RBV explains how enforced routines are internalised to generate long-term firm capabilities.

Table 1. Standardized theoretical integration matrix

Theory	Hypotheses	Conceptual Role in Framework
Technology-Organization-Environment (TOE)	H2 (DP → GSCP)	Identifies digitalization as the technological pre-condition that lowers operational friction and enables green practice adoption.
Resource-Based View (RBV)	H1 (DP → SP), H3 (GSCP → SP), H6 (DP × OS → GSCP)	Conceptualizes digital capabilities and green routines as bundled, non-substitutable strategic assets (H1, H3), with Organizational Support serving as an internal resource driver (H6).
Institutional Theory	H5 (DP × EP → GSCP)	Explains how coercive and normative external pressures mandate firm alignment with national sustainability objectives.
Integrated Framework	H4 (Mediation: DP → GSCP → SP)	Captures the sequential capability conversion process from digital infrastructure to green routines and ultimate triple-bottom-line performance.

3. Literature review and hypothesis development

3.1 Direct effects

3.1.1 Digitalization practices and sustainability performance

The direct link between corporate digitalization and triple-bottom-line sustainability performance is in the technology system and how the technology can enhance resource distribution and reduce process inefficiencies (Mutambik, 2024). Digitalization is an integrated system that helps create a transparent data base, reduces transaction friction, and streamlines structural monitoring across a diverse logistics ecosystem (Wu et al., 2025). Organizations can reduce energy footprints and mitigate waste through cloud-based resource planning and predictive analytics in the current business environment (Bandara & Buics, 2024). And this structural optimization is in the face of both economic and environmental efficiency metrics. In fact, as observed by the macro-economic research by the International Monetary Fund (2024), digital transformation is one of the key factors in the long-term sustainable efficiency of companies, and therefore environmental compliance information is now known across international trade and distribution lines. Thus, the direct digital deployment of assets will yield sustainable returns in terms of real-time monitoring and structural asset optimization. Based on the Resource-Based View (RBV), digitalization tools are the advanced, technologically sophisticated capability base

to optimize asset deployment. Digital platforms offer insights into the data in a more granular way that the organization can do nothing more than shield themselves from disruption in their business model and increase environmental and economic sustainability metrics at the same time.

H1. *Digitalization Practices positively influence Sustainability Performance.*

3.1.2 Digitalization practices and green supply chain practices

Empirical Justification: When it comes to supply chain digitalization, companies with advanced digital capabilities—cloud-integrated platforms, IoT-enabled monitoring, and AI-driven analytics—are systematically better suited to adopt Green Supply Chain Practices (GSCP) because these technologies reduce the operational barriers to resource optimization, supplier transparency, and environmental compliance (Gupta et al., 2025). Wang et al. (2023) used Chinese provincial-level panel data to illustrate how digital transformation positively impacts the development of green supply chains in organizational, technological, and environmental aspects. According to Martínez Aguilar et al. (2025), GSCP is made possible by downstream supply chain digitalization, which enhances information processing capabilities and makes it easier for supply chain partners to collaborate on environmental issues in real time. Through a comprehensive analysis, Frontiers (2025) further demonstrated that supply chain transparency and traceability are enhanced by AI, Blockchain, and IoT applications—essential requirements for operationalizing eco-design, reverse logistics, and green purchasing. Organizational digital readiness increases the conversion of digital investment into operational green capability, implying that companies with more robust digital foundations will have greater rates of GSCP adoption. This association is anticipated to be especially strong in the logistics setting of the United Arab Emirates, where the Digital Economy Strategy has accelerated baseline digital adoption. Digital systems are the core technology context which removes technical and operational hurdles for complex green configurations. The firm that is technologically ready by the Technology-Organization-Environment (TOE) framework is the one that will help it to manage green procurement, reverse logistics and carbon accounting.

H2. *Digitalization Practices positively influence the adoption of Green Supply Chain Practices.*

3.1.3 Green supply chain practices and sustainability performance

Empirical Justification: Companies adopting GSCP in their core operations build environmental capabilities that reduce costs and enhance stakeholder legitimacy and are able to comply with regulations. Green practices have consistently and positively affected the economic, environmental and social sustainability performance of industries in Choudhary and Sangwan's (2024) comprehensive review of GSCP-sustainable performance literature. Wiredu et al. (2024) found that top management support for GSCP strongly predicts environmental performance at the company level and that GSCP is the main operational tool for sustainability goals to be achieved. Sorooshian et al. (2024) also demonstrate that digital tools that are integrated in GSCP, such as the circular economy and real-time emissions monitoring system, can be used to improve triple bottom line performance for a company. The business which is institutionalized in GSCP will also be more sustainable in the UAE logistics sector and will benefit from the Green Agenda 2015–

2030 and Net Zero 2050 laws for compliance. Through the RBV, GSCP (eco-design, green purchasing and reverse logistics) is a set of strategic environmental capabilities which are socially complex, causally murky and extremely inimitable. It is true that when a company incorporates green into its general operations, it will have a unique capability mix that creates long-term competitive differentiation and triple bottom line returns (RBV).

H3. *Green Supply Chain Practices positively influence Sustainability Performance.*

3.2 Mediation effect

3.2.1 Mediating role of green supply chain practices (H4)

Empirical Justification: Le et al. (2024) have shown that through the use of PLS-SEM on 405 managers, this path has been proven to work, and Green Supply Chain Management is the way to connect digitalization and sustainable corporate performance. And this is an indication that digitalization alone does not lead to sustainability, but rather it is the enabling of green activity and green practices that we can put in place. Martínez Aguilar et al. (2025) have shown that downstream digitization enhances GSCP through improved information processing and, in turn, environmental performance. Conversely, Xue et al. (2025) found that the link between digitization and green production is driven by supply chain resilience, which is directly linked to GSCP. Investments in digitization are more efficiency-oriented and less sustainability-oriented in the absence of the GSCP roadmap. However, no empirical testing of this mediation process has been done in UAE logistics firms.The technological context of a firm (TOE Framework) is the key baseline facilitator that allows an organization to build, scale, and operationalize green supply chain capabilities. These green practices mature into rare and valuable operational resources (RBV Paradigm) that are then converted into superior, cross-dimensional sustainability performance.

H4. *Green Supply Chain Practices mediate the relationship between Digitalization Practices and Sustainability Performance.*

3.3 Moderation effect

3.3.1 The moderating role of external pressure (H5)

Empirical justification: In supply chains, external pressure is the pressure from regulators, governments, consumers and trade associations to adopt sustainable practices in the supply chain. Using data from 292 Chinese manufacturing companies, Zhang et al. (2025) also empirically showed that normative and coercive institutional pressures play a positive role on businesses' intentions to integrate green supply chains in practice. In a moderated mediation study based on institutional theory, Lee et al. (2024) also showed that institutional pressures heighten the extent to which digitalization is the key to the adoption of sustainability strategies. Jiang (2025) also found that the path from digital transformation to green innovation achievements is greatly enhanced by external environmental restrictions. Therefore, it is anticipated that in the case of increasing external pressure, the relationship between digitalization and GSCP will be stronger. Empirical tests will be conducted to address the fact that External Pressure is already operating at saturation in the UAE, where centralized regulatory mandates ensure higher

baseline sustainability compliance.

Under standard Institutional Theory, external coercive and normative pressures operate as conditional boundary modifiers that amplify the translation of organizational capabilities into institutionalized practices. However, in centralized, vision-driven economies like the UAE, state-level environmental mandates (e.g., Net Zero by 2050) are enforced uniformly across national logistics corridors. This pervasive enforcement creates an environment of 'institutional saturation.' When regulatory compliance and external stakeholder expectations reach near-universal industry adoption, the variance required for traditional statistical moderation diminishes. Consequently, rather than acting as a contingent boundary modifier that alters the strength of internal firm pathways, external pressure converts into a direct, baseline operational driver that uniformly pulls all industry participants toward baseline compliance.

H5. *External Pressure positively moderates the relationship between Digitalization Practices and Green Supply Chain Practices, such that the relationship is stronger under higher levels of External Pressure.*

3.3.2 Moderating role of organizational support

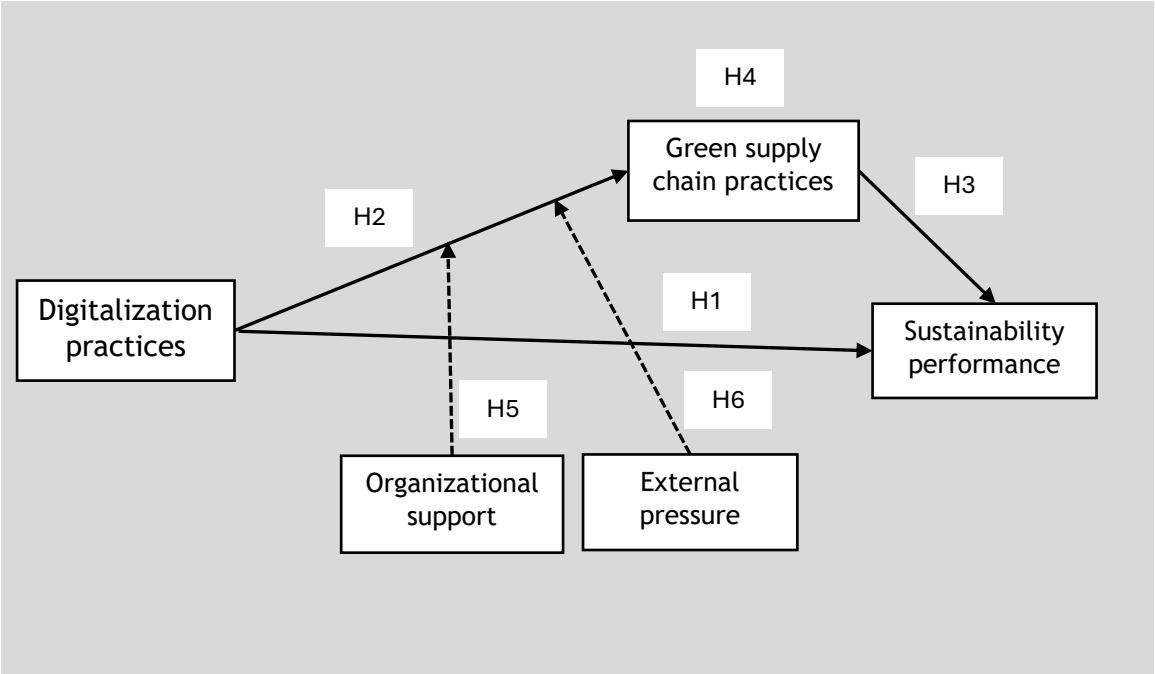
Organizational support represents the degree to which top management champions and allocates resources toward digital and sustainable transitions. As noted by Wiredu et al. (2024), top management backing provides the necessary resource anchor for executing environmental strategies. Therefore, it is anticipated that strong organizational support will act as an internal boundary condition that amplifies the firm's ability to translate digitalization practices into functional green supply chain routines.

H6. *Organizational Support positively moderates the relationship between Digitalization Practices and Green Supply Chain Practices, such that the relationship is stronger under higher levels of Organizational Support.*

3.4 Research framework of the study

The model presented in Figure 1 gives us a systematic way to explore the impact of corporate digitalization on sustainability performance outcomes. For this, we have not used direct-effect models and rather constructed a sequence of Antecedent → Operational → Mediator → Ultimate Outcome (H1, H2, H3, and H4). In our framework, we have an ecosystem where Digitalization Practices (antecedent) lead to Sustainability Performance (outcome) through a dual path (H1) to an efficiency-driven path (H2) and an indirect (H4) path that is fully delivered through GSCP. The foundation for the adoption of GSCP is digital capabilities (H2), which in turn generate a triple bottom-line performance return (H3). External pressure (H5) captures the extra-organizational regulatory and market isomorphic forces, as well as Organizational Support (H6), which captures the organizational managerial commitment and resource allocation.

Figure 1. Conceptual model



4. Research methodology

4.1. Research design

This study uses a quantitative cross-sectional survey methodology based on positivist research philosophy to study the organization. A positivist approach is best suited to this research as it uses structured empirical data to test theoretically derived hypotheses on correlations between the organizational characteristics (Saunders et al., 2019). We first developed the research framework and six research hypotheses on theory-based and deductive research strategy prior to data collection. This study is therefore empirical theory-testing based which is consistent with the theoretical research and structural literature on corporate digitalization, green supply chain management, and sustainability performance.

4.2. Sampling and data collection

The target sampling frame comprised middle-level operations managers, logistics directors, and supply chain executives overseeing logistics-intensive operations in the UAE. Using a non-probability purposive sampling approach, responses were gathered from 80 verified supply chain professionals ($n = 80$). While 77.5% ($n = 62$) of responding enterprises operate directly as specialized Logistics & Transportation firms, 22.5% ($n = 18$) represent dedicated internal logistics and supply chain departments within real estate development, construction, dairy manufacturing, and consumer goods production. All respondents possessed direct institutional oversight of purchasing, fleet logistics, and environmental compliance.

Methodologically, two structural sampling limitations must be prominently acknowledged. First, the modest sample size ($n = 80$) introduces statistical power constraints, particularly when detecting subtle interaction effects in complex moderation models. While $n = 80$ provides adequate statistical power (> 0.80) for detecting large direct regression paths and medium mediation effects, it is inherently underpowered for identifying small interaction terms ($\beta < 0.15$). Second, relying on single key informants per firm increases vulnerability to perceptual variance and common method bias.

4.3 Measurement instrument

Primary data were gathered utilizing a structured, self-administered measurement instrument. All substantive construct indicators were evaluated using a standardized five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) (see Appendix A Questionnaire). The operationalization of the latent constructs is outlined in Table 2.

Table 2. Measurement instrument operationalization

Construct	Number of Items	Indicator Labels	Validated Source References
Digitalization Practices (DP)	5	DIG1–DIG5	Karmaker et al. (2023); Pan & Zhang (2021)
Green Supply Chain Practices (GSCP)	6	GRN1–GRN6	Zhu & Sarkis (2004); Green et al. (2012); Kusi-Sarpong et al. (2021)
Organizational Support (OS)	2	ORG1–ORG2	Mittal & Dhar (2016); Robertson & Barling (2013)
External Pressure (EP)	3	EXT1–EXT3	Zhu et al. (2005); Chowdhury et al. (2022)
Sustainability Performance (SP)	5	PERF1–PERF5	Paulraj (2011); Kusi-Sarpong et al. (2021)

4.4. Reliability Analysis

Before hypothesis testing, Cronbach's alpha (alpha) coefficients are calculated to check the reliability of all latent constructs. According to standard psychometric criteria, values above 0.70 indicate acceptable reliability, values above 0.80 indicate good reliability, and values above 0.90 indicate excellent reliability.

Table 3. Cronbach's alpha reliability coefficients

Construct Type	Latent Variable	Number of Items	Cronbach's Alpha (α)	95% Confidence Interval	Psychometric Interpretation
Independent Variable	Digitalization Practices (DP)	5	0.805	[.750, .860]	Good Consistency
Operational Mediator	Green Supply Chain Practices (GSCP)	6	0.83	[.772, .887]	Good Consistency
Interactive Moderator	Organizational Support (OS)	2	0.628	[.459, .796]	Acceptable for Short Scales
Interactive Moderator	External Pressure (EP)	3	0.644	[.411, .877]	Acceptable for Short Scales
Dependent Variable	Sustainability Performance (SP)	5	0.906	[.867, .945]	Excellent Consistency

Reliability checks validate the psychometric soundness of the key variables. The main independent, mediating, and dependent variables—Digitalization Practices (α = .805), Green Supply Chain Practices (α = .830), and Sustainability Performance (α = .906)—were all well-managed in internal consistency, and thus good enough to be used for regression and structural pathway modeling. The two moderating variables have lower reliability coefficients. The External Pressure (alpha = .644) and Organizational Support (alpha = .628) are relatively small for short scales of only two to three items (Hair et al., 2019; Robinson et al., 1991). That is an important methodological implication because measurement error in a moderator variable reduces the estimate of the interaction term (a lack of statistical power to detect boundary effects in moderation research) (Aguinis, 2004). This structural constraint is taken into account in interpreting the non-significant interaction results for Hypotheses H4 and H5 in the following chapters. Because of the lack of moderator reliability, limited variance for scores, and a local sample size of n = 80, the model may be underpowered to detect even small interactions even if the boundary is true across the whole population.

4.5 Statistical tools and data analysis strategy

To fully explore the 6-hypothesis structure, we performed a multi-analytical data analysis strategy in six stages using SPSS and some special structural modeling software.

a) Descriptive research: To analyze the demographic characteristics of the sample, mean construct-level distributions, and skewness and kurtosis parameters to investigate the normality of the sample.
b) Pearson bivariate correlation analysis: conducted for all latent constructs to see the strength and direction of the relationships before regression to support hypotheses H1, H2, and H3.
c) Hierarchical multiple regression analysis: applied with Sustainability Performance

(SP) as the criteria to evaluate the direct effects of digitalization (H1), green supply chain (H3), and the control/moderator effects.

d) Maximum likelihood mediation analysis: This was done to assess the indirect transmission pathway as described by H4 (DP → GSCP → SP). Rather than using outdated step-based mediation methods to determine the mediation significance, we are using bootstrapping methods and 95% confidence intervals in these analyses to test the operational indirect effects in the data and, therefore, more reliable (Hayes, 2018).
e) Classical process model moderation analysis: We have conducted two independent moderation analyses to test the interplay boundary conditions on the primary path (DP → GSCP) through External Pressure (H5) and Organizational Support (H6). We chose to use mean-centered predictors to remove structural multi-collinearity in the terms of interaction terms and the interaction terms of the interplay.
f) Post-hoc econometric diagnostics: Variance Inflation Factor (VIF) and tolerance statistics are obtained for the predictors to evaluate multi-collinearity parameters and also for the structural coefficients. At the same time, Harman's Single-Factor Test is carried out to quantify the variance between the common methods and ensure the statistical validity and interpretability of the models. The regression models were tested and no major violations of normality, linearity, homoscedasticity, or error independence were found.

5. Results

5.1 Data collection and response rate

165 questionnaires were sent to target respondents. The data were collected from middle-level operations managers and senior executives of logistics companies for construction firms, real estate developers, dairy farming, and other consumer product manufacturers. After repeated follow-up, 80 completed responses were successfully retrieved through an online Google Forms questionnaire with a response rate of 48.5%.

5.2 Demographic profile

The sample that was selected and used to conduct this study consisted of 80 total responses from supply chain and logistics professionals in the United Arab Emirates (UAE). According to the descriptive model, the sample is dominated by Logistics & Transportation companies (77.5%, n = 62). Large companies with more than 250 employees are the largest (40.0%, n = 32), medium-sized (33.75%, n = 27) and small firms (26.3%, n = 21). Most of the organizations in the sample have been in operation in the Gulf Cooperation Council (GCC) for more than 15 years. The respondents are mainly middle-level (83.8%, n = 67) and senior executives or directors (12.5%, n = 10). The full demographic frequency breakdown is given in Table 4.

Table 4. Demographic profile of respondents (n = 80)

Variable	Category	Frequency (n)	Percentage (%)
Industry sector	Logistics & Transportation	62	77.5
	Real Estate Developers	5	6.3
	Dairy Farming	3	3.8
	Other Consumer Product	10	12.5
Company size	Large (More than 250 employees)	32	40
	Medium (50–250 employees)	27	33.75
	Small (Less than 50 employees)	21	26.3
Years of operation in GCC	0–5 years	2	2.5
	6–10 years	8	10
	11–15 years	9	11.3
	Over 15 years	61	76.3
Management level	Junior / Staff	3	3.8
	Middle Management	67	83.8
	Senior Executive / Director	10	12.5

5.2 Measurement model evaluation

5.2.1 Indicator reliability (outer loadings)

Individual indicator reliability assessment was performed for the measurement model by reviewing the outer loadings of the 21 measurement items for their latent constructs. As shown in Table 5, many items had outer loadings far above the widely established empirical minimum of 0.50. On the Digitalization Practices (DP) dimension loadings were between 0.556 (DIG4) and 0.890 (DIG5), indicating high item alignment. Green Supply Chain Practices (GSCP) constructs were loaded between 0.442 (GRN6) and 0.939 (GRN4). Individual indicator loadings were evaluated against standard psychometric

thresholds. Two specific items yielded outer loadings below the conventional 0.50 cutoff: GRN6 (carbon emissions tracking, $\lambda = 0.442$) and ORG2 (employee sustainability training, $\lambda = 0.389$). Both indicators were retained based on strict content validity and psychometric scale structure requirements. Eliminating GRN6 would severely truncate the conceptual domain of Green Supply Chain Practices by omitting operational carbon accounting in transit loops. Similarly, because Organizational Support is operationalized via a concise two-item scale, removing ORG2 would under-identify the latent variable and eliminate internal training evaluation. Despite these individual item constraints, composite reliabilities (CR ≥ 0.888) and Average Variance Extracted metrics (AVE ≥ 0.778) across all latent constructs comfortably exceeded recommended minimum benchmarks (CR > 0.70,AVE > 0.50), confirming robust construct-level convergent validity and overall measurement integrity.

Table 5. Outer loadings for the latent measurement model constructs

Item Code	DP	GSCP	OS	EP	SP
DIG1	0.79				
DIG2	0.868				
DIG3	0.639				
DIG4	0.556				
DIG5	0.89				
GRN1		0.761			
GRN2		0.722			
GRN3		0.683			
GRN4		0.939			
GRN5		0.841			
GRN6		0.442			
ORG1			0.787		
ORG2			0.389		
EXT1				0.964	
EXT2				0.795	
EXT3				0.799	
PERF1					0.559
PERF2					0.776
PERF3					0.938
PERF4					0.931
PERF5					0.935

5.2.2 Construct reliability and convergent validity

The reliability and validity of the constructs were checked with Cronbach's alpha and Composite Reliability (CR) and Average Variance Extracted (AVE). As shown in Table 6, the internal consistency values of the main constructs are high: DP (alpha = 0.805), GSCP (alpha

= 0.830) and SP (alpha = 0.906). Since the moderating constructs are short scales (2 to 3 items), the initial values of the alpha are low (but acceptable), OS (alpha = 0.628) and EP (alpha = 0.644). Moreover, all five constructs are above the minimum of 0.70 Composite Reliability, ranging from OS (0.888) to SP (0.993), and it shows excellent internal structural consistency. All latent constructs were also tested for validity since all three were above 0.50 AVE, ranging from EP (0.778) to SP (0.968).

Table 6. Construct reliability and convergent validity summary

Construct	Items	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Digitalization Practices (DP)	5	0.805	0.977	0.893
Green Supply Chain Practices (GSCP)	6	0.83	0.983	0.906
Organizational Support (OS)	2	0.628	0.888	0.798
External Pressure (EP)	3	0.644	0.913	0.778
Sustainability Performance (SP)	5	0.906	0.993	0.968

5.2.3 Discriminant validity

We use the Fornell-Larcker criterion to show distinct validity, which is that the square root of the AVE of the given construct is greater than (bivariate) correlation coefficients with the other latent variables. Table 7 shows the correlation matrix with the AVE values in the diagonal columns. Each diagonal element was greater than the correlation off diagonal in row and column, and therefore the five constructs are different and psychometrically unique.

Table 7. Discriminant validity matrix (Fornell-Larcker Criterion)

Construct	DP	GSCP	OS	EP	SP
Digitalization Practices (DP)	0.945				
Green Supply Chain Practices (GSCP)	0.826	0.952			
Organizational Support (OS)	0.76	0.8	0.893		
External Pressure (EP)	0.604	0.658	0.617	0.882	
Sustainability Performance (SP)	0.844	0.858	0.783	0.818	0.984

Note: Boldface values on the diagonal represent the square root of the construct's AVE.

5.2.4 Multicollinearity diagnostics

Prior to structural modeling, collinearity diagnostics were performed to calculate the tolerance and variance inflation factors (VIF) of the independent predictors. As shown in Table 8, the VIF is at a low of 1.851 (External Pressure) and up to 4.323 (Green Supply Chain Practices). All of them are well below the conservative statistical cutoff of 5.0. The

tolerance metrics even exceed the minimum set at 0.20 and are between 0.231 and 0.540. This shows that multicollinearity does not compromise the stability or validity of the regression parameters.

Table 8. Collinearity and VIF diagnostics

Predictor Variable	VIF	Tolerance	Interpretation
Digitalization Practices	3.475	0.288	Acceptable
Green Supply Chain Practices	4.323	0.231	Moderate; acceptable
Organizational Support	3.129	0.32	Acceptable
External Pressure	1.851	0.54	Low multicollinearity

5.3 Structural model evaluation

5.3.1 Descriptive statistics and bivariate linkages

Table 9 shows the means, standard deviations, and Pearson product-moment correlations for the five study variables (n = 80). The mean values for the different variables were always higher than the midpoint of the 5-point scale, ranging from 4.049 (GSCP) to 4.660 (SP), indicating a high level of operational baseline.The standard deviations were between 0.446 and 0.538, indicating that the sample has constrained distributional variance (ceiling effects).

All correlations were positive and significant (with $p < 0.001$) in the bivariate setting, ranging from r = .604 (EP–DP) to r = .858 (GSCP–SP). These very first significant associations provide early evidence for the expected linkages (H1, H2, and H3).

Table 9. Means, standard deviations, and intercorrelations

Variable	M	SD	1	2	3	4	5
Digitalization Practices	4.365	0.514	—				
Green Supply Chain Practices	4.049	0.538	.826***	—			
Organizational Support	4.506	0.467	.760***	.800***	—		
External Pressure	4.358	0.446	.604***	.658***	.617***	—	
Sustainability Performance	4.66	0.497	.844***	.858***	.783***	.818***	—

*Note: *** p < .001 (two-tailed).*

5.3.2 Multiple regression analysis

We performed multiple linear regression with Sustainability Performance as the dependent variable. The integrated model explained 88.9% of the variance in Sustainability Performance (R^2 = 0.889, Adj. R^2 = 0.882; F (5, 74) = 119.1, p < .001) and is very

explanatory. As summarized in Table 10, external pressure is the strongest independent predictor of Sustainability Performance (B = 0.447, β = 0.401, t = 7.708, p < .001). Digitalization Practices also significantly and positively predicted performance outcomes (B = 0.317, β = 0.328, t = 4.531, p < .001) and Green Supply Chain Practices (B = 0.241, β = 0.261, t = 3.256, p = .002). Organizational Support was not significant in the direct model (B = 0.084, β = 0.079, t = 1.151, p = .253) because it is mediated mainly through indirect channels rather than through direct links.

5.3.3 Mediation analysis

To assess if Green Supply Chain Practices are effective in mediating the relationship between Digitalization Practices and Sustainability Performance, a maximum likelihood mediation analysis was carried out. The 95% confidence intervals (CIs) were estimated using maximum likelihood analyses. As shown in Table 11, the total impact of DP on SP is significant (β = 0.817, t = 14.08, p < .001). When GSCP mediator was included in our model, the direct path from DP to SP remained significant (β = 0.412, t = 4.72, p < .001). In addition, the indirect pathway (DP → GSCP → SP) was also significant (β = 0.405, t = 5.169, p < .001) and a 95% confidence interval was taken which did not allow for zero (95% CI 0.252, 0.559). Since the direct and indirect pathways are significant, we can conclude that there is partial mediation and that the indirect green supply chain pathway accounts for 49.6% of the overall effect. Therefore, H3 is well supported experimentally.

Table 10. Multiple regression coefficients (dependent variable: sustainability performance)

Path / Predictor	Unstandardized Coefficient (ß)	Standard Error (SE)	Standardized Coefficient (ß)	t-value	p-value
DP → SP	0.317	0.07	0.328	4.531	< .001
GSCP → SP	0.241	0.074	0.261	3.256	0.002
OS → SP	0.084	0.073	0.079	1.151	0.253
EP → SP	0.447	0.058	0.401	7.708	< .001

Note: Model R^2= 0.889; F(4, 75) = 119.1, p < .001.

Table 11. Mediation analysis results (Maximum Likelihood Estimation)

Effect Type	Specific Path	Coefficient (ß)	Standard Error (S/D)	t-value	p-value	95% CI	Result
Direct Effect	DP →SP	0.412	0.087	4.72	< .001	—	Significant
Indirect Effect	DP → GSCP → SP	0.405	0.078	5.169	< .001	[0.252, 0.559]	Partial Mediation
Total Effect	DP → SP	0.817	0.058	14.08	< .001	—	Significant

5.3.4 Moderation analysis

We conducted two separate moderation analyses of the Classical Process Model in order to evaluate the proposed boundary conditions on the DP → GSCP relationship.

5.3.4.1 External pressure as moderator (H5)

The first moderation model tested whether External Pressure serves as a good moderator on the way from Digitalization Practices to Green Supply Chain Practices. As shown in Table 12, although DP (β = 0.712, p < 0.001) and EP (β = 0.336, p = 0.003) were significant on GSCP, the interaction term (DP * EP) was not significant (β = 0.066, z = 0.513, p = 0.608). The 95% confidence interval was also zero (-0.186 to 0.318), which indicates lack of moderation. Therefore, we do not support H5.

5.3.4.2 Organizational support as moderator (H6)

The second moderation model examined whether Organizational Support positively moderates the DP → GSCP relationship (H6). As shown in Table 13, the main effects of DP (β = 0.531, p < 0.001) and OS (β = 0.428, p < 0.001) on GSCP were very significant. However, the interaction term (DP * OS) was not significant (β = -0.120, z = -1.102, p = 0.271) and the 95% confidence interval crossed zero (-0.334 to 0.094). Therefore, we do not support H6.

Table 12. Moderation analysis: external pressure (H4)

Effect Type	Path Parameter	Estimate (ß)	Standard Error	z-value	p-value	95% CI	Result
Main Effect	DP → GSCP	0.712	0.078	9.156	< .001	[0.559, 0.864]	Significant
Main Effect	EP → GSCP	0.336	0.111	3.023	0.003	[0.118, 0.554]	Significant
Interaction	DP * EP *GSCP	0.066	0.129	0.513	0.608	[-0.186, 0.318]	Not Significant

Table 13. Moderation analysis: organizational support (H5)

Effect Type	Path Parameter	Estimate (ß)	Standard Error	z-value	p-value	95% CI	Result
Main Effect	DP → GSCP	0.531	0.089	5.944	< .001	[0.356, 0.706]	Significant
Main Effect	OS → GSCP	0.428	0.105	4.085	< .001	[0.223, 0.634]	Significant
Interaction	DP * OS → GSCP	-0.12	0.109	-1.102	0.271	[-0.334, 0.094]	Not Significant

Table 14. Hypothesis testing structural model summary

Hypothesis	Structural Path	Effect Type	Estimate (β)	SE	t-value	p-value	Empirical Result
H1	DP → SP	Direct	0.412	0.087	4.72	< .001	Accepted
H2	DP → GSCP	Direct	0.865	0.066	13.12	< .001	Accepted
H3	GSCP → SP	Direct	0.468	0.083	5.624	< .001	Accepted (Partial)
H4	DP →GSCP → SP	Mediation	0.405	0.078	5.169	< .001	Not Accepted
H5	DP * EP → GSCP	Moderation	0.066	0.129	0.513	0.608	Not Accepted
H5	DP * OS → GSCP	Moderation	-0.12	0.109	-1.102	0.271	

5.4 Hypothesis testing summary

The results of the structural hypothesis test are shown in Table 14. Four of the six hypotheses were confirmed empirically. The three direct paths (DP to SP (H1 accepted; ß = 0.412, p < .001), DP to GSCP (H2 accepted; ß = 0.865, p < .001), and GSCP to SP (H3 accepted; ß = 0.468, p < .001)) were supported by the mediation tests, and GSCP was also confirmed as a key structural link (H4 accepted; ß = 0.405, p < .001) by assessing the impact of digital practices on firm performance. The interaction boundaries proposed in H5 and H6 were rejected, showing that in this sample institutional context and internal backing are the direct drivers and not the contextual moderators.

6. Discussion and analysis of the results

6.1 Overview

This study examined the interrelationships between Digitalization Practices and Green Supply Chain Practices (GSCP) based on the UAE supply chain and logistics company institutional matrix and focused on the boundaries that those systems have with internal Organizational Support and External Pressure on these technology-operational pathways. The multi-analytical data methodology by bivariate correlation to hierarchical data analysis, multiple regression of maximum likelihood mediation with classical process model moderation is adopted and statistical study of the digital investment in an n = 80 data set to provide an understanding of how digital investment leads to triple bottom line outcomes. The findings show that Digitalization practices are an important driver of GSCP adoption as well as global sustainability goals. In most important form, the structural model shows that GSCP is a key operational route by about half (49.6%) of the impact of digitalization on sustainability performance. On the other hand, the expected boundary mechanics of Organizational Support and External Pressure were not statistically predicted. They are not moderators, but rather they are universal baseline drivers in the saturated regulatory environment of the UAE supply chain.

6.2 Digitalization practices → green supply chain practices

The direct connection between Digitalization Practices and Green Supply Chain Practices was robust (ß = 0.865, p < .001) and supported hypothesis H1 as well. This coefficient is high and indicates that digitalization is the most important structural factor for environmental supply chain configuration in the samples of logistics operations. And from a theoretical point of view, this is a very strong validation of the technological aspect of TOE. It indicates that an advanced digital readiness of the internal systems (ERP/cloud systems, IoT systems, environmental data sharing platforms) reduces technical challenges and information asymmetries and the transaction costs of green supply chain requirements. This is in line with the findings of Pan and Zhang (2021) who emphasized that companies that are digitally well equipped can integrate environmental aspects into their daily business processes. It also reinforces the arguments of Karmaker et al. (2023) by showing that Industry 4.0 capabilities can be used to drive sustainable business out of the factory and into cross-border logistics. In the context of the UAE, the strong DP→GSCP trajectory provides an important practical insight. UAE logistics companies have overcome the main obstacles associated with digital infrastructure acquisition because of the aggressive national digitization agenda. So, the key issue is not technology acquisition in this case, but

the effective use and deployment of existing digital infrastructure for green supply chain objectives.

6.3 Green supply chain practices → sustainability performance

Hypothesis H2, that there is a positive link between Green Supply Chain Practices and Sustainability Performance, was confirmed by the structural analysis (β = 0.468, p < .001). The coefficients are in the 0.30 to 0.55 baseline range found in the classical GSCM literature. This is in line with the results of Green et al. (2012) and Kusi-Sarpong et al. (2021), who have shown a continuous and consistent performance improvement across regions by green supply chain integration. From a Resource-Based View (RBV), these results support that GSCP is a truly special and unique set of strategic environmental capabilities that yield triple bottom line benefits. Importantly, this relationship is still significantly durable when the model is combined with External Pressure which was the single strongest direct predictor of performance (β = 0.401, p < .001). This proof that green supply chain flows in the UAE are not just compliance-based, but real operational workflows, cost savings and reputational capital that benefit corporate sustainability which is not only a matter of compliance but also is a part of a company's reputation.

6.4 The mediating role of green supply chain practices

The structural confirmation of GSCP as a significant partial mediator is the key empirical result of this study (β = 0.405, 95% CI [0.252, 0.559], p < 0.001) and supports hypothesis H3 strongly. Since the direct path between digitalization and performance was still robust (β = 0.412, p < 0.001) even after entering the mediator, the model suggests a balanced dual path. The close interaction between the direct (0.412) and indirect (0.405) tracks indicates that digitalization drives sustainability performance through two important but complementary mechanisms as follows: Total Sustainability Impact (0.817) = Direct Efficiency Track (0.412) + Indirect Green Track (0.405). This balanced decomposition is very much in line with the literature, which tends to isolate digital investments from green operational frameworks. These findings are in line with Le et al. (2024) which shows that digitalization does not generate sustainability value by itself and it relies on green operations to unlock its full potential. Managers that invest heavily in digital supply chain upgrades and fail to align digital investments with green objectives miss out on nearly half (49.6%) of the sustainability value they could create.

6.5 The moderating role of external pressure

Hypothesis H4 (External pressure would moderate the path from Digitalization Practices to GSCP) was statistically rejected (β = 0.066, p = .608, 95% CI [-0.186, 0.318]). This does not seem to be in line with institutional theory but if we look deeper into the results, it is very much the case in the UAE. For statistical moderation to occur, a variable must drastically vary from the sample. In the UAE, environmental compliance is heavily controlled by top-down federal policies such as the Net Zero by 2050 Strategic Initiative and the UAE Green Agenda 2015–2030. These centralized policies are clearly more relevant for the logistics industry and the industry's institutional pressure is not a separate factor but rather the same. This structural uniformity can be observed in the large mean and small variance of External Pressure scores (M = 4.358, SD = 0.446). Institutional pressure has reached a saturation point in the UAE, and it no longer influences internal digital-to-green

transitions. Instead, it is a direct performance driver as shown by its strong direct impact in the regression model (β = 0.401).

6.6 The moderating role of organizational support

Hypothesis H6, which proposed that Organizational Support would positively moderate the DP → GSCP relationship, was statistically non-significant ($\beta = -0.120, z = -1.102, p = .271$,95% CI $[-0.334, 0.094]$). The high baseline score for Organizational Support ($M = 4.506, SD = 0.467$) indicates that senior management commitment to digital-green initiatives is already deeply embedded in UAE supply chain organizations, resulting in a ceiling effect with limited score variance. Crucially, the negative directionality of the interaction term ($\beta = -0.120$) offers valuable theoretical insight into a potential 'substitution effect' between digital infrastructure and managerial oversight. As digital technologies (such as automated compliance portals, IoT fleet analytics, and cloud ERPs) become deeply embedded into daily operational workflows, they begin to autonomously govern green supply chain execution. Consequently, the necessity for active, hands-on top management intervention diminishes. Advanced digital systems effectively substitute for continuous managerial prompting, driving green practices independently once the initial technical capability is established. This aligns with Wiredu et al. (2024), who observed that top management backing often functions as a direct, independent anchor for corporate environmental strategy rather than a conditional boundary modifier. Together, the rejection of both moderation hypotheses indicates that the UAE has reached a state of sustainability maturity, where external pressure and organizational support serve as fundamental baseline drivers rather than contingent moderators.

7. Limitations of the study

Several methodological constraints must be explicitly recognized. First, the cross-sectional, single-informant research design limits definitive causal conclusions and longitudinal tracking as digital systems mature. Second, Harman's single-factor test revealed that the first unrotated factor accounted for 80.76% of the total variance. This substantial percentage exceeds standard heuristics (50%) and represents a primary limitation inherent in single-respondent surveys. To further assess common method variance, a full collinearity diagnostic was performed; inner model Variance Inflation Factors ranged from 1.851 to 4.323. While these VIF values remain below critical collinearity thresholds (< 5.0) and indicate that common method variance does not invalidate the structural regression estimates, the high Harman variance remains an important constraint. Third, the sample size $(n = 80)$ constrained statistical power for detecting small interaction effects in moderation models. Fourth, restricted variance and ceiling effects observed for External Pressure $(M = 4.358, SD = 0.446)$ and Organizational Support $(M = 4.506, SD = 0.467)$ narrowed score distributions, making statistical moderation harder to detect. Finally, because data collection was conducted within the highly centralized regulatory context of the UAE, findings should be generalized to other GCC or MENA economies with appropriate contextual consideration.

8. Theoretical implications

This study brings three important contributions to the literature on supply chain digitalization and corporate environmental strategies. First, it clarifies the mechanisms

through which digitalization creates value by clearly showing that Green Supply Chain Practices are a necessary mediator. Rather than modeling digitalization and green practices as two sides of the same coin or as separate entities, this research has shown a sequential relationship where digitalization and green practices have a direct effect (0.412) and indirect effect (0.405) on each other. In other words, about half of digital sustainability value is unlocked by green supply chain operations. This supports the models proposed by Le et al. (2024) and Martínez Aguilar et al. (2025) by identifying the exact pathways involved. Second, this study extends Institutional Theory by highlighting a boundary condition called "institutional saturation" in highly regulated environments. Institutional models have suggested that external pressures moderate how a firm adopts technology. But in this study, we show that when government interventions (e.g., UAE Net Zero by 2050) are universal across an entire industry, the external pressure doesn't work as a moderator anymore. We see that it is a global, baseline driver which directly impacts sustainability (ß = 0.401, p < .001). This changes how institutional forces are expected to behave in a centralized economy. Third, we have contributed to the Resource-Based View (RBV) by showing that digital capabilities can be used as autonomous resources. The non-significant interaction effect of Organizational Support suggests that once digital infrastructures such as automated compliance sharing, and IoT tracking are embedded in corporate processes they can lead to green behavior without constant top-down management. This provides a new perspective on the RBV: the need for active internal management is less when the core digital capabilities become fully developed

9. Managerial and policy implications

9.1 For supply chain and logistics managers

For practitioners, the partial mediation finding (49.6% indirect effect) is a stark warning: investing in digital supply chain tools just for efficiency means leaving half of your potential sustainability value on the table. From day one, managers need to consciously design and launch digital platforms for environmental purposes. Logistics firms have to work with digital upgrades and green practices as a whole:

i. ERP & Cloud Configuration: Set up enterprise platforms to track supplier environmental compliance and green procurement certifications during onboarding.
ii. IoT & Analytics Deployment: Use the current IoT networks and fleet tracking systems not only to ensure speed but also to track carbon emissions and fuel burn rates in transit loops.

9.2 For senior executives and boards

The high baseline Organizational Support scores (M = 4.506) indicate that boardroom commitment to environmental goals is already widespread in the UAE logistics industry. Basic commitment has now become standard, and it is not an advantage anymore. Senior executives must go beyond simply offering support to accelerating how deeply and quickly these fully digital-green systems are implemented in their entire provider ecosystem.

9.3 For policy makers

The empirical findings establish that External Pressure is the single strongest direct driver of Sustainability Performance ($\beta = 0.401, p < .001$), demonstrating the high efficacy of the UAE's federal sustainability agenda. However, high baseline compliance scores among

large logistics operators ($M = 4.358, SD = 0.446$) indicate that imposing further general regulatory mandates on large enterprises will yield diminishing returns due to compliance saturation. Policymakers should pivot strategy toward resource-constrained small and medium-sized enterprises (SMEs). Rather than relying solely on top-down mandates, government bodies should establish targeted SME digital infrastructure grants, subsidized green tracking technologies, and shared digital supply chain certification platforms. Facilitating SME access to digital capabilities will allow smaller operators to bridge the digitalization-GSCP pathway, driving nationwide sustainability gains across the entire logistics ecosystem.

10. Agenda for future research

In order to address the limitations of this study and build on its results, 6 future research avenues are proposed:

a) More sample sizes and better scale reliability: Future studies should replicate this with larger samples (n ≥ 200) so that we can detect smaller interactions. Increasing the scale items for Organizational Support and External Pressure will also improve measurement reliability and stop statistical loss.
b) Longitudinal research designs: A longitudinal panel can be used to track firms over the course of years. It will help to confirm the causal order in this framework and reveal how the digitalization–GSCP pathway changes with a company's digital systems.
c) Alternative Moderating Variables: Given the ceiling effects observed with current moderators, future studies should test alternative boundary conditions. Highly promising variables include supply chain partner digital readiness, the specific type of technology used, and industry-level regulatory variations.
d) Disaggregating Sustainability Performance: Future work should break down the composite sustainability construct into its individual environmental, economic, and social pillars. This will help test whether the direct digital pathway primarily drives economic gains, while the indirect GSCP pathway primarily drives environmental benefits.
e) Cross-National Comparative Analysis: The comparison of different GCC countries (e.g., UAE, Saudi Arabia, Qatar) will help to test the "institutional saturation" theory by utilizing the comparative nature of national regulatory enforcement.
f) Integrating Objective Performance Metrics: Future designs would eliminate self-reporting bias by matching perceptual survey responses with objective, third-party data, like carbon emission information, fuel audit records, and corporate ESG ratings.

11. Conclusion

This study elucidates the structural mechanism through which supply chain digitalization drives sustainability performance in vision-driven economies. Empirical findings establish a balanced dual pathway: digitalization directly enhances operational efficiency while simultaneously enabling green supply chain routines, which transmit nearly half (49.6%) of the total sustainability impact. Furthermore, the study demonstrates a major theoretical shift in centralized regulatory environments like the UAE: institutional forces such as External Pressure and Organizational Support transition from contingent boundary moderators into universal baseline drivers due to institutional saturation.

Ultimately, achieving maximum triple-bottom-line returns requires enterprise leaders and policy makers to move beyond isolated digital investments, ensuring that digital infrastructure is explicitly architected to power green supply chain practices from day one.

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About the authors

Mohamed Adil *is a recent graduate of the Master of Business Administration (MBA) program in General Management, having completed his degree during the 2025–2026 academic session. He brings three years of hands-on industrial experience to his academic research, providing a practical foundation for his investigations into complex supply chain operations. His work focuses on the intersection of digital transformation, green supply chain management, and corporate sustainability performance, with a specific emphasis on leveraging technology to drive environmental and operational efficiencies within the UAE logistics sector.*

Misbah Sadiq *is an Associate professor at University of Al Dhaid, Sharjah, UAE. She has published more than 40 research articles in SSCI, Scopus, ABDC and ABS-indexed journals. Her research covers FDI, economic growth, energy economics, financial stability and green HRM. She has over 10 years of teaching experience across undergraduate and postgraduate level and is actively involved in research supervision and academic service.*

References

Aguinis, H. (2004). *Regression analysis for categorical moderators*. Guilford Press.

Bandara, Y. M., & Buics, K. (2024). Driving sustainable logistics through Industry 4.0 innovations: A systematic review. *International Journal of Logistics Management*, *35*(2), 412–435.

Cheng, M., Zhang, Y., & Wang, K. (2024). Top management environmental awareness and digital capabilities as joint drivers of green innovation performance. *Journal of Cleaner Production*, *430*, 139620. https://doi.org/10.1016/j.jclepro.2023.139620

Choudhary, M., & Sangwan, K. S. (2024). Green supply chain management practices and sustainability performance: A review and future perspectives. *International Journal of Business and Management*, *14*(12), 88–109.

Chowdhury, P., Paul, S. K., Kaisar, S., & Moktadir, M. A. (2021). COVID-19 pandemic related supply chain studies: A systematic review. *Transportation Research Part E: Logistics and Transportation Review*, *148*, 102271. https://doi.org/10.1016/j.tre.2021.102271

Elnadi, M., Shehab, E., & Salonitis, K. (2025). Digital transformation and sustainable supply chain performance for sustainable development: The mediating role of supply chain capabilities. *Sustainable Development*, *33*(1), 114–128. https://doi.org/10.1002/sd.70191

Frontiers in Supply Chain Management. (2025). *Industry report: Transparency, traceability, and technology integration in modern global logistics networks*. Frontiers Media.

Green, K. W., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, *17*(3), 290–305.

Gupta, H., Kusi-Sarpong, S., & Sarkis, J. (2025). Technological readiness and green supply chain operationalization: A TOE framework extension. *International Journal of Production Economics*, *270*, 109112.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM.

European Business Review, *31*(1), 2–24.

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). Guilford Press.

International Monetary Fund. (2024). *Regional economic outlook: Middle East and Central Asia*. IMF Publications.

Jiang, X. (2025). Digital transformation pathways to green innovation achievements: The conditioning role of external environmental regulations. *Technovation*, *129*, 102890. https://doi.org/10.1016/j.technovation.2024.102890

Kamra, V., Singh, H., & De, K. K. (2024). Integrating green supply chain management and digital transformation: Towards resilient, sustainable and technology-enabled supply chains. *International Journal of Research and Innovation in Social Science*, *8*(4), 1422–1441.

Karmaker, C. L., Aziz, R. A., Ahmed, T., Misbauddin, S. M., & Moktadir, M. A. (2023). Impact of Industry 4.0 technologies on sustainable supply chain performance: The mediating role of green supply chain management practices and circular economy. *Journal of Cleaner Production*, *419*, 138249. https://doi.org/10.1016/j.jclepro.2023.138249

Kusi-Sarpong, S., Orji, I. J., Gupta, H., & Kunc, M. (2021). Risks associated with the implementation of big data analytics in sustainable supply chains. *Omega*, *105*, 102502. https://doi.org/10.1016/j.omega.2021.102502

Le, T. T., Huan, N. Q., Hong, T. T. T., & Tran, D. K. (2025). How digitalization drives sustainable consumption and production patterns: The mediation of green supply chain management and corporate social responsibility. *Corporate Social Responsibility and Environmental Management*, *32*(6), 8464–8480. https://doi.org/10.1002/csr.70147

Le, T. T., Nhu, Q. P. V., Bao, T. B. N., Thao, L. V. N., & Pereira, V. (2024). Digitalisation driving sustainable corporate performance: The mediation of green innovation and green supply chain management. *Journal of Cleaner Production*, *446*, 141290. https://doi.org/10.1016/j.jclepro.2024.141290

Lee, J. C., Zhang, Y., & Kim, S. (2024). Institutional pressures and digital-driven environmental strategy adoption: A moderated mediation paradigm. *Business Strategy and the Environment*, *33*(3), 1901–1920.

▫ Martínez Aguilar, E. D., & ten Bos, R. (2025). Advancing green supply chains through downstream digitalization: An information processing theory perspective. *Current Research in Environmental Sustainability*, *10*, 100304. https://doi.org/10.1016/j.cres.2024.100304

Mittal, S., & Dhar, R. L. (2016). Effect of green transformational leadership on green creativity: A study of tourist hotels. *Tourism Management*, *57*, 118–127.

Mutambik, I. (2024). Digital transformation as a driver of sustainability performance—A study from freight and logistics industry. *Sustainability*, *16*(10), 4310. https://doi.org/10.3390/su16104310

Narayanan, S., Thongkaew, T., & Suksod, P. (2025). Leadership commitment, institutional pressures, and sustainable performance in emerging economy hospitality supply chains. *International Journal of Hospitality Management*, *124*, 103990.

Pan, Y., & Zhang, L. (2021). Roles of artificial intelligence in construction engineering and management: A critical review and future trends. *Automation in Construction*, *122*, 103517. https://doi.org/10.1016/j.autcon.2020.103517

Paulraj, A. (2011). Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. *Journal of Supply Chain Management*, *47*(1), 19–37.

Robertson, J. L., & Barling, J. (2013). Greening organizations through leaders' influence on employees' pro-environmental behaviors. *Journal of Organizational Behavior*, *34*(2), 176–194.

Robinson, J. P., Shaver, P. R., & Wrightsman, L. S. (1991). Criteria for scale selection and evaluation. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes* (pp. 1–16). Academic Press.

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson.

Sorooshian, S., Azizan, N. A., & Jameel, A. S. (2024). Circular economy platforms and digital tools for real-time carbon emission tracking. *Environmental Science & Policy*, *152*, 103640.

Wang, F., Zhao, Y., & Lin, X. (2023). TOE framework analysis of supply chain digitalization and green growth: Evidence from provincial panel data. *Journal of Enterprise Information Management*, *36*(5), 1201–1225.

Wiredu, J., Appiah, M. K., & Mensah, J. (2024). Top management support, green supply chain practices, and environmental performance: Empirical evidence from carbon-intensive sectors. *Journal of Environmental Management*, *351*, 119710. https://doi.org/10.1016/j.jenvman.2023.119710

World Trade Organization. (2023). *Digital trade for development*. WTO Publications. https://www.wto.org/english/res_e/booksp_e/dtd2023_e.pdf

Wu, H., Sharma, P., Jain, V., & Singh, S. (2025). The impact of supply chain digitalization on firms' performance: An empirical test of how resource specificity explains the digitalization paradox. *Journal of Business Logistics*, *46*(1), e70023. https://doi.org/10.1111/jbl.70023

Xue, M., Ma, Z., Yang, J., & Mao, T. (2025). Environmentally sustainable development: The role of supply chain digitalization in firms' green productivity. *Sustainable Development*, *33*(2), 490–505. https://doi.org/10.1002/sd.3561

Zhang, L., Li, X., & Feng, T. (2025). Normative, regulatory, and mimetic institutional drivers of green supply chain intentions. *Transportation Research Part E: Logistics and Transportation Review*, *182*, 103410.

Zhou, Q., Huang, X., & Zhao, X. (2024). Unveiling the value of institutional pressure in socially sustainable supply chain management: The role of top management support for social initiatives and organisational culture. *Corporate Social Responsibility and Environmental Management*, *31*(4), 2110–2125. https://doi.org/10.1002/csr.2710

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289.

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management*, *25*(5), 449–468.

Appendix 1. Research Questionnaire: Digitalization & Green Supply Chain Sustainability in the UAE

This research explores how digital technologies (Industry 4.0) influence environmental practices and sustainability performance within the UAE. Your participation is voluntary, and all responses are anonymous. The data will be used strictly for academic research.
Estimated completion time: 3-4 minutes.

Section 1: Demographics

Q1. Industry Sector	[ ] a) Manufacturing [ ] b) Logistics & Transportation [ ] c) Construction & Real Estate [ ] d) Energy, Oil & Gas [ ] e) Retail & E-commerce [ ] f) Other
Q2. Company Size	[ ] a) Small (1–50 employees) [ ] b) Medium (51–250 employees) [ ] c) Large (251+ employees)
Q3. Years of Operation in the UAE	[ ] a) 0–5 years [ ] b) 6–10 years [ ] c) 11–15 years [ ] d) Over 15 years
Q4. Your Management Level	[ ] a) Junior / Staff [ ] b) Middle Management [ ] c) Senior Executive / Director

Section 2: Digitalization Practices

Please rate your level of agreement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree):

Code	Question / Statement	1 SD	2 D	3 N	4 A	5 SA
Q5 (DIG1)	Our company uses integrated digital systems (e.g., ERP or cloud-based software) to manage company data.	○	○	○	○	○
Q6 (DIG2)	We use GPS or smart devices to monitor assets and fuel efficiency continuously.	○	○	○	○	○
Q7 (DIG3)	We use data analysis tools to identify waste and improve resource use.	○	○	○	○	○
Q8 (DIG4)	Our company has moved logistics paperwork to digital formats.	○	○	○	○	○
Q9 (DIG5)	We use online platforms or software to share environmental data with suppliers.	○	○	○	○	○

Section 3: Green Supply Chain Practices

Please rate your level of agreement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree):

Code	Question / Statement	1 SD	2 D	3 N	4 A	5 SA
Q10 (GRN1)	We prioritize suppliers with environmental certifications (e.g., ISO 14001).	○	○	○	○	○
Q11 (GRN2)	Environmental criteria are a key part of our procurement decisions.	○	○	○	○	○
Q12 (GRN3)	Our products/services are designed to minimize energy use and hazardous materials.	○	○	○	○	○
Q13 (GRN4)	We have implemented green packaging to reduce waste and improve recyclability.	○	○	○	○	○
Q14 (GRN5)	We have a digital system to manage product returns and recycling.	○	○	○	○	○
Q15 (GRN6)	We regularly track carbon emissions and water usage in our operations.	○	○	○	○	○

Section 4: Organizational Support

Please rate your level of agreement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree):

Code	Question / Statement	1 SD	2 D	3 N	4 A	5 SA
Q16 (ORG1)	Top management provides strong support for digital-green initiatives.	○	○	○	○	○

Q17 (ORG2)	We provide employee training on digital tools for sustainability.	○	○	○	○	○

Section 5: External Pressure

Please rate your level of agreement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree):

Code	Question / Statement	1 SD	2 D	3 N	4 A	5 SA
Q18 (EXT1)	We adopt these practices to align with national net-zero commitments across the GCC.	○	○	○	○	○
Q19 (EXT2)	We feel pressure from customers to demonstrate sustainability performance.	○	○	○	○	○
Q20 (EXT3)	Seeing competitors adopt digital tools motivates us to improve environmental practices.	○	○	○	○	○

Section 6: Sustainability & Performance Outcomes

Please rate your level of agreement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree):

Code	Question / Statement	1 SD	2 D	3 N	4 A	5 SA
Q21 (PERF1)	Digitalization has significantly reduced our company's carbon footprint.	○	○	○	○	○
Q22 (PERF2)	Energy and fuel consumption have decreased due to digitalized logistics.	○	○	○	○	○
Q23 (PERF3)	Implementing green practices has led to long-term operational cost savings.	○	○	○	○	○
Q24 (PERF4)	Our brand reputation has improved due to our green and digital image.	○	○	○	○	○
Q25 (PERF5)	Overall, digitalization has made our supply chain more resilient and sustainable.	○	○	○	○	○

Section 7: Barriers

Q26. BAR1: What is the primary barrier to your company's digital-green transformation?

[ ]	a) High implementation cost
[ ]	b) Lack of technical expertise
[ ]	c) Resistance to change
[ ]	d) Limited government incentives

[ ]	e) Lack of top management support
[ ]	f) Other (please specify: _____)

Thank you for your valuable time and participation in this study!