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Supply Chain Optimisation, Digitalisation, and Performance: The Mediating Role of Integration in a Developing Economy

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Abstract

Rapid changes in technology, globalization, and exposure to external shocks have rendered global supply chains increasingly vulnerable, particularly in developing economies. This paper explores the connections between supply chain optimization practices, digitalization capabilities, supply chain integration, and supply chain performance, with a particular focus on the mediating role of integration in Bangladesh. The study employs Ordinary Least Squares (OLS) regression and mediation analysis on hypotheses based on survey data from 267 supply chain professionals in manufacturing, logistics, retail, and export-oriented industries. Results indicate that digitalization capabilities and supply chain optimization practices significantly improve supply chain performance. However, these effects are not uniform. The link between optimization practices and performance is fully mediated by supply chain integration, meaning that the benefits of optimization are limited unless supported by integrated planning, information sharing, and coordinated decision-making. Conversely, the impact of digitalization on performance is partially mediated by integration, showing that digital capabilities positively influence performance both directly and indirectly through internal decision-making and integration processes. Framing integration as a conditional transmission mechanism, rather than a presumed ability, contributes to supply chain capability theory and extends empirical research in a developing economy characterized by structural inefficiencies and coordination challenges. The findings offer practical insights for managers and policymakers aiming to translate operational and digital investments into sustainable performance outcomes.

Keywords: Supply chain optimisation; Digitalisation capability; Supply chain integration; Supply chain performance; Developing economy, Bangladesh

I. INTRODUCTION

The rapid change in technology and exposure to external shocks have contributed to the complexity and vulnerability of supply chains, especially due to globalisation. The COVID-19 pandemic highlighted these weaknesses, as total international trade decreased by an average of 5.3% in 2020, and more than three-quarters of companies worldwide experienced logistical delays and supply disruptions (Dabić-Miletić, 2026). The firms are currently experiencing an average of 3.7 significant supply chain disruptions of one month or more that have caused cumulative losses of 30-50% of annual EBITi over ten years (Fatimah & Puspitasari, 2026). All these disturbances have worsened the necessity of not only efficient supply chains but also digitally-enabled and structurally integrated supply chains. The optimisation of the supply chain has thus become a major concern of management. Inventory rationalization, reduction in lead time, and logistics coordination, as well as process alignment practices, have been found to cut operating costs by 10-30 percent and inventory holding costs by 20-40 percent in industries that are manufacturing- and logistics-intensive (Mwandla et al., 2026). There is also empirical support for the fact that optimisation efforts are associated with enhanced delivery reliability, order fulfilment, and service quality (Khairi et al., 2025). Nevertheless, the research suggests the decreasing returns to optimisation when applied independently, especially in the presence of demand uncertainty, or poor organisational coordination (Khan et al., 2025; Rafli and Irjayanti, 2025).

Supply chain operations have also been changed further through digitalisation. In 2023, the global investments into the supply chain digital technologies were more than USD 8.6 billion, comprising ERP systems, big data analytics, IoT, and digital platforms (Sarwar & Shafiq, 2025). Firms that are digitally mature show reduced decision-making cost, accuracy in the forecasts as well as enhanced operational performance (Jafari, Akhavan, and Amirhossein, 2025). However, the recent research warns that digitalisation is not a sure way to achieve improvements in performance without the corresponding capabilities in organisations (Tian & Cui, 2025). Those difficulties can be observed especially in Bangladesh, where the supply chains hire over 35% of the industrial employees and the ready-made garments industry brings over 80% of the export earnings (Jebin, 2022). Although it is economically significant, supply chain integration is still ineffective, with manual processes, minimal digitalization, and high dependency of the supply chain on intermediaries. The post-harvest losses (25-30 percent) in agri-food supply chains are caused by poor sourcing and poor integration (Hossain, 2017).

II. OBJECTIVE OF THIS STUDY

This research paper focuses on investigating the effects of supply chain optimisation practices and digitalisation capability on supply chain performance, as well as the mediating role of supply chain integration in a developing economy.

III. CONCEPTUAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Supply chain optimisation is defined as the process of enhancing the supply chain operations in an orderly manner in order to obtain the best efficiency and effectiveness in the sourcing, production, inventory, transportation, and distribution (Rafli & Irjayanti, 2025). It entails analytical procedures, process synchronization, and synchronized utilization of resources to minimize expenditures and squandering as well as enhance the degree of service and reactivity to changes in demand (Mentzer et al., 2001). At the operational level, optimisation improves the efficiency of the supply chain system by ensuring that the flow of materials,

information, and money used in the supply chain is efficient (Sarwar & Shafiq, 2025). Supply chain integration, on the other hand, indicates how far organisations plan internal operations to external partners, such as suppliers and customers, in managing supply chain activities as one system (Zhang et al., 2025). This is done by means of sharing information, planning together, and decision making in order to enhance coordination and performance outcome (Mwandla et al., 2026). As evidenced in the existing literature on supply chain management, optimisation, digitalisation, and integration have become increasingly important in improving the performance of the supply chain, especially in uncertain and resource-constrained settings. Based on the insights of the global and developing-economy views, this research consolidates the existing empirical and theoretical works in order to find the gaps and construct the conceptual framework and hypotheses.

H1: Supply chain optimisation practices positively influence supply chain performance

There is a significant amount of empirical evidence to prove that there is a positive correlation between supply chain optimisation practices and performance. Investigating the logistics processes in the automotive industry of South Africa, Mwandla et al. (2026) discovered that the optimisation of storage arrangements, inventory management, and logistics coordination contributes to a high level of operational efficiency and to the overall supply chain performance. The same case can be noted with perishable supply chains, which have been optimised to decrease bottlenecks, expenses, and the lack of reliability of services. This relationship is also evidenced in Bangladesh. According to Hossain (2017), the inefficiencies of vegetable supply chains are caused by ineffective sourcing, inventory management, and the involvement of too many intermediaries, which results in the arrival of increased costs and waste. By comparison, improved sourcing optimisation increases efficiency and profitability. In COVID-19 disruptions, RMG firms that had focused on lead-time reduction, sourcing diversification, and logistics optimisation were in a position to maintain performance better (Jebin, n.d.). On the grander scale of systems, Khubisa and Olugbara (2026) show that the optimised agricultural processes lead to the minimisation of losses and enhancement of productivity, which enhances the overall performance of the supply chain. Nevertheless, there are other studies with conditional or weak effects. According to Rafli and Irjayanti (2025), green supply chain optimisation practices applied at McDonalds Bandung have a low effect on the outcome of the Triple Bottom Line. Likewise, Khan et al. (2025) state that inventory optimisation technologies ensure better performance only under certain circumstances, and demand uncertainty seriously deteriorates the optimisation performance correlation. In spite of the limitations, the existing evidence confirms the claim that supply chain optimisation has a positive impact on performance, which results in the development of Hypothesis 1.

H2: Digitalisation Capability positively influences supply chain performance.

Substantial amounts of literature support the idea that digitalisation competence can improve supply chain performance, through the boost of agility, coordination, and quality of decisions. Jafari, Akhavan, and Amirhossein (2025) demonstrate that supply chain digitalisation with the use of big data analytics greatly contributes to agility and, in its turn, to performance improvement. In the same vein, Sarwar and Shafiq (2025) conclude that the direct beneficial impact that digitalisation has on the textile industry of Pakistan is positive, and technology management serves as a mediator. Beigi Firoozi et al. (2025) also point out that integration of digital platforms, especially the data integration, has a positive effect on innovation performance. In terms of sustainability, according to Mrad and Belgaroui (2025), digitalisation enhances the performance of the supply chain of both SMEs economically and environmentally. Although Poku et al. (2025) observe no direct effect on resilience, they establish high indirect effects via supply chain ambidexterity. On the other hand, other researchers indicate that digitalisation

impacts are context-based. Tian and Cui (2025) demonstrate that digitalisation is more likely to improve resilience than instant performance results, and Awuah-Gyawu, Otchere Fianko, and Etse (2025) conclude that the role of resilience lies in the mediation of digitalisation to performance. Regardless of these subtleties, the evidence, in general, confirms digitalisation capability as an important supply chain performance driver, which justifies Hypothesis 2.

H3a: Supply chain integration mediates the relationship between supply chain optimisation practices and supply chain performance.

The emerging body of supply chain research is raising doubts over the direct and homogeneous impact of supply chain optimization practices (OP) on supply chain performance (SCP). Rather, some data indicate that optimisation projects tend to need a mediating coordination mechanism that allows the local efficiency gains to be converted into system-wide performance delivery. This change has taken supply chain integration (SCI) out of the peripheral capability to a central explanatory construct. Emon and Ahmed (25) demonstrate that performance-based gains of green practices based on optimisation are not significant unless they are mediated by enabling mechanisms, like the adoption of technology. Their results show that single optimisation initiatives are still operationally diffused and do not produce visible results. Their study is based on technological mediation; however, the logic is very similar to SCI since they both are used to align processes and coordinate activities within the supply chain. In line with this opinion, Rashid and Rasheed (2025) show that supranormal technologies and analytics have a non-direct impact on sustainability performance on organisational absorptive capacity and ambidexterity. This ability-based channel lays emphasis on the shortcomings of the direct-effect model and supports the claim that optimisation demands integrative structures to disseminate profits on organisational and inter-organisational lines. Chen and Sun (2025) go on to posit that, in the absence of effective mediating mechanisms, integration-driven efficiencies do not result in observable performance outcomes and this supports the theoretical suggestion of the fact that optimisation achieves better results in the presence of effective translation mechanisms. Nevertheless, there is also recent evidence upon which the relevance of SCI as a mediator is contested. Ma et al. (2025) discover that green entrepreneurial orientation is significant in promoting sustainable performance, but market orientation is not, and the relationship between green supply chain management and other relationships is selective. This implies that the presence of the integrative mechanisms does not guarantee strategic alignment and efficiency in resource utilisation. On the same note, Idayanti and Nurlia (2025) show that the green accounting programs are not directly associated with better firm value, but only when it is converted into financial performance, which means that optimisation can be achieved without a highly integrated supply chain. Khan et al. (2025) also reveal that information systems have a positive impact on the inventory performance, but the main mediating force is uncertainty and not the integration. Taken together, these results indicate that SCI is not a universal transmission process and the relationship between optimisation and performance is extremely context specific. However, the wider literature is favouring SCI as an important mediating capability by which optimisation practices are turned into superior performance. The hypothesis is as follows, based on this.:

H3b: Supply chain integration mediates the relationship between digitalisation capability and supply chain performance.

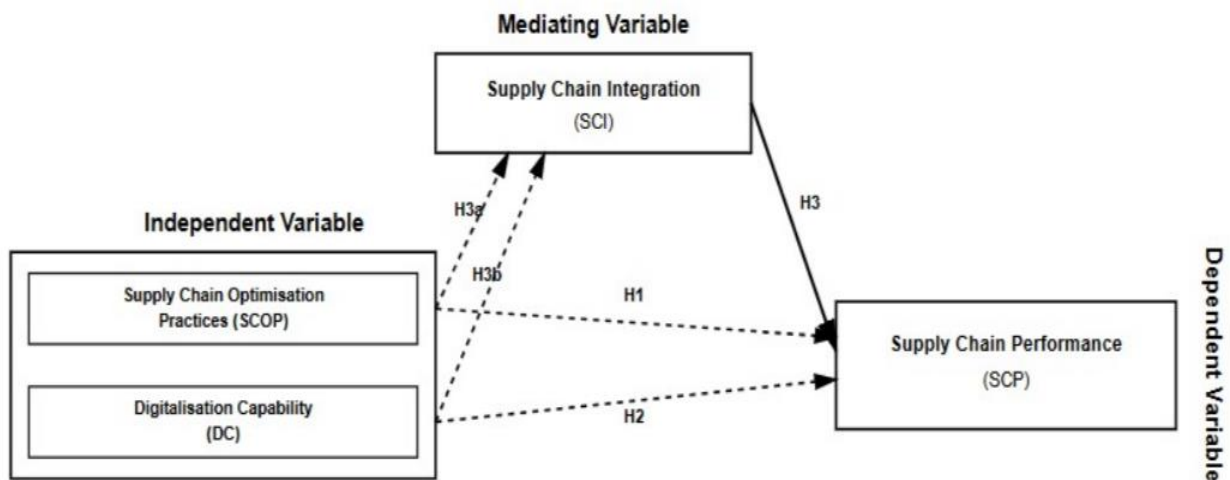
Empirical findings recently confirmed the same idea, showing that the creation of value by digitalisation capability is only achieved when it is embedded in coordinated and integrated processes of a supply chain as opposed to being a standalone technological change. Tetteh and Owusu Kwateng (2025) show that supply chain digitalisation raises the flexibility, by integrating both the physical and financial flows, in which the authors depict integration as the key channel

through which transmission is transmitted to performance. Their SEM-NCA findings indicate that digital value creation is impossible without integration, but the integration is limited in generalisability by the manufacturing emphasis and Ghanaian setting. There is Pakistani evidence to back this conditional opinion. Rehman and Imran (2025) discovered that digitalisation enhances performance only when it is supported by organisational performance capacities like resilience and risk management, and this means that technology has to be integrated into routines. Anwar, Qaiser, and Anam (2025) explicitly mediate integration with the help of PLS-SEM and determine an important indirect influence of digitalisation on performance with the mediants of SCI, although the sample size restrictions are present. The same tendencies are observed in unconventional supply chains. Fatimah and Puspitasari (2026) demonstrate that digital transformation and AI have the impact on performance indirectly, through the channel of operational efficiency, whereas Motwani and Kataria (2025) point at internal coordination as the most important channel between digital capability and performance. On the other hand, Beigi Firoozi et al. (2025) discover that process integration is not a mediator of the connection between digital leadership and innovation performance, as data integration plays the central role of transmission. This puts into question the fact that process integration is an automatic consequence of digital capability. On the whole, even though integration is not a necessary and sufficient condition, literature justifies SCI as a major mediating factor.

IV. RESEARCH GAPS AND CONCEPTUAL FRAMEWORK

Supply chain optimisation and digitalisation are the primary drivers of supply chain performance studied in the existing literature, with little empirical research on the mechanisms that drive these factors. Besides, supply chain integration is usually presumed to enable performance improvement as opposed to being a variable experimented on. The comparative and interacting impacts of optimisation and digitalisation, in one analytical structure, are not frequently compared in past research. The limited empirical evidence on the developing economies, especially in Bangladesh, still lacks despite the structural and coordination issues that are peculiar to such environments. The analysis of the data proves that the performance improvement by optimisation and digitalisation is a conditional option, depending on the integration that has created a gap in the existing models of supply chain performance. Based on the identified gaps, the researcher has chosen the following conceptual framework for the current study:

Figure 1: The Conceptual Framework



V. RESEARCH METHODOLOGY OF THIS STUDY

A. Data and Sampling:

The research design that is used in this study is quantitative because it seeks to investigate the relationships between supply chain optimisation practices, digitalisation capability, supply chain integration, and supply chain performance in a developing economy setting, i.e., Bangladesh. The sample was made up of supply chain personnel engaged in procurement, logistics, operations, production planning, distribution, and information systems in manufacturing, retail, logistics service providers, and export-oriented industries like ready-made garments and technology-enabled firms. The major industrial centres of Dhaka, Chattogram, Gazipur, Narayanganj, and Khulna undertook online and email-based structured questionnaires where the data was gathered. 267 valid responses were analysed. The respondents were assured of anonymity and confidentiality and the sample size was enough to give enough statistical power to perform regression and mediation analyses (Hair et al., 2019).

B. Measurement Instrument:

The measurement tool was a structured and closed-ended questionnaire that was created based on the pre-tested multi-item scales to ensure reliability and validity. The measurement of all constructs was performed in a five-point Likert scale with a range of 1 (strongly disagree) to 5 (strongly agree). The supply chain optimisation practices were quantified using items that reflected efficiency of the process, management of inventory, coordination of logistics, and cost management. The capability of digitalisation was measured with help of the items connected with the usage of digital technologies, data analytics, system integration, and real-time information sharing. The integration of supply chains has been assessed using the indicators of inner coordination, information exchange, and the joint planning with supply chain partners. The performance of supply chains was determined on indicators involving efficiency, responsiveness, reliability and overall performance of the operations. Small modifications of words were done to allow contextual relevance to the Bangladeshi supply chain environment without changing the construct's meaning.

C. Data Analysis Technique:

IBM SPSS Statistics was used in the quantitative analysis of data. First, descriptive statistics were used to summarise the characteristics of the respondents and evaluate the suitability of the data. Direct effects have been tested by ordinary least squares (OLS) regression,

whereas mediation analysis has been done according to the regression approach suggested by Baron and Kenny (1986). Moreover, construct reliability, convergent, and discriminant validity were measured using SmartPLS 3, which increases the rigor of the methods.

VI. FINDINGS OF THIS STUDY

A. Demographic Information

The demographic profile of the respondents surveyed in this study, i.e. 267 respondents, is given in Table 1. The age-based distribution indicates that the highest number of respondents consisted of young-adults aged 18-24 years (44.2%), then there are young-adults aged 25-34 years of age (38.2%). The number of male respondents was 67.0 percent and that of females was 33.0 percent. Regarding education, the majority of the respondents had graduated (64.0%), and a large percentage of respondents were postgraduates (25.1%). The supply chain and logistics professionals occupied the majority (54.7%), students with industry exposure came in the second place (22.8). Also, the sample was knowledgeable and experienced with a majority of respondents having over three years of work experience (33.7%).

Category	Frequency	Percent (%)
Age Level		
18–24 years	118	44.2
25–34 years	102	38.2
35–44 years	32	12.0
45–54 years	15	5.6
Gender		
Male	179	67.0
Female	88	33.0
Level of Education		
SSC/HSC or below	18	6.7
Graduation	171	64.0
Post-Graduation	67	25.1
Post-Graduation with other degrees (MPhil/PhD/CA/CMA etc.)	11	4.1
Occupation		
Supply chain / logistics professionals (job holders)	146	54.7
Business owners / entrepreneurs	38	14.2
Students (final year / postgraduate with industry exposure)	61	22.8
Others	22	8.2

Work Experience		
Less than 1 year	41	15.4
1–2 years	62	23.2
2–3 years	74	27.7
More than 3 years	90	33.7

Table 1 - Demographic Characteristics of the Respondents

B. Measurement Model

The results of the reliability and validity test of the tools are given below:

Convergent validity

Construct	Item	Loading	Cronbach's Alpha (CA)	rho_A	Composite Reliability (CR)	AVE
Supply Chain Optimisation Practices (SCOP)	SCOP1	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.50
	SCOP2	≥ 0.70				
	SCOP3	≥ 0.70				
	SCOP4	≥ 0.70				
Digitalisation Capability (DC)	DC1	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.50
	DC2	≥ 0.70				
	DC3	≥ 0.70				
	DC4	≥ 0.70				
Supply Chain Integration (SCI)	SCI1	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.50
	SCI2	≥ 0.70				
	SCI3	≥ 0.70				
	SCI4	≥ 0.70				
Supply Chain Performance (SCP)	SCP1	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.70	≥ 0.50
	SCP2	≥ 0.70				
	SCP3	≥ 0.70				
	SCP4	≥ 0.70				

Table 2: Item loading, convergent validity, and reliability

The results of the measurement model in SCOP, DC, SCI, and SCP are displayed in Table 2. All the indicator loadings are over 0.70, which proves high item reliability. The alpha, composite, and rhoA of Cronbach are higher than 0.70, which is satisfactory internal consistency. Average Variance Extracted values show that they are more than 0.50, which indicates sufficient convergent validity. In general, the constructs can be considered as reliable and fit for analysis in a structural model (Hair et al., 2019).

Discriminant Validity

	SCOP	DC	SCI	SCP
SCOP				
DC	0.612			
SCI	0.724	0.689		
SCP	0.641	0.655	0.781	

Table 3 : Heterotrait–Monotrait (HTMT) Ratio

SCOP, DC, SCI and SCP have the following ratios as presented in table 4. They all fall lower than the 0.85 level to verify the discriminant validity (Henseler et al., 2014; Hair et al., 2019). The increasing HTMT of SCI and SCP indicates the strong conceptual connection between the two, as it is consistent with the mediation findings, whereas the remaining constructs reflect a large but not negligible relationship that can be analyzed structurally.

C. Empirical Results and Hypothesis Testing

Direct Effects Analysis

R	R ²	Adjusted R ²	Std. Error of the Estimate
0.313	0.098	0.095	0.57753

Table 4 : Effect of Supply Chain Optimisation Practices on Supply Chain Performance (H1)

Table 4 shows the regression equation that investigates the effect of Supply Chain Optimisation Practices (SCOP) and Supply Chain Performance (SCP). The value of the correlation coefficient ($R = 0.313$) shows that there is a moderate positive correlation between the performance and optimisation practices. The coefficient of determination ($R^2 = 0.098$) indicates that the variance in SCP attributed to SCOP is 9.8%, which can be considered an acceptable amount of variance in behavioural and organisational research studies (Hair et al., 2019). Adjusted R^2 (0.095) is very close to R^2 indicating that there is no significant inflation of the model. The standard error (0.57753) implies the presence of the reasonable predictive accuracy (Field, 2018), which proves the fact that SCOP is a meaningful albeit partial predictor of SCP.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9.622	1	9.622	28.849	0.000
Residual	88.389	265	0.334		
Total	98.011	266			

Table 5: ANOVA Results for the Effect of Supply Chain Optimisation Practices on Supply Chain Performance

The results of ANOVA of the regression model are also in Table 5. The overall model validity and explanatory power are indicated by the significant F-statistic ($F = 28.849$, $p = 0.000$). Although a significant amount of variance is yet to be explained, this is common in supply chain research (Ketchen and Hult, 2007). The high ANOVA value merits the additional explanation of the regression coefficients (Gujarati and Porter, 2009).

Predictor	B	Std. Error	β	t	Sig.
Constant	1.820	0.249	—	7.308	0.000
SCOP	0.365	0.068	0.313	5.371	0.000

Table 6: Regression Coefficients for the Effect of Supply Chain Optimisation Practices on Supply Chain Performance

Table 6 shows the regression coefficients which evaluate the direct impact of SCOP on SCP. The unstandardised coefficient ($B = 0.365$) shows that an increase of one unit in optimisation practices of supply chain increases the supply chain performance, without other factors constant, by 0.365 units. This depicts a substantive and positive association between the two constructs. The standardised coefficient ($b = 0.313$) indicates the moderate effect and allows the comparison across models and constructs measured with the help of different scales. Cohen (1988) indicates that the b value in the range of 0.30 is a significant practical effect in social science studies. The t -value ($t = 5.371$) and the level of significance ($p < 0.001$) indicate the relationship is statistically significant and appears not to be based on random chance. The constant value is the performance, without the optimisation practices. In line with previous studies, these results support the significance of process alignment, cost management and operational efficiency in improving the performance of the supply chain (Flynn et al., 2010; Mentzer et al., 2001).

Decision (H1): Supply chain optimisation practices have a statistically significant positive effect on supply chain performance ($\beta = 0.313$, $p < 0.001$). Therefore, **H1 is supported**.

4.3.1.2 Effect of Digitalisation Capability on Supply Chain Performance (H2)

R	R ²	Adjusted R ²	Std. Error of the Estimate
0.327	0.107	0.103	0.57479

Table 7: Model Summary for the Effect of Digitalisation Capability on Supply Chain Performance

Table 7 shows the model summary of the regression analysis conducted on studying the relationship between digitalisation capability (DC) and supply chain performance (SCP). The

correlation coefficient ($R = 0.327$) suggests the moderate positive relationship between digitalisation capability and supply chain performance meaning that the greater the levels of digital maturity, the higher the performance outcome. The coefficient of determination ($R^2 = 0.107$) indicates that the capability of digitalisation explains the variance of supply chain performance at around 10.7 percent. This explanatory power is regarded as meaningful in the framework of supply chain and information systems study because performance outcomes are usually subject to a wide range of organisational, technological, and environmental factors (Hair et al., 2019). The adjusted R^2 (0.103) represents both the sample size and the complexity of the model and it is nearly equal to the unadjusted R^2 , which means that the model has not been overfitted. The standard error of the estimate (0.57479) represents the mean error in the prediction and indicates a reasonable amount of inconsistency in estimating the supply chain performance. On the whole, the model summary shows that the digitalisation capability plays a significant role in the explanation of the differences in the performance of a supply chain, which is empirically justified to test the direct effect hypothesis of H2.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	10.461	1	10.461	31.662	0.000
Residual	87.551	265	0.330		
Total	98.011	266			

Table 8: ANOVA Results for the Effect of Digitalisation Capability on Supply Chain Performance

The Analysis of Variance (ANOVA) results are reported in table 8 and they test the overall statistical significance of the regression model. F-statistic ($F = 31.662$) has a statistically significant value of $p < 0.001$, meaning that the regression model accounts much more of the variation in the supply chain performance than a null model (the model that does not predict). This proves the fact that the capability of digitalisation is a significant predictor of the supply chains performance. The regression sum of squares (10.461) shows the amount of the variance of the supply chain performance that is accounted by the digitalisation capability and the residual sum of squares (87.551) indicates the amount of the variance that cannot be accounted by other organisational and environmental variables. It is not surprising that such residual variance appears in an organisational study because the performance of the supply chain is determined by strategic alignment, inter-firm relationship, market dynamics, and operational capabilities (Christopher, 2016). The mean square values also indicate that the true variance is significantly higher than the unexplained variance on a per-degree-of-freedom basis and thus the F-ratio is strong. According to Gujarati and Porter (2009), a statistically significant ANOVA value justifies the regression model in addition to the further interpretation of the estimates of the coefficients.

Predictor	B	Std. Error	β	t	Sig.
Constant	1.970	0.212	—	9.304	0.000
DC	0.344	0.061	0.327	5.627	0.000

Table 9: Regression Coefficients for the Effect of Digitalisation Capability on Supply Chain Performance

Table 9 shows the regression coefficients that determine the direct effect of the ability to digitalize on the supply chain performance. The coefficient ($B = 0.344$) is unstandardised and implies that a one-unit rise in digitalisation capability will result in an increment in the supply chain performance by 0.344 units, with other factors remaining constant. This demonstrates a beneficial and significant connection between performance results and digital ability. The standardised coefficient ($b = 0.327$) is a moderate size of effects, which is possible to compare with other predictors that are measured at different scales. Cohen (1988) said that b values over 0.30 are the practical ones in behavioural and management research. The t -value ($t = 5.627$) and the corresponding significance level ($p < 0.001$) indicate that the correlation is statistically significant and it could not be as a result of chance. These results are consistent with previous studies that revealed that digital solutions like data analytics, system integration, and real-time information sharing would increase supply chains visibility, responsiveness, and coordination, which positively contributes to performance (Bharadwaj et al., 2013; Dubey et al., 2019).

Decision (H2):

Digitalisation capability has a statistically significant positive effect on supply chain performance ($\beta = 0.327$, $p < 0.001$). Thus, **H2 is supported**.

4.3.2 Mediating effects

4.3.2.1 Regression Results for Mediation Analysis (SCOP–SCI–SCP)

Dependent Variable	Predictor	β	t	Sig.	R^2	Adjusted R^2	F	F Sig.
SCP	SCOP	0.313	5.371	0.000	0.098	0.095	28.849	0.000
SCI	SCOP	0.401	7.129	0.000	0.161	0.158	50.828	0.000
SCP	SCOP	0.096	1.769	0.078	0.344	0.339	69.169	0.000
SCP	SCI	0.541	9.942	0.000	0.344	0.339	69.169	0.000

Table 10: Regression Results for Mediation Analysis

Table 10 presents the regression findings oriented to the mediation of supply chain integration (SCI) between supply chain optimisation practices (SCOP) and the supply chain performance (SCP). The first model reports a significant positive relationship between SCOP and SCP ($b = 0.313$, $t = 5.371$, $p < 0.001$) that explains 9.8 per cent of variance ($R^2 = 0.098$), and significant F-statistic ($F = 28.849$, $p < 0.001$), thus, satisfying the first mediation test. The second model demonstrates that SCOP is a significant predictor of SCI ($b = 0.401$, $t = 7.129$, $p < 0.001$) with 16.1 percent of the variance ($R^2 = 0.161$), which can be supported by a strong F-statistic ($F = 50.828$, $p < 0.001$), which satisfies the second condition. In the third model, SCI has a significant effect on SCP ($b = 0.541$, $t = 9.942$, $p < 0.001$), but the direct effect of SCOP becomes insignificant ($b = 0.096$, $t = 1.769$, $p = 0.078$). The combined model is related to 34.4 percent performance variance ($R^2 = 0.344$; $F = 69.169$, $p < 0.001$), which is complete mediation. On this basis, Hypothesis **H3a is accepted**.

4.3.2.2 Regression Results for Mediation Analysis (DC–SCI–SCP)

Dependent Variable	Predictor	β	t	Sig.	R ²	Adjusted R ²	F	F Sig.
SCP	DC	0.327	5.627	0.000	0.107	0.103	31.662	0.000
SCI	DC	0.313	5.361	0.000	0.098	0.094	28.737	0.000
SCP	DC	0.161	3.107	0.002	0.359	0.355	74.084	0.000
SCP	SCI	0.529	10.207	0.000	0.359	0.355	74.084	0.000

Table 11: Regression Results for Mediation Analysis

Table 11 is a regression analysis of the mediating effect of the supply chain integration (SCI) in the relationship between digitalisation capability (DC) and the supply chain performance (SCP). The former demonstrates that DC has a positive and significant impact on SCP ($b = 0.327$, $t = 5.627$, $p < 0.001$), with a significant effect on performance variation ($R^2 = 0.107$; $F = 31.662$, $p < 0.001$), which meets the first mediation criterion. According to the second model, DC is a significant predictor of SCI ($b = 0.313$, $t = 5.361$, $p < 0.001$), which explains 9.8 percent of the variance ($R^2 = 0.098$; $F = 28.737$, $p < 0.001$). In the third model SCI highly predicts SCP ($b = 0.529$, $t = 10.207$, $p = 0.001$) whilst DC is significant though lesser ($b = 0.161$, $t = 3.107$, $p = 0.002$). The model is partially mediated as it explains 35.9% performance variance ($R^2 = 0.359$). Accordingly, Hypothesis H3b is accepted (partial mediation).

VII. DISCUSSION OF THE DISCUSSION

A. Relational Effects of Supply Chain Optimisation and Performance

The findings suggest that optimisation practices of the supply chain have a positive relationship with supply chain performance, but this relationship is not independent but conditional. Logistics coordination, inventory rationalization, and process alignment optimization activities improve performance to a limited degree when done in isolation. This result is consistent with previous research that reports the efficiency increase of optimisation at the functional level (Flynn et al., 2010; Mwandla et al., 2026), but also reflects the concerns that these improvements do not generalise to overall performance in systems where demand uncertainty and structural fragmentation are common (Khan et al., 2025; Rafli & Irjayanti, 2025). The findings critically indicate that in the Bangladeshi environment, where supply chains are often decentralized and utilize intermediaries, optimization in itself leads to localized rather than overall improvement of performance. This supports the view that optimisation practices are latent performance potential, the actualisation of which is facilitated by larger-scale relational and coordination processes, and not by process-specific improvements.

B. Relational Effects of Digitalisation Capability and Performance

Digitalisation capability shows a higher and stronger relationship with the supply chain performance than optimisation, as it shows its importance in improving information visibility, the speed of decisions, and the responsiveness of operations. This observation aligns with the data of the developing economies that place digital tools as the facilitators of agility and coordination under the conditions of resource-constrained settings (Jafari et al., 2025; Sarwar & Shafiq, 2025).

Nonetheless, the medium scale of this association confirms recent sources that warn against the notion of universalizing or self-sustaining performance drivers as digitalisation (Tian & Cui, 2025; Awuah-Gyawu et al., 2025). Instead of ensuring high-quality performance, it seems that digital capability plays the role of an enabling factor that needs the supporting organisational frameworks to realise the full potential of its performance returns. This highlights the necessity to view digitalisation as not a result-generating asset but an asset that has a value that is activated in some context.

C. Supply Chain Integration as a Translation Mechanism for Optimisation

One of the main contributions of the study is the fact that it has shown that supply chain integration completely mediates between optimisation practices and performance. Although optimisation may seem to have an impact on performance at first, this will be completely assimilated when the concept of integration is added into the model. This suggests that efficiencies as generated by optimisation are limited to functional limits unless they are found within integrated planning, information-sharing, and coordinated decision-making frameworks.

The result confirms the theoretical arguments that the efficiency gains are to be systemically coordinated to produce the performance outcomes of the supply chain level (Chen & Sun, 2025; Rashid & Rasheed, 2025). Optimisation in fragmented supply chains, as in the case of Bangladesh, may risk strengthening the operational silos in organisational boundaries and the diffusion of benefits within the organisation. Unlike other studies that have shown to have selective or weak mediation effects (Ma et al., 2025; Idayanti & Nurlia, 2025), the intensity of integration in this case indicates that integration takes a greater role in the developing economies where structural inefficiency and coordination gaps are more dominant.

D. Differential Mediation of Integration in the Digitalisation–Performance Relationship

As opposed to optimisation, supply chain integration only mediates the relationship between the digitalisation capability and performance partially. Although integration does have a significant enhancement of the performance impact of digitalisation, there is still a direct effect after the contribution of integrative mechanisms. This two-way channel draws a significant difference between operational and digital capabilities. On the one hand, digitalisation indirectly improves performance through integration, coordination, and cross-functional alignment, which has been previously noted to be in line with relational mechanisms (Anwar et al., 2025; Tetteh & Owusu Kwateng, 2025). Conversely, the fact that a direct effect is persistent makes it possible that digital capabilities can enhance performance by using internal processes, including data-driven decision-making, analytical efficiency, and quick responsiveness (Motwani & Kataria, 2025). This result gives credence to a capability-based perspective where digitalisation is driven by a number of performance streams as opposed to one channel of integration.

In the Bangladeshi setting, where trust levels are low, governmental barriers and limitations to infrastructure can limit deep levels of inter-organisational integration; the residual direct effect is especially acute. The performance benefits created by digital tools in the context of the lack of complete supply chain integration are facilitated by enhancing internal coordination and analytical capability and partially offsetting external structural constraints. The results indicate a consistent corresponding image of relations: supply chain optimisation and digitalisation are upstream competences, the performance outcomes of which are dependent on the existence and intensity of supply chain integration. Integration is a prevailing translation mechanism to optimisation and a reinforcing, though not exclusive, mechanism of digitalisation. This differentiation of mediation structure is an addition to the supply chain capability theory that indicates that not every capability involves the same pathway to performance, especially in the setting of a developing economy.

VIII. RECOMMENDATIONS

Based on the findings of the study, the researchers have developed the following recommendations:

1. **Be more integrative and less individual efficiency programs:** The companies cannot engage in silo practise of optimisation. Instead, it should be brought to cross-functional and inter-organisational integration to ensure that the efficiency gains could be translated into the general performance gains.
2. **Make digitalisation correspond with integrative processes:** The investments in the digital technologies should also accompany the change in the routines of coordination, the systems of joint planning and sharing the information. The advantage of digital tools is in the fact that they help make integrated decisions and not independent automation.
3. **Insourcing focus on in-house assimilation:** In the case where trust or governance limitations inhibit inter-firm integration, organisations should first build internal integration to enjoy the maximum performance benefits of both optimisation and digitalisation.
4. **Infrastructure and data Standards Support:** The policymakers should make digital platforms and data interoperability to integrate the supply chain, particularly for SMEs.
5. **Encourage supply chain collaborative working:** Collaboration can be developed through the provision of training, cluster programs, and incentives by the government and industry organizations with the aim of integration.

IX. CONCLUSION

This paper examines the direct and mediating relationships between supply chain optimisation practices, digitalisation capabilities, supply chain integration, and supply chain performance in the context of a developing economy. On the basis of the survey results that data on 267 supply chain professionals in Bangladesh, the paper utilizes Ordinary Least Squares (OLS) regression and mediation analysis to offer empirical data on the impacts of operational and digital capabilities that affect performance outcomes. The results affirm that the supply chain performance is positively and significantly influenced by supply chain optimisation practices. Inventory optimisation, logistics coordination, and process alignment are some of the aspects of practice that are involved in enhancing efficiency, reliability, and quality of service provision. Nevertheless, the explanatory power of optimisation is rather small, which shows that efficiency-oriented initiatives are not enough to produce significant performance gains in structurally constrained settings. Equally, the ability to digitalise is observed to affect the supply chain performance positively and significantly. Enterprise systems, data analytics, and real-time information sharing are digital tools that increase visibility, responsiveness, and speed of decision-making. However, the medium-sized effect indicates agreement with the existing literature on the fact that digitalisation is not a universal and self-moving performance driver. One of the contributions that this study made is to prove that supply chain integration is a mediating variable. The findings indicate that the optimisation-performance relationship is completely mediated by integration and the digitalisation-performance relationship by a half. This means that optimisation benefits are not integrated, whereas digitalisation has a greater impact on performance in the case of integration planning, coordination, and information exchange. This research, through empirical validation of the concept of integration as an

important transmitter of supply chain, adds to the extent of supply chain theory, in addition to providing a broadly relevant research gap in the context of Bangladesh where the supply chains are faced with infrastructural and governance constraint challenges.

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