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Linking Supply Chain Practices to Performance and Sustainability: The Mediating Role of Operational Efficiency among Ethnic Minority Micro-Enterprises in Bangladesh

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Abstract

Ethnic micro-enterprises often operate with limited formal support, scarce resources, and locally embedded exchange relationships, yet little is known about how their supply chain practices translate into enterprise outcomes. This study examines the relationships of supply chain practices with operational efficiency, business performance, and business sustainability among ethnic micro-enterprises in Bangladesh, and tests the mediating role of operational efficiency. Using a positivist, deductive, cross-sectional design, survey data from 330 owner-managers and knowledgeable enterprise representatives were analyzed through partial least squares structural equation modelling. The findings show positive relationships between supply chain practices and all three outcomes. The strongest direct relationship concerns operational efficiency, followed by business sustainability, while the relationship with business performance is comparatively smaller. Operational efficiency also mediates the relationships of supply chain practices with business performance and business sustainability, supporting all proposed hypotheses. The study advances supply chain and capability-based research by showing that coordinated sourcing, information exchange, inventory discipline, and fulfilment routines do not create uniform value across outcomes. Their contribution depends partly on whether they are converted into efficient day-to-day execution. The findings also distinguish immediate business performance from the enterprise's longer-term capacity to remain viable and use resources responsibly. For managers and enterprise-support institutions, the evidence indicates that supply chain assistance should combine relationship coordination with practical improvements in inventory control, information flow, delivery reliability, and resource use. Because the analysis relies on cross-sectional perceptual data, the findings indicate association rather than causation.

Keywords: *supply chain practices; operational efficiency; business performance; business sustainability; ethnic micro-enterprises.*

1.0 Introduction

Micro-enterprises sustain a substantial share of Bangladesh's local economic activity by generating household income, employment, and access to markets beyond large formal business systems. The Economic Census 2024 reported approximately 11.70 million economic units in Bangladesh, of which 56.67% were micro-enterprises (Bangladesh Bureau of Statistics [BBS], 2026). Micro-enterprises are therefore not a business segment at the periphery, but a major component of the country's business landscape. Within this wider economy, ethnic minority communities represent a small but socially important population group. The Population and Housing Census 2022 reported that ethnic minority communities accounted for approximately 1% of Bangladesh's population (BBS, 2022). For ethnic micro-enterprises, business survival may depend not only on market demand but also on access to resources, local networks, and efficient day-to-day operations (Haq et al., 2024; Islam, 2025).

Supply chain practices are consequently relevant to the performance and sustainability of these enterprises. Supplier coordination, information exchange, disciplined procurement, inventory control, and risk management can lower uncertainty, contain costs, and improve responsiveness to customers (Munir et al., 2020; Wong et al., 2021). Bangladesh-based research also identifies strategic vendor management and digital-tool adoption as practical routes to better coordination, although cost, skills, and infrastructure constrain implementation among smaller firms (Hai et al., 2024; Rahman et al., 2023). Ganbold et al. (2020) associate digitally enabled integration with stronger operations, whereas Doetzer and Pflaum (2021) show that shared digital information contributes to flexibility only when firms can translate it into decisions. Evidence on lean operations and Supply Chain 4.0 likewise indicates that performance depends on embedding coordination within routine work rather than adopting tools in isolation (Garcia-Buendia et al., 2023; Roldán Bravo et al., 2023).

The Bangladeshi context makes this issue more important because supply chain reliability remains uneven. The World Bank's Logistics Performance Index gives Bangladesh a 2023 overall logistics score of 2.60 out of 5, indicating continuing constraints in the wider trade and transport environment (World Bank, 2023). Research on Bangladeshi MSMEs further notes that limited awareness, solution costs, and shortages of skilled workers restrict FinTech use despite its potential to strengthen supply chain efficiency (Rumky et al., 2023). Although this national indicator does not directly measure the local operations of ethnic micro-enterprises, such constraints may be particularly relevant to firms with limited resources and weaker access to formal business support (Haq et al., 2024; Islam, 2025). Prior studies show that green and sustainable supply chain practices are associated with business performance and sustainability outcomes, particularly when integration, traceability, and information sharing are present (Cousins et al., 2019; Han & Huo, 2020; Kong et al., 2021). Evidence from SMEs, however, suggests that supply chain practices do not automatically improve firm outcomes unless they strengthen internal process capability, resource use, and operational efficiency (Afum et al., 2020; Junaid et al., 2022).

Prior evidence connects integration, shared information, risk controls, and sustainability-oriented supply chain activity with firm-level outcomes (Han & Huo, 2020; Munir et al., 2020; Wong et al., 2021). Yet the dominant empirical settings are manufacturing companies, conventional SMEs, green supply chains, and digitally enabled systems. Research on ethnic micro-enterprises remains concentrated in Western settings and is still limited in non-Western contexts (Haq et al., 2024; Verver et al., 2019). This is more than a geographic omission. Ethnic micro-enterprises may operate with scarce financial and managerial resources, culturally embedded relationships, informal procurement arrangements, and weaker access to mainstream business support. These conditions may influence

whether supply chain routines function as usable organisational capabilities and whether their benefits reach short-term business outcomes, longer-term sustainability, or both (Haq et al., 2024; Islam, 2025).

The unresolved issue is not only whether supply chain practices relate to outcomes, but how their effects emerge inside the enterprise. Studies have tested intervening processes between supply chain practices and firm performance (Agyei-Owusu et al., 2022; Beka Be Nguema et al., 2022), but evidence for small, resource-constrained ethnic enterprises remains limited. Operational efficiency is a relevant mechanism because supply chain practices may improve outcomes by reducing delays, waste, stock problems, and coordination costs while strengthening the use of labour and other limited resources. Process-level performance has been linked with firm performance, while related capability pathways have been associated with sustainable performance (Agyei-Owusu et al., 2022; Lin & Fan, 2024). Treating operational efficiency as the mediator therefore tests a concrete conversion process instead of presuming a direct passage from supply chain practices to performance and sustainability.

Accordingly, the analysis focuses on four constructs in Bangladeshi ethnic micro-enterprises: supply chain practices, operational efficiency, business performance, and business sustainability. It tests the three direct associations and then examines whether operational efficiency carries the relationships from supply chain practices to the two enterprise outcomes. The ethnic micro-enterprise is the unit of analysis, and the proposed relationships are tested using quantitative cross-sectional survey data and PLS-SEM. Consistent with the design, the study interprets the estimated paths as associations and predictive relationships rather than proof of causality.

This study makes three connected contributions. First, it identifies operational efficiency as the resource-conversion mechanism through which supply chain practices may become performance and sustainability outcomes, instead of treating these practices as automatically valuable. This extends the resource-based and natural resource-based logic of organisational capabilities by specifying how an operational mechanism converts coordinated routines into enterprise-level value (Barney, 1991; Hart, 1995; Wernerfelt, 1984). Second, the study uses the conditions of ethnic micro-enterprises to refine this capability argument. Resource scarcity, culturally embedded networks, informal operating arrangements, and limited formal support may shape the usefulness of supply chain practices, making the context theoretically relevant rather than merely a new research location. Third, the study makes a distinction between business performance and business sustainability and investigates the same mechanism of operation in both cases. This separation helps to give a more accurate picture of whether a supply chain practice will contribute to the immediate achievement of business goals or to the long-term ability of the business to continue to operating responsibly. The evidence generated can help in the formulation of policies, strategies and approaches for support, training and enterprise development for ethnic micro-enterprises in Bangladesh.

2.0 Literature Review

2.1 Theoretical Framework

The conceptual argument is based mainly on the Resource-Based View (RBV) and the Natural Resource-Based View (NRBV) and the TCE (Transaction Cost Economics) is offered as a supplemental explanation. Resources and capabilities are considered advantageous if they are valuable, rare, costly to imitate and organisationally embedded (Wernerfelt, 1984; Barney, 1991). Here, supplier coordination, procurement discipline, stock handling, information exchange, and relationship management are treated as a bundle of operating capabilities. This interpretation is especially pertinent to ethnic micro-enterprises in Bangladesh, whose access to finance, formal

support, and managerial resources may be restricted and whose exchanges are often embedded in community networks (Haq et al., 2024; Islam, 2025). The basic central RBV argument is thus that these firms can better leverage scarce resources when their supply chains are more highly organised.

NRBV also applies this to the environmental and sustainability impacts (Hart, 1995; Hart & Dowell, 2011). It is relevant because in the study, financial and market performance is separated from business sustainability, which here is defined as 'continuing economic, environmental and social viability and not only survival.' (Zaid et al., 2018). This can happen through supply chain practices that reduce waste, conserve resources, ensure continuity of supply and enhance the business' long-term ability to operate. TCE adds a narrower explanation for operational efficiency: firms organise exchanges to reduce coordination costs, uncertainty, and opportunism (Coase, 1937; Williamson, 2008). This can consequently reduce delays, shortages, information gaps and supplier related exposure through reliable information, inventory discipline and supplier coordination. RBV, NRBV and TCE provide a collective account of why the same supply chain practices can be connected, albeit different, pathways to operational efficiency, business performance and business sustainability.

2.2 Supply Chain Practices and Operational Efficiency

At firm level, supply chain practices organise dealings with suppliers, information movement, inventory, and responsiveness. Their importance is especially direct in micro-enterprises, where timely purchasing, low waste, quick replenishment, and coordination between buyers and suppliers shape daily operating efficiency. The value obtained from these routines varies with the particular practice, the depth of integration, and the organisational setting. Case evidence from a Bangladeshi micro-supply-chain setting also suggests that collective supplier aggregation and bargaining can reduce unit costs and lead times, although the small case design limits generalisation (Hawlader, 2026). Munir et al. (2020), for example, show that supply chain risk management is linked with operational performance when supported by supply chain integration, suggesting that risk awareness alone is insufficient unless firms also coordinate effectively with internal and external partners. Similarly, Wong et al. (2021) argue that supply environment and supply chain integration are associated with operational performance through business-process discipline, especially when opportunistic behaviour is reduced.

Digital and lean-oriented practices can also improve operations, although their value depends on how they are used. Ganbold et al. (2020) link digitally enabled supply chain integration with operational performance, indicating that visibility helps firms coordinate processes and manage uncertainty. Doetzer and Pflaum (2021) show that digital information sharing supports flexibility when organisations possess the capability to act on the information received. Roldán Bravo et al. (2023) connect the joint use of Supply Chain 4.0 and lean management with operational outcomes, while Garcia-Buendia et al. (2023) find that lean responses can protect performance and competitiveness under technological uncertainty.

Taken together, the evidence suggests that faster information movement, lower waste, and greater supply flexibility can improve the efficiency of operations. For ethnic small businesses in Bangladesh, the relationship is theoretically important as their resource constraints, culturally embedded networks and limited access to formal business support can affect efficiency (Haq et al., 2024; Islam, 2025). Their supply chain systems may be less formal than those of large businesses and may rely on regular transactions, local knowledge and trust-based procurement. Hence, the present study does not make

any causal inferences, but proposes that there is a positive relationship between stronger supply chain practices and operational efficiency in this context. Thus;

H1: *Supply chain practices are positively related with operational efficiency among ethnic micro-enterprises in Bangladesh.*

2.3 Supply Chain Practices, Business Performance and Business Sustainability

Research does not show a uniform connection between supply chain practices and business outcomes. The reason is partly that firms pursue different supply chain priorities, ranging from cost, speed, and reliability to collaboration, traceability, environmental responsibility, and broader sustainability. Zaid et al. (2018) report that green human resource and supply chain practices support sustainable performance when they operate as complementary capabilities. Yildiz Çankaya and Sezen (2019) similarly find that green supply chain activities do not contribute equally across all sustainability dimensions. Prangan et al. (2025) identified that environmental and social sustainability dimensions were linked with performance of agro-based SMEs while FinTech usability was an intervening mechanism in Bangladesh. These mixed patterns are a warning sign not to regard supply chain practice as a performance solution.

The extent to which sustainability and integration are embedded in the supply chain strategy also influences the performance outcomes. Cousins et al. (2019) demonstrate that eccentricity and traceability influence the value of green supply chain practices, suggesting that practices should be integrated into the supply chain on a routine, as opposed to symbolic basis. Han and Huo (2020) also link GSCI to the economic and sustainability outcomes of actors involved. Afum et al. (2020) define green supply chain integration for SMEs as the journey to bring green manufacturing to sustainable performance. Together, these studies imply that coordination converts sustainability intent into operational action.

Recent evidence broadens the argument to innovation, finance, and environmental outcomes. Kong et al. (2021) link green supply chain integration with financial performance through information sharing and social contagion, suggesting that value grows when practices circulate across the network. Junaid et al. (2022) associate sustainable integration with green innovation and firm performance, which positions learning as another route to business value. In Indonesian SMEs, Dzikriansyah et al. (2023) report a relationship between green supply chain management and environmental performance. That setting is pertinent because micro-enterprises in developing economies often confront comparable resource and institutional constraints.

For ethnic micro-enterprises in Bangladesh, business performance can be defined in terms of sales stability, customer retention, cost control and market responsiveness, while business sustainability can be defined in terms of long-term economic viability, responsible resource use, social responsibility and enterprise continuity (Zaid et al., 2018). Supply chain practices can be used to help these enterprises procure supplies, reduce operational disruption and respond to customer needs, as these enterprises are likely to participate in competitive and resource-poor local markets. However, this is based on perceptual survey data; thus, the relationship is one of association and not necessarily proven causality. Therefore, the following hypotheses are generated:

H2: *Supply chain practices are positively related with business performance among ethnic micro-enterprises in Bangladesh.*

H3: *Supply chain practices are positively related with business sustainability among ethnic micro-enterprises in Bangladesh.*

2.4 Operational Efficiency as a Mechanism Linking Supply Chain Practices to Performance and Sustainability

Direct paths alone do not reveal how supply chain practices reach performance and sustainability. A process explanation is needed because improvements may first appear in day-to-day operations before becoming enterprise-level outcomes. Agyei-Owusu et al. (2022) connect integration dimensions with operational and firm performance, identifying operations as a plausible route from coordination to broader results. Nguyen et al. (2022) likewise emphasise integration in explaining economic performance in a developing-country setting. Related SME research confirms the importance of intervening mechanisms. Kitchot et al. (2021) show that HRM practices transmit part of the relationship between supply chain management and Thai SME performance, which suggests that internal routines convert supply chain inputs into outcomes. Beka Be Nguema et al. (2022) use a mediated model to show that supply chain finance also requires an enabling process before organisational performance improves. During the COVID-19 period, Hendijani and Norouzi (2023) identify resilience and robustness as channels between integration and firm performance, reinforcing the view that supply chain value becomes visible through capabilities that help firms manage disruption.

In the present model, operational efficiency represents the process improvement that may connect supply chain practices with performance and sustainability. Agyei-Owusu et al. (2022) link integration, operational performance, and firm performance, while Lin and Fan (2024) show that related organisational capabilities can contribute to sustainable performance. For ethnic micro-enterprises in Bangladesh, fewer stock shortages, lower waste, more reliable delivery, and tighter cost control could convert coordination into stronger enterprise outcomes. The proposed mediation test therefore avoids assuming that supply chain practices generate value automatically. It asks whether operational efficiency accounts for the relationships between those practices and the two outcome constructs. Accordingly, the following hypotheses are proposed:

H4: *Operational efficiency mediates the relationship between supply chain practices and business performance among ethnic micro-enterprises in Bangladesh.*

H5: *Operational efficiency mediates the relationship between supply chain practices and business sustainability among ethnic micro-enterprises in Bangladesh.*

2.5 Conceptual Framework

The proposed conceptual framework explains the relationship between supply chain practices, operational efficiency, business performance and business sustainability among ethnic micro-enterprises in Bangladesh.

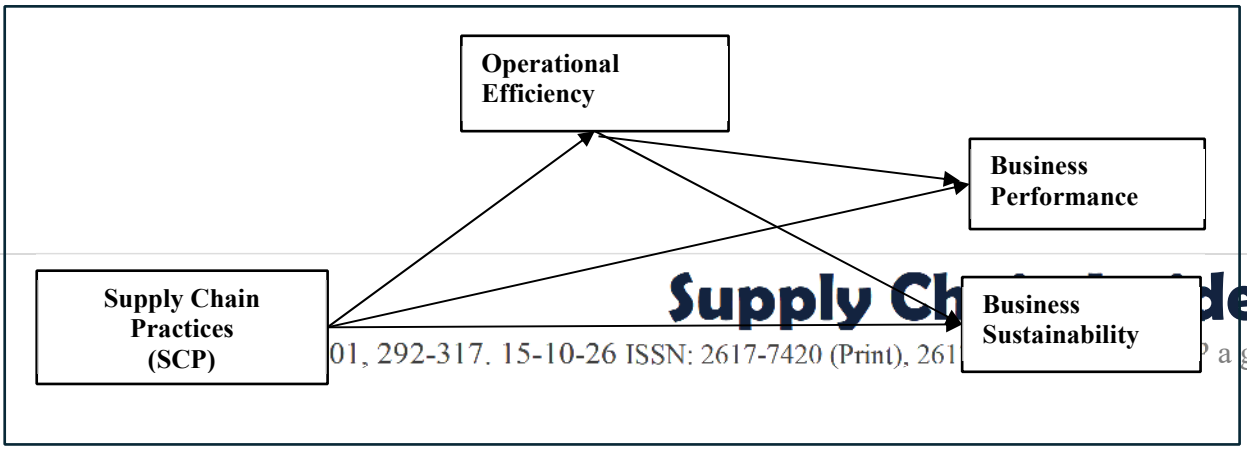


Figure 1: *Proposed Conceptual framework*

Supply chain practices are positioned as the main independent construct, while business performance and business sustainability are the outcome constructs. Operational efficiency is included as a mediating construct because supply chain practices are expected to be associated with outcomes through improvements in day-to-day processes, including reduced delays, better inventory control, improved coordination and lower wastage. The framework also includes direct paths from supply chain practices to business performance and business sustainability, allowing the study to assess both direct associations and the mediating role of operational efficiency.

3.0 Methodology

3.1 Research Design, Philosophical Position, and Study Context

The research followed a positivist position and deductive logic to test relationships specified in advance among supply chain practices, operational efficiency, business performance, and business sustainability. Hypotheses derived from supply chain and sustainability literature were examined with a quantitative cross-sectional survey (Saunders et al., 2019). Because all measures were collected at one point, the design estimates association and prediction but cannot demonstrate temporal sequence or experimental causation. Path estimates are therefore interpreted within the proposed model and not as proof that one construct produced change in another (Bollen & Pearl, 2013).

The ethnic micro-enterprise was the unit of analysis, while an owner, owner-manager, or knowledgeable employee served as the organizational informant. These respondents were directly involved in sourcing, inventory, customer fulfilment, resource use, or operating decisions. Role-based selection strengthens organization-level perceptual measures when informants possess direct knowledge of the focal activities (Kumar et al., 1993). PLS-SEM was selected because the analysis combines explanatory prediction, simultaneous direct and mediated paths, explained variance, and out-of-sample prediction (Hair et al., 2019). Its use therefore followed the analytical purpose, not a sample-size shortcut.

3.2 Population, Sampling, and Data-Collection Process

The target population comprised ethnic minority-owned or ethnic minority-managed micro-enterprises operating in Bangladesh. Eligible enterprises were actively engaged in sourcing, purchasing, inventory management, production or service delivery, and customer fulfilment. Respondents had to be owners, owner-managers, managers, or key personnel with direct knowledge of these activities. Following Kumar et al. (1993), the screening criteria aligned respondent knowledge with the constructs and reduced firm-level judgments from unsuitable informants. One eligible informant represented each participating enterprise.

Because no complete sampling frame of ethnic micro-enterprises was available, purposive sampling was used. Eligible enterprises were accessed through community contacts, neighbourhood enterprise networks, market associations, local business contacts, and area-based visits. This procedure provided access to a dispersed and under-documented population but did not create a statistically representative national sample. Inference was thus restricted to the enterprises represented in the data set. Network-based recruitment also meant that a conventional response rate could not be calculated from a single verified sampling-frame denominator.

Sample adequacy was determined by statistical power not the ten times heuristic. A fixed multiple regression analysis was used in the G*Power analysis, which set the number of predictors to three for the most complex endogenous construct, alpha to .05, power to .80, and a medium effect size (.15) (Faul et al., 2009). This resulted in a minimum of 77. This was an analytical file with 150 cases which was more than this requirement. This sample also allowed direct and indirect paths to be estimated using these bootstraps. Inference, however, was based on confidence intervals and effect sizes, rather than significance only (Hair et al., 2019). A structured self-administered questionnaires were used to collect data. Participants were told about the academic nature, voluntary, confidentiality, and withdrawal of the study. A personally identifiable file was not required and results were presented in a group format. The data was kept safe and only utilized for the specified research.

3.3 Construct Operationalization and Instrument Development

The multi-item measures were preceded by eligibility and profile questions. The instrument consisted of 24 indicators, evenly distributed among the four constructs. Responses were made at a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Practices included in the supply chain were supplier relationships, joint problem solving, information sharing, communication with the customer, feedback, and purchasing/stock and delivery. These indicators were adapted from existing supply chain management and integration indicators (Flynn et al. 2010; Li et al. 2005, 2006).

Operational efficiency is defined as timely fulfilment, delivery reliability, inventory control, operating-cost control, waste reduction and resource utilization (Agyei-Owusu et al., 2022; Beamon, 1999; Flynn et al., 2010). Business performance included sales, profit, customer retention, market and progress. Business sustainability covered continuity and adaptability, stable operations, responsible use of resources, working conditions and community relations. The information needed for sustainability content was extracted from Zaid et al. (2018) and continuity and adaptive capacity information was taken from Chowdhury and Quaddus (2016). Previous SME studies have identified that supply chain practices can impact enterprise results via both direct and indirect processes (Afum et al., 2020; Kitchot et al., 2021).

All constructs were defined reflectively as indicators were viewed as manifesting the particular organizational practice or outcome and were assumed to be co-varying. For micro-enterprises, adapted wording was used and simplified, but with no change in intended construct domain. The questionnaire was content reviewed for content coverage, clarity, reading difficulty and contextual suitability prior to administration. To find problems interpreting the meaning of the questions, Presser et al. (2004) suggests pretesting the survey questions. The review focused on the consistency of understanding of references to suppliers, stock, waste, performance, and continuity; minor changes in wording and ordering to reduce ambiguity and respondent burden while maintaining the concept of the source measures were made.

3.4 Common Method Bias

Common-method variance was a potential problem because all variables were collected from a single informant at a single time; therefore, the following procedural control measures were used in the survey (Podsakoff et al., 2003). Respondents were told that their responses would be anonymous, confidential, voluntary and that there were no right or wrong answers, while the wording of the constructs was neutral, labels were disguised and the predictor and criterion sections were separated in order to reduce evaluation apprehension, social desirability and guessing of the hypothesis.

Twenty-four indicators and 150 usable cases were included in post-estimation diagnostics. An unrotated principal-components solution yielded four components whose eigenvalues exceeded 1. The leading component had an eigenvalue of 10.857 and accounted for 45.238% of total variance, remaining below the 50% reference point used for Harman's single-factor check. However, this check is not very powerful, and it was considered as just preliminary evidence (Fuller et al., 2016). The full-collinearity VIFs were 2.122 for business performance, 2.324 for business sustainability, 2.320 for operational efficiency, and 2.251 for supply chain practices; each was below 3.3 (Kock, 2015). Taken together, these diagnostics do not indicate material common-method distortion, although they cannot demonstrate its complete absence.

3.5 Data Preparation and PLS-SEM Estimation

Screening was completed before estimation. The checks covered missing data, duplicates, ineligible observations, invariant response patterns, straight-lining, and internal inconsistency. All indicators were oriented in the same direction, and respondent characteristics were summarised with frequencies and percentages. SmartPLS 4 was then used to estimate the model for the final 150 cases (Ringle et al., 2024). The PLS routine used standardized data, a maximum number of iterations of 3,000 and a stopping tolerance of 10-7. The number of bootstrap resample was set at 5000 with fixed seed, alpha = .05 and 95% Bootstrap confidence intervals (Hair et al., 2019) in the fixed parameters of the Inference.

Measurement quality was established before interpreting the structural paths. Outer loadings were used as an indicator of the reliability with the reference of .708. Internal consistency was assessed using Cronbach's alpha, rho_A and composite reliability, while convergence was assessed by average variance extracted. Hair et al. (2020) considered values of reliability ≥ .70 and average variance extracted ≥ .50 to be acceptable. Discriminant validity was mainly based on the heterotrait–monotrait ratio, as .85 was considered a conservative cut–off and .90 was considered for conceptually close constructs (Henseler et al., 2015), with the Fornell–Larcker test (Fornell & Larcker, 1981) as supporting evidence.

For the structural model, the reported diagnostics comprised inner variance inflation factors, standardized coefficients, t values, p values, confidence intervals, R^2, adjusted R^2, and f^2. Direct, indirect, and total effects were used for mediation, and when the bootstrapped confidence interval for the indirect path did not include zero, the mediation path was considered supported (Nitzl et al., 2016). PLSpredict was performed using 10 folds and 10 repetitions (Shmueli et al., 2019). The performance of Q^2predict and error measures (root mean squared error and mean absolute error) were compared to linear-model benchmarks, while the predictive loss was evaluated using the cross-validated predictive

ability test. The standardized root mean square residual was retained only as an auxiliary model diagnostic.

4.0 Results

4.1 Respondents Profile and Analytical Sample

The final analytical dataset comprised 330 responses. Table 1 shows the recruitment profile provided for the study by gender, age, education, enterprise role, managerial experience and ethnic community. Slightly more respondents identified as male (165, 50.0%) than female (160, 48.5%), with 5 identifying as other or preferring not to disclose (1.5%). Respondents aged 25-34 and 35-44 each accounted for 30.0%, while those aged 45-54 represented 20.0%. Respondents under 25 and those aged 55 or above each represented 10.0% of the sample.

Table 1

Respondents-profile (N=330)

Characteristic	Category	Target n	Target (%)
Gender	Male	165	50.0
	Female	160	48.5
	Other / prefer not to disclose	5	1.5
Age group	Under 25 years	33	10.0
	25-34 years	99	30.0
	35-44 years	99	30.0
	45-54 years	66	20.0
	55 years and above	33	10.0
Highest educational qualification	No formal education	33	10.0
	Primary education	66	20.0
	Secondary education (SSC or equivalent)	99	30.0
	Higher secondary education (HSC or equivalent)	66	20.0
	Undergraduate degree	50	15.2
	Postgraduate degree or above	16	4.8
Role in the enterprise	Owner-manager	231	70.0
	Owner directly involved in operations	66	20.0
	Managing partner / senior family manager	25	7.6
	Hired manager with decision-making authority	8	2.4
Experience managing the enterprise	Less than 2 years	33	10.0
	2-5 years	99	30.0
	6-10 years	99	30.0
	11-15 years	59	17.9
	More than 15 years	40	12.1

Characteristic	Category	Target n	Target (%)
Ethnic community	Khasi / Khasia	75	22.7
	Manipuri	75	22.7
	Garo	55	16.7
	Patro	40	12.1
	Tripura	35	10.6
	Other self-identified ethnic communities	50	15.2

Educational attainment was concentrated at the secondary level: 99 respondents had completed secondary education (30.0%), while primary and higher secondary education each accounted for 20.0%. Undergraduate and postgraduate qualifications accounted for 15.2% and 4.8%, respectively, and 10.0% had no formal education. The majority of the responses (70.0%) came from owner-managers; an additional 20.0% were owners directly engaged in operations. There were also managing partners or senior family managers (7.6%) and hired managers with decision-making authority (2.4%). The managerial experience was focused on the 2-10 year range, with 30.0% in the 2-5 year range and 30.0% in the 6-10 year range. The respondents of Khasi or Khasia was 22.7%, Manipuri 22.7%, Garo 16.7%, Patro 12.1%, Tripura 10.6% and other ethnic groups who identified themselves 15.2%. These distributions determine who the 330 respondents are who were used in the analysis.

4.2 Measurement Model Assessment

Indicator performance was evaluated alongside three internal-consistency coefficients and average variance extracted. A loading of .708 was used as the preferred guide, but slightly lower values were considered with reliability, convergence, construct coverage, and theoretical meaning (Hair et al., 2019; Hair et al., 2020). Loadings were between .707 and .854 as indicated in Table 2. The lowest loading was .707 for SCP1, .721 for BP2, .722 for OE1 and .854 for BS5 while the highest loading was .854 for BS5. All other indicators fell within this acceptable range and no indicator had a weak loading coupled with poor reliability or validity evidence that would lead to its deletion.

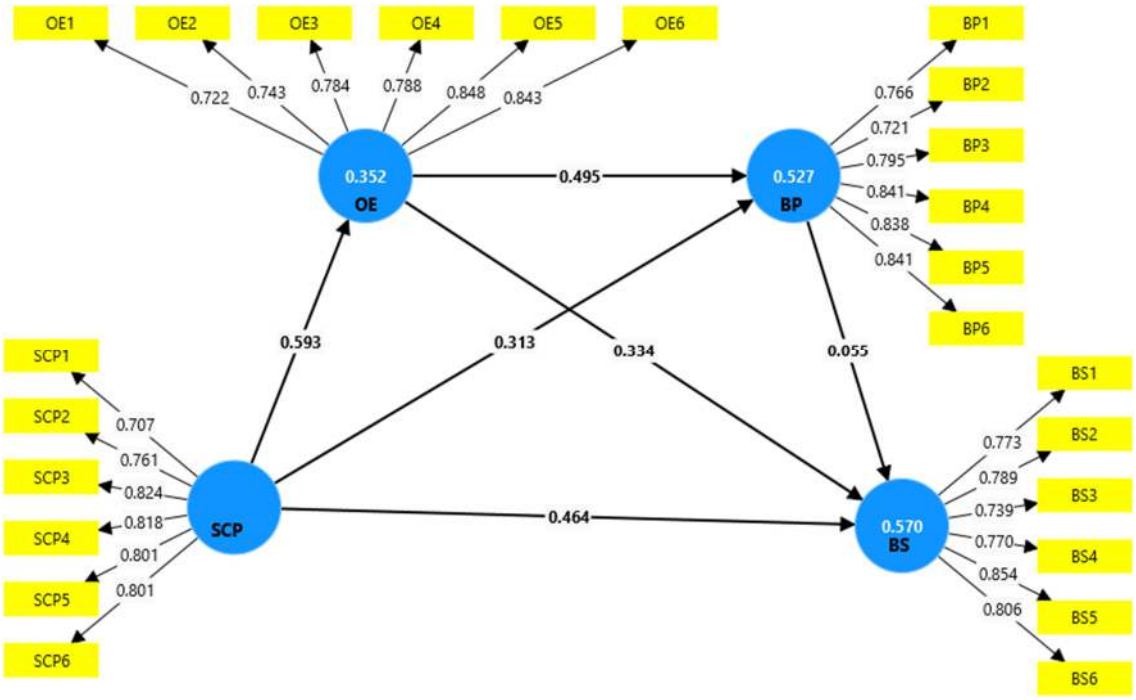


Figure 2: *PLS algorithm estimates for the Measurement Model*
Source: *Authors based on SmartPLS 4 Output, 2026*

All of the constructs fulfilled the internal-consistency criteria. Cronbach's alpha was within the range .876 to .888, starting with the supply chain practices and ending with business performance. Rho_A ranged from .881 to .890 and composite reliability ranged from .907 to .915. All the coefficient values were in the range of .70 to .95 indicating consistency and no obvious redundancy problems (Hair et al., 2019). All of the average variance extracted (AVE) values were greater than .50 and therefore convergence was also supported. Business performance had the highest AVE of .643, followed by operational efficiency and business sustainability at .623 each, and the supply chain practices at .618. Each latent variable accounted for over 50% of the variance in the measures.

Table 2
Reflective indicator quality, internal consistency, and convergent validity

Construct	Indicator	Loading	Cronbach's alpha	rho_A	rho_C	AVE
Business performance	BP1	0.766	0.888	0.890	0.915	0.643
	BP2	0.721				
	BP3	0.795				
	BP4	0.841				
	BP5	0.838				
	BP6	0.841				
Business sustainability	BS1	0.773	0.879	0.886	0.908	0.623
	BS2	0.789				
	BS3	0.739				

Construct	Indicator	Loading	Cronbach's alpha	rho_A	rho_C	AVE
	BS4	0.770				
	BS5	0.854				
	BS6	0.806				
Operational efficiency	OE1	0.722	0.878	0.881	0.908	0.623
	OE2	0.743				
	OE3	0.784				
	OE4	0.788				
	OE5	0.848				
	OE6	0.843				
Supply chain practices	SCP1	0.707	0.876	0.881	0.907	0.618
	SCP2	0.761				
	SCP3	0.824				
	SCP4	0.818				
	SCP5	0.801				
	SCP6	0.801				

Note. rho_A and rho_C denote Dijkstra-Henseler's reliability and composite reliability, respectively; AVE = average variance extracted. Values are rounded to three decimals.

All 24 indicators were retained because the different patterns of joint loadings, reliability estimates and average variance extracted indicated their retention. Retention was based on the overall measurement evidence, not a rigid loading threshold. The slight difference in .707 loading of SCP1 compared to .708 is not significant and is consistent with the supply chain practices reliability coefficients and average variance extracted. Deleting it for a marginal coefficient increase could reduce content coverage without materially strengthening measurement quality (Hair et al., 2020).

Fornell-Larcker and HTMT provided separate checks of discriminant validity. Under the Fornell-Larcker test, the square root of each construct's average variance extracted should be greater than its correlations with other constructs (Fornell & Larcker, 1981). Table 3 shows diagonal entries from .786 to .802, all above their corresponding off-diagonal values. The highest latent correlation was .695 for supply chain practices and business sustainability, still below both pertinent diagonal entries (.786 and .789). Business performance and operational efficiency had the next highest correlation at .681. Thus, every construct related more strongly to its own indicators than to the remaining constructs.

Table 3

Fornell-Larcker criterion

Construct	BP	BS	OE	SCP
BP	0.802			
BS	0.564	0.789		
OE	0.681	0.647	0.789	
SCP	0.607	0.695	0.593	0.786

Note. Diagonal entries are the square roots of AVE and lower-triangle entries are latent-variable correlations. BP = business performance; BS = business sustainability; OE = operational efficiency; SCP = supply chain practices. Blank cells are intentionally not duplicated.

Table 4

HTMT (Heterotrait-monotrait) ratios

Construct	BP	BS	OE	SCP
BP				
BS	0.636			
OE	0.770	0.728		
SCP	0.685	0.782	0.674	

Note. Lower-triangle HTMT values are reported.

The six HTMT coefficients in Table 4 span .636 to .782. None reaches .85, and all are also below .90. The combined evidence from Tables 3 and 4 therefore supports empirical separation of the constructs and reduces concern that overlap is biasing the structural paths (Henseler et al., 2015).

4.3 Structural Model and Direct Relationships

Structural assessment combined inner variance inflation factors, standardized coefficients, bootstrap uncertainty, separate lower and upper limits for the bias-corrected 95% intervals, and f^2. For the hypothesized direct paths, inner variance inflation factors were between 1.000 and 1.751, values that do not suggest consequential predictor collinearity (Hair et al., 2019). The confidence limits were considered jointly with t and p statistics, and f^2 was used to separate significance from effect magnitude. Table 5 is restricted to the three direct hypotheses stated in the proposal.

Table 5

Hypothesis testing for the proposed direct relationships

H#	Relationship	Beta	SD	t	p	BC 95% CI lower	BC 95% CI upper	VIF	f-squared	Effect-size magnitude	Decision
H1	Supply chain practices → Operational efficiency	0.593	0.056	10.609	< .001	0.468	0.691	1	0.543	Large	Supported
H2	Supply chain practices → Business performance	0.313	0.067	4.687	< .001	0.183	0.443	1.543	0.135	Small	Supported
H3	Supply chain practices → Business sustainability	0.464	0.083	5.562	< .001	0.293	0.617	1.751	0.285	Medium	Supported
	Business performance → Business sustainability	0.055	0.054	0.082	0.675	0.5	[-0.109, 0.212]	2.115	0.003	No effect	Not Supported
	Operational efficiency → Business performance	0.495	0.496	0.058	8.519	< .001	[0.378, 0.608]	1.543	0.335	Medium	Supported
	Operational efficiency → Business sustainability	0.334	0.335	0.079	4.208	< .001	[0.182, 0.493]	2.061	0.126	Small	Supported

Note. Beta is the original-sample path coefficient. Bootstrap SD, t, p, and the separately reported lower and upper bias-corrected (BC) 95% confidence limits are from SmartPLS bootstrapping. VIF and f-squared are from the PLS algorithm output. Effect-size magnitude follows the conventional f-squared thresholds of 0.02 (small), 0.15 (medium), and 0.35 (large). Values are rounded to three decimals.

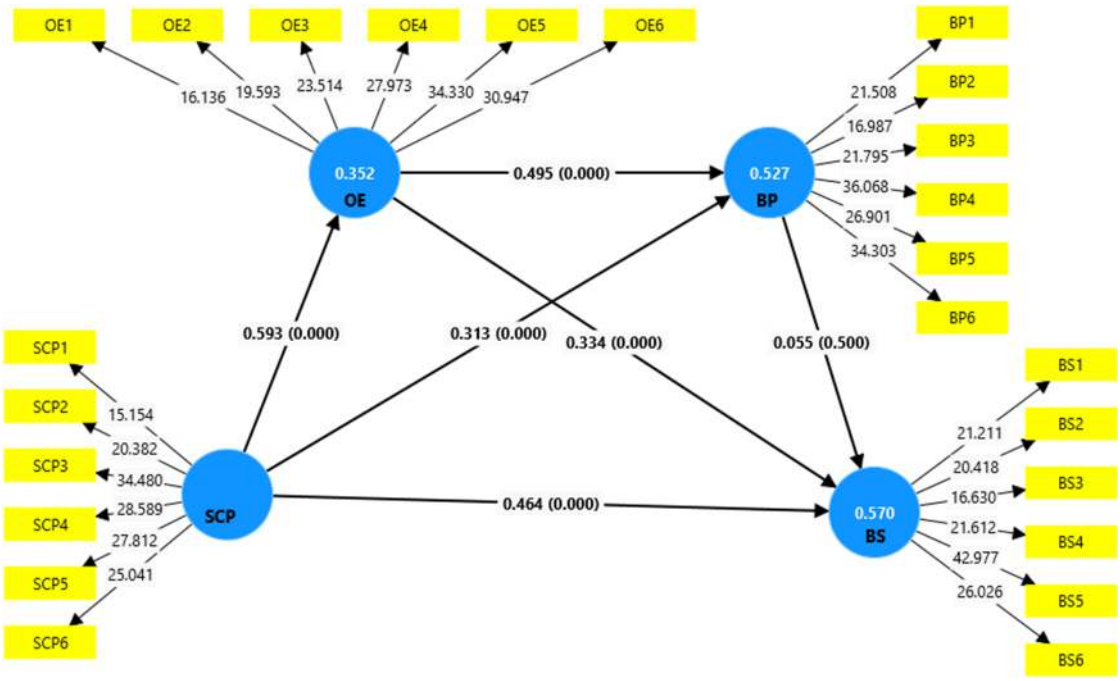


Figure 3: *Bootstrapped structural paths and indicator statistics*
Source: *Authors based on SmartPLS 4 Output, 2026*

All three proposed direct relationships were positive and statistically supported. Supply chain practices were positively associated with operational efficiency, with the largest direct coefficient in the model (beta = .593, SD = .056, t = 10.609, p < .001, bias-corrected 95% CI [.468, .691]). Because the interval was entirely above zero, H1 was supported. Supply chain practices were also positively associated with business performance (beta = .313, SD = .067, t = 4.687, p < .001, bias-corrected 95% CI [.183, .443]), supporting H2. The association with business sustainability was positive and larger than the direct association with business performance (beta = .464, SD = .083, t = 5.562, p < .001, bias-corrected 95% CI [.293, .617]); therefore, H3 was supported.

The f-squared results distinguish statistical support from the magnitude of each predictor contribution. The supply chain practices to operational efficiency relationship had a large effect size of .543. The relationship with business sustainability had a medium effect size of .285, whereas the relationship with business performance had a small effect size of .135. The results therefore show that the strongest direct contribution of supply chain practices occurred for operational efficiency. The smaller f-squared value for business performance does not negate H2, but it indicates a more limited unique contribution to the explained variance of that outcome than the contributions observed for operational efficiency and business sustainability.

4.4 Mediating Role of Operational Efficiency

Specific indirect effects from the bootstrap analysis were used to test operational efficiency as mediator. An indirect path was accepted when it followed the proposed direction and its bias-corrected interval did not cross zero (Nitzl et al., 2016). Table 6 therefore reports only the two mediation relationships specified in the proposal. This focused presentation keeps the confirmatory analysis aligned with H4 and H5 and avoids treating unplanned indirect paths as hypotheses.

Table 6
Mediating role of operational efficiency

Hypothesis	Mediating relationship	Indirect beta	Bootstrap SD	t	p	BC 95% CI lower	BC 95% CI upper	Decision
H4	Supply chain practices → Operational efficiency → Business performance	0.294	0.044	6.720	< .001	0.214	0.384	Supported
H5	Supply chain practices → Operational efficiency → Business sustainability	0.198	0.051	3.849	< .001	0.105	0.306	Supported

Note. Values are rounded to three decimals.

H4 was supported because the indirect path from supply chain practices to business performance through operational efficiency was positive and significant (indirect beta = .294, SD = .044, t = 6.720, p < .001, bias-corrected 95% CI [.214, .384]); zero was outside the interval. The corresponding indirect path to business sustainability was likewise positive and significant (indirect beta = .198, SD = .051, t = 3.849, p < .001, bias-corrected 95% CI [.105, .306]), supporting H5. Its coefficient was smaller than the indirect effect for business performance, so the estimated operational-efficiency route was stronger for performance. Since the tables omit the complete set of direct and total effects needed to distinguish complementary, competitive, and indirect-only mediation, no such label is assigned.

4.5 Explanatory Power, Predictive Relevance, and Model Diagnostics

Table 7 reports explanatory strength through R^2 and adjusted R^2 and out-of-sample prediction through Q^2predict, RMSE, and MAE. The model accounted for 35.2% of operational efficiency, 52.7% of business performance, and 57.0% of business sustainability. Adjusted R^2 values were .348, .521, and .561, respectively. Their proximity to the corresponding R^2 values indicates little inflation from model complexity. Explained variance was greatest for business sustainability, then business performance and operational efficiency. These are model-contingent explanatory estimates and do not demonstrate causation.

Table 7
Explanatory and out-of-sample predictive power

Endogenous construct	R-squared	Adjusted R-squared	Q-squared predict	RMSE	MAE
Business performance	0.527	0.521	0.356	0.813	0.673
Business sustainability	0.570	0.561	0.473	0.735	0.584
Operational efficiency	0.352	0.348	0.338	0.825	0.681

Note. R-squared and adjusted R-squared are from the PLS algorithm output. Q-squared predict, RMSE, and MAE are from the PLSpredict latent-variable summary. RMSE = root mean squared error; MAE = mean absolute error.

Q^2predict was positive for operational efficiency (.338), business performance (.356), and business sustainability (.473), showing improvement over mean-based naive prediction for each endogenous construct (Shmueli et al., 2019). Business sustainability produced the highest Q^2predict. Across constructs, RMSE varied from .735 to .825 and MAE from .584 to .681. Both errors were smallest for business sustainability and largest for operational efficiency. These PLSpredict errors cannot, by themselves, establish a low, medium, or high level of predictive power. That classification requires comparison with a suitable linear-model benchmark, which is absent from the supplied final table (Shmueli et al., 2019).

The results of fit diagnostics are presented in Table 8. The value of the SRMR in both the saturated and estimated models were .054, which is lower than the oft-referenced value of .08, however, global

fit is secondary in PLS-SEM evaluation (Hair et al., 2019). The remaining values were d_ULS = .887, d_G = .393, chi-square = 329.007, and NFI = .852. All indexes were the same for each of two model columns. They are therefore reported as supplementary diagnostics, not as replacements for measurement quality, path inference, explanatory strength, or prediction.

Table 8
Model fit indices reported by SmartPLS

Fit index	Saturated model	Estimated model
SRMR	0.054	0.054
d_ULS	0.887	0.887
d_G	0.393	0.393
Chi-square	329.007	329.007
NFI	0.852	0.852

Note. SRMR = standardized root mean square residual; NFI = normed fit index.

The d_ULS and d_G statistics remain descriptive because the supplied table lacks the bootstrapped HI95 and HI99 values required for formal discrepancy testing. The NFI is also given without assuming it as evidence of model fit. In total, the four reflective constructs were found to have achieved the reported reliability and validity criteria, the five hypotheses were supported, the endogenous constructs had a meaningful explained variance, and each was positively out-of-sample predictive. These conclusions are subject to the specification of the cross-sectional model. The paths show internally consistent relations and prediction between supply chain practices, operational efficiency, business performance and business sustainability, but are not able to show sequence or causal effects.

5. Discussion

Supply Chain Practices and Enterprise Outcomes

Supply chain practices related positively to all three endogenous constructs, although their effects differed in size. The highest direct coefficient was related to operational efficiency; contribution to business performance was small and to business sustainability was medium. For ethnic micro-enterprises, this trend depicts practices in the supply chain primarily as operational capability and not as an automatic source of overall performance. . This interpretation is relevant where scarce resources and culturally embedded networks shape exchange relationships (Haq et al., 2024; Islam, 2025). It also supports the resource-based and transaction-cost arguments that coordinated routines create value by improving resource deployment and reducing exchange uncertainty (Barney, 1991; Williamson, 2008).

The H1 result accords with Munir et al. (2020), whose evidence links integration with coordinated response and operational performance. It also complements Wong et al. (2021), who show that business-process discipline and integration can improve operations by limiting opportunism. Within Bangladesh, evidence on digital SCM adoption and strategic vendor management similarly points to efficiency and coordination benefits, while also identifying cost, capability, and infrastructure constraints (Hai et al., 2024; Rahman et al., 2023). The present finding extends this evidence to ethnic micro-enterprises, where structured supplier relationships, information exchange, inventory control, and customer coordination appear to compensate for limited managerial and material resources. Trust-

based networks may facilitate exchange, but they do not replace disciplined operating routines (Haq et al., 2024).

H2 was supported, but its small effect provides a more qualified result than studies reporting broader performance benefits from integration and sustainable supply chain practices (Junaid et al., 2022; Kong et al., 2021; Nguyen et al., 2022). It is also more cautious than the Bangladeshi micro-supply-chain case reported by Hawlader (2026), where collaborative purchasing produced cost and lead-time gains in a very small group of enterprises. Supply chain coordination may improve market responsiveness and customer outcomes, but it cannot remove constraints involving finance, scale, and market access that affect ethnic and Indigenous enterprises (Haq et al., 2024; Islam, 2025). The medium association with business sustainability supports H3 and is consistent with evidence linking integrated supply chain practices with economic, environmental, and social outcomes (Afum et al., 2020; Han & Huo, 2020; Zaid et al., 2018). In natural resource-based view terms, coordinated sourcing and resource-use routines can support continuity and responsible operations (Hart & Dowell, 2011). Because sustainability was measured through respondents' perceptions, however, this evidence concerns perceived organisational sustainability rather than independently verified environmental or social impacts.

Operational Efficiency as the Linking Mechanism

The indirect results identify operational efficiency as one route by which supply chain practices reach enterprise outcomes. It carried the relationships with both business performance and business sustainability, supporting H4 and H5, while both direct paths also remained significant. This pattern is compatible with Agyei-Owusu et al. (2022), who position operational performance between integration and firm performance, and with Kitchot et al. (2021), who show that internal organisational practices transmit SCM effects in SMEs. The present evidence applies that process logic to two outcomes within ethnic micro-enterprises. Coefficient sizes indicate that business performance relies more strongly on converting supply chain routines into efficient execution, whereas sustainability may additionally depend on continuity, responsible resource use, and community ties. Because those further mechanisms were outside the model, this explanation remains tentative.

Taken together, the findings refine the theoretical argument from possession of supply chain practices to a capability-conversion sequence. Resource-based logic explains the value of coordinated routines, transaction cost economics explains efficiency gains from lower coordination problems, and the natural resource-based view explains why those routines can also support longer-term sustainability (Hart, 1995; Wernerfelt, 1984; Williamson, 2008). The cross-sectional evidence supports this integrated explanation, but it does not establish temporal or causal ordering.

6.0 Conclusion and Overall Contribution

The study tested whether supply chain practices relate to operational efficiency, business performance, and business sustainability in Bangladeshi ethnic micro-enterprises and whether operational efficiency transmits part of those relationships. The survey of 330 enterprises showed all the proposed paths were supported. The direct contribution was highest when it came to operational efficiency, followed by business sustainability and lastly, business performance. The indirect effect of operational efficiency was found to be quite significant for both outcomes, especially for business performance. The key takeaway is that discipline is more important than possession; and, that if a supply chain routine is not being disciplined, it is not creating value. These cross-sectional findings establish association and predictive structure within the sample, not causal effects.

Theoretical Implications

The study elaborates the capability-based explanations for value in the supply chain by determining the operational efficiency as a specific conversion mechanism. The benefits of co-ordinated supply chain routines can be understood from a resource-based logic, while an understanding of the transaction cost economics illuminates how these routines can help to reduce co-ordination problems, and the natural resource-based view helps to understand their relevance for continuity and responsible use of resources (Barney, 1991; Hart, 1995; Williamson, 2008). Further differentiating business performance and business sustainability also reveals that the same capability will not have the same impact on outcomes. There was a relatively small direct contribution to the business performance and yet the supported indirect pathway, means having supply chain practices would not be enough – unless they are executed better. In this sense, a culturally embedded relationship can help to mediate exchange, and value will still require operating discipline.

Managerial and Policy Implications

The owners and managers should consider supply chain improvement as an operating programme and not just a series of loose relationships. Good supplier coordination, information exchange and basic inventory discipline, customer-fulfilment routines and systematic waste and resource monitoring should be prioritized. The indirect, small impact on business performance also warns against relying on supply chain training to address finance, scale, and market access constraints. Enterprise-support organisations and public agencies should therefore link and bundle context-sensitive supply chain trainings with affordable digital record-keeping tools, shared procurement and/or logistics services, better connections to reliable suppliers and buyers, and easy access to working-capital assistance. Operational results (stock available, delivery reliability, resources lost, continuity of operations) should be monitored in the evaluation of the programme, not just participation or number of tools adopted.

Limitations and Future Research

The conclusions are bounded by four design features. First, cross sectional observations can't show order in time. Secondly, one knowledgeable respondent per enterprise, this means measures reflect self-reported perceptions of organisations. Third, common method bias can be reduced, but not eliminated, by the use of procedural controls and statistical diagnostics. Lastly, due to the lack of an exhaustive sampling frame, the only option was purposive recruitment, making the results not fully representative of the country and restricting generalisation beyond the Bangladeshi enterprises involved in the study.

Future studies should be time-lagged or longitudinal and include objective measures of delivery time, stockout, inventory turnover, sales growth, waste, and energy use, in addition to survey measures. Testing of the model could be done across ethnic communities, regions or non-ethnic micro-enterprises, to determine its stability across settings. Additional research is also needed to disaggregate individual practices of the supply chain and to consider financial access, digital capability and institutional support as boundary conditions and to look for resilience and market access as alternative mechanisms. These designs would clarify when operational efficiency is the principal route from supply chain practice to enterprise performance and sustainability.

References

Afum, E., Osei-Ahenkan, V. Y., Agyabeng-Mensah, Y., Amponsah Owusu, J., Kusi, L. Y., & Ankomah, J. (2020). Green manufacturing practices and sustainable performance among Ghanaian manufacturing SMEs: The explanatory link of green supply chain integration. *Management of Environmental Quality: An International Journal, 31*(6), 1457–1475. https://doi.org/10.1108/MEQ-01-2020-0019

Agyei-Owusu, B., Asamoah, D., Nuertey, D., & Acquah, I. N. (2022). Examining the relationship between dimensions of supply chain integration, operational performance and firm performance: Evidence from Ghana. *Management Research Review, 45*(12), 1644–1669. https://doi.org/10.1108/MRR-06-2021-0464

Bangladesh Bureau of Statistics. (2022). *Population and housing census 2022: Preliminary report*. Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh. Available at: https://nsds.bbs.gov.bd/storage/files/1/Publications/BBS_Preliminary_Census_2022.pdf (Accessed: 30 August 2026).

Bangladesh Bureau of Statistics. (2026). *Economic census 2024: National report (Volume 1)*. Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh. Available at: https://objectstorage.ap-dcc-gazipur-1.oraclecloud15.com/n/axvjbnqprylg/b/V2Ministry/o/office-bbs/2026/3/5c074dc0-09bd-41a5-9068-308e67afe931.pdf (Accessed: 30 August 2026).

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management, 19*(3), 275–292. https://doi.org/10.1108/01443579910249714

Beka Be Nguema, J. N., Bi, G., Akenroye, T. O., & El Baz, J. (2022). The effects of supply chain finance on organizational performance: A moderated and mediated model. *Supply Chain Management: An International Journal, 27*(1), 113–127. https://doi.org/10.1108/SCM-05-2020-0223

Bollen, K. A., & Pearl, J. (2013). Eight myths about causality and structural equation models. In S. L. Morgan (Ed.), *Handbook of causal analysis for social research* (pp. 301–328). Springer. https://doi.org/10.1007/978-94-007-6094-3_15

Chowdhury, M. M. H., & Quaddus, M. (2016). Supply chain readiness, response and recovery for resilience. *Supply Chain Management: An International Journal, 21*(6), 709–731. https://doi.org/10.1108/SCM-12-2015-0463

Coase, R. H. (1937). The nature of the firm. *Economica, 4*(16), 386–405. https://doi.org/10.1111/j.1468-0335.1937.tb00002.x

Cousins, P. D., Lawson, B., Petersen, K. J., & Fugate, B. (2019). Investigating green supply chain management practices and performance: The moderating roles of supply chain ecocentricity and traceability. *International Journal of Operations & Production Management, 39*(5), 767–786. https://doi.org/10.1108/IJOPM-11-2018-0676

Doetzer, M., & Pflaum, A. (2021). The role of digitalized information sharing for flexibility capability utilization: Lessons from Germany and Japan. *International Journal of Physical Distribution & Logistics Management, 51*(2), 181–203. https://doi.org/10.1108/IJPDLM-01-2020-0030

Dzikriansyah, M. A., Masudin, I., Zulfikarijah, F., Jihadi, M., & Jatmiko, R. D. (2023). The role of green supply chain management practices on environmental performance: A case of Indonesian small and medium enterprises. *Cleaner Logistics and Supply Chain, 6*, 100100. https://doi.org/10.1016/j.clscn.2023.100100

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management, 28*(1), 58–71. https://doi.org/10.1016/j.jom.2009.06.001

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Fuller, C. M., Simmering, M. J., Atinc, G., Atinc, Y., & Babin, B. J. (2016). Common methods variance detection in business research. *Journal of Business Research, 69*(8), 3192–3198. https://doi.org/10.1016/j.jbusres.2015.12.008

Ganbold, O., Matsui, Y., & Rotaru, K. (2020). Effect of information technology-enabled supply chain integration on firm's operational performance. *Journal of Enterprise Information Management, 34*(3), 948–989. https://doi.org/10.1108/JEIM-10-2019-0332

Garcia-Buendia, N., Moyano-Fuentes, J., Maqueira, J. M., & Avella, L. (2023). The lean supply chain management response to technology uncertainty: Consequences for operational performance and competitiveness. *Journal of Manufacturing Technology Management, 34*(1), 67–86. https://doi.org/10.1108/JMTM-07-2022-0250

Hai, S. B. A., Uddin, M. J., Rahim, A. R., Haq, N., & Israq, F. (2024). Adoption of digital tools in supply chain management among SMEs in Bangladesh. *Supply Chain Insider, 12*(1), 86–100. https://doi.org/10.5281/zenodo.13865129

Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research, 109*, 101–110. https://doi.org/10.1016/j.jbusres.2019.11.069

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. https://doi.org/10.1108/EBR-11-2018-0203

Han, Z., & Huo, B. (2020). The impact of green supply chain integration on sustainable performance. *Industrial Management & Data Systems, 120*(4), 657–674. https://doi.org/10.1108/IMDS-07-2019-0373

Haq, M., Johanson, M., Davies, J., Ng, W., & Dana, L.-P. (2024). Bourdieusian and resource-based perspectives on ethnic minority microbusinesses: The construction of a culture-induced entrepreneurship model. *Journal of Small Business Management, 62*(4), 1982–2015. https://doi.org/10.1080/00472778.2023.2192760

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986–1014. https://doi.org/10.5465/AMR.1995.9512280033

Hart, S. L., & Dowell, G. (2011). Invited editorial: A natural-resource-based view of the firm: Fifteen years after. *Journal of Management, 37*(5), 1464–1479. https://doi.org/10.1177/0149206310390219

Hawlader, M. S. (2026). Developing collaborative bargaining and supplier aggregation framework to improve negotiation power of a micro supply chain. *Supply Chain Insider, 18*(1), 1–29. https://doi.org/10.5281/zenodo.18935782

Hendijani, R., & Norouzi, M. (2023). Supply chain integration and firm performance in the COVID-19 era: The mediating role of resilience and robustness. *Journal of Global Operations and Strategic Sourcing, 16*(2), 337–367. https://doi.org/10.1108/JGOSS-03-2022-0022

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Islam, M. S. (2025). Empowering Indigenous women entrepreneurs in Bangladesh: Sustainable strategies for resilience amid uncertainty. *Rural Society, 34*(2), 182–198. https://doi.org/10.1080/10371656.2025.2516392

Junaid, M., Zhang, Q., & Syed, M. W. (2022). Effects of sustainable supply chain integration on green innovation and firm performance. *Sustainable Production and Consumption, 30*, 145–157. https://doi.org/10.1016/j.spc.2021.11.031

Kitchot, S., Siengthai, S., & Sukhotu, V. (2021). The mediating effects of HRM practices on the relationship between SCM and SMEs firm performance in Thailand. *Supply Chain Management: An International Journal, 26*(1), 87–101. https://doi.org/10.1108/SCM-05-2019-0177

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration, 11*(4), 1–10. https://doi.org/10.4018/IJEC.2015100101

Kong, T., Feng, T., & Huo, B. (2021). Green supply chain integration and financial performance: A social contagion and information sharing perspective. *Business Strategy and the Environment, 30*(5), 2255–2270. https://doi.org/10.1002/bse.2745

Kumar, N., Stern, L. W., & Anderson, J. C. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal, 36*(6), 1633–1651. https://doi.org/10.2307/256824

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega, 34*(2), 107–124. https://doi.org/10.1016/j.omega.2004.08.002

Li, S., Rao, S. S., Ragu-Nathan, T. S., & Ragu-Nathan, B. (2005). Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management, 23*(6), 618–641. https://doi.org/10.1016/j.jom.2005.01.002

Lin, J., & Fan, Y. (2024). Seeking sustainable performance through organizational resilience: Examining the role of supply chain integration and digital technology usage. *Technological Forecasting and Social Change, 198*, 123026. https://doi.org/10.1016/j.techfore.2023.123026

Munir, M., Jajja, M. S. S., Chatha, K. A., & Farooq, S. (2020). Supply chain risk management and operational performance: The enabling role of supply chain integration. *International Journal of Production Economics, 227*, 107667. https://doi.org/10.1016/j.ijpe.2020.107667

Nguyen, M. H., Phan, A. C., & Matsui, Y. (2022). Supply chain integration and economic performance: Empirical evidence from a developing country. *Benchmarking: An International Journal, 29*(9), 2710–2732. https://doi.org/10.1108/BIJ-01-2021-0004

Nitzl, C., Roldan, J. L., & Cepeda, G. (2016). Mediation analysis in partial least squares path modeling: Helping researchers discuss more sophisticated models. *Industrial Management & Data Systems, 116*(9), 1849–1864. https://doi.org/10.1108/IMDS-07-2015-0302

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Prangan, T. H., Ahmed, M. R., Islam, A.-A., Islam, M. A., & Mim, J. S. (2025). Evaluating the impact of sustainable supply chain management (SSCM) practices on business performance among agro-based SMEs in Bangladesh: Mediating role of FinTech usability. *Supply Chain Insider, 17*(1), 207–268. https://doi.org/10.5281/zenodo.17285206

Presser, S., Couper, M. P., Lessler, J. T., Martin, E., Martin, J., Rothgeb, J. M., & Singer, E. (2004). Methods for testing and evaluating survey questions. *Public Opinion Quarterly, 68*(1), 109–130. https://doi.org/10.1093/poq/nfh008

Rahman, M., Tamim, M. W. A., Toha, A. T. M., & Rezwan-Ur-Rouf, M. (2023). Impact of strategic vendor management to improve supply chain performance. *Supply Chain Insider, 9*(1), 1–15. https://doi.org/10.5281/zenodo.10018571

Ringle, C. M., Wende, S., & Becker, J.-M. (2024). *SmartPLS 4* [Computer software]. SmartPLS GmbH. Available at: https://www.smartpls.com (Accessed: 30 August 2026).

Roldán Bravo, M. I., Maqueira-Marín, J. M., & Moyano-Fuentes, J. (2023). Supply chain 4.0 ambidexterity and lean supply chain management: Interrelationships and effect on the focal firm's operational performance. *Supply Chain Management: An International Journal, 28*(7), 112–128. https://doi.org/10.1108/SCM-05-2023-0274

Rumky, S. A., Latif, M. A., & Hossain, M. (2023). Potential influence of FinTech on MSMEs supply chain performance improvement in Bangladesh. *Supply Chain Insider, 9*(1), 1–10. https://doi.org/10.5281/zenodo.10018606

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

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing, 53*(11), 2322–2347. https://doi.org/10.1108/EJM-02-2019-0189

Verver, M., Passenier, D., & Roessingh, C. (2019). Contextualising ethnic minority entrepreneurship beyond the west: Insights from Belize and Cambodia. *International Journal of Entrepreneurial Behaviour & Research, 25*(5), 955–973. https://doi.org/10.1108/IJEBR-03-2019-0190

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 171–180. https://doi.org/10.1002/smj.4250050207

Williamson, O. E. (2008). Outsourcing: Transaction cost economics and supply chain management. *Journal of Supply Chain Management, 44*(2), 5–16. https://doi.org/10.1111/j.1745-493X.2008.00051.x

Wong, W. P., Sinnandavar, C. M., & Soh, K.-L. (2021). The relationship between supply environment, supply chain integration and operational performance: The role of business process in curbing opportunistic behaviour. *International Journal of Production Economics, 232*, 107966. https://doi.org/10.1016/j.ijpe.2020.107966

World Bank. (2023). *Logistics performance index 2023: Bangladesh scorecard*. Available at: https://lpi.worldbank.org/international/scorecard/radar/C/BGD/2023 (Accessed: 30 August 2026).

Yildiz Çankaya, S., & Sezen, B. (2019). Effects of green supply chain management practices on sustainability performance. *Journal of Manufacturing Technology Management, 30*(1), 98–121. https://doi.org/10.1108/JMTM-03-2018-0099

Zaid, A. A., Jaaron, A. A. M., & Bon, A. T. (2018). The impact of green human resource management and green supply chain management practices on sustainable performance: An empirical study. *Journal of Cleaner Production, 204*, 965–979. https://doi.org/10.1016/j.jclepro.2018.09.062

Appendix

Measurement Instruments

Table A1

Constructs, Measurement Items, and Source References

Construct	Item code	Measurement item	Source
Supply Chain Practices (SCP)	SCP1	Our enterprise maintains close and reliable relationships with its main suppliers.	Li et al. (2006); Flynn et al. (2010)
	SCP2	Our enterprise works together with suppliers to solve problems related to quality, cost, or delivery.	Li et al. (2006); Flynn et al. (2010)
	SCP3	Our enterprise shares useful information about orders, demand, stock, and delivery changes with its main suppliers.	Li et al. (2006); Flynn et al. (2010)
	SCP4	Our enterprise regularly communicates with customers to understand their needs and changes in demand.	Li et al. (2006); Flynn et al. (2010)
	SCP5	Our enterprise uses customer feedback to improve its products/services and delivery.	Li et al. (2006); Flynn et al. (2010)

Construct	Item code	Measurement item	Source
	SCP6	Purchasing, stock, production/service, and delivery activities are well coordinated in our enterprise.	Li et al. (2006); Flynn et al. (2010)
	SCP7	Our enterprise can quickly adjust its sourcing, order quantities, or delivery arrangements when customer demand changes.	Li et al. (2006); Flynn et al. (2010)
Operational Efficiency (OE)	OE1	Our enterprise is able to complete customer orders within a short period of time.	Flynn et al. (2010); Beamon (1999)
	OE2	Our enterprise delivers products/services to customers on time as promised.	Flynn et al. (2010); Beamon (1999)
	OE3	Our enterprise keeps unnecessary stock or raw materials at a low level.	Flynn et al. (2010); Beamon (1999)
	OE4	Our enterprise effectively controls purchasing, storage, transportation, and other operating costs.	Flynn et al. (2010); Beamon (1999)
	OE5	Our enterprise minimizes waste, spoilage, errors, rework, and unnecessary use of materials.	Flynn et al. (2010); Beamon (1999)
	OE6	Our enterprise makes efficient use of labour, equipment, working space, and other available resources.	Flynn et al. (2010); Beamon (1999)
Business Performance (BP)	BP1	The sales of our enterprise have increased during the past three years.	Flynn et al. (2010)
	BP2	The profitability of our enterprise has improved during the past three years.	Flynn et al. (2010)
	BP3	The number of customers or repeat customers of our enterprise has increased.	Flynn et al. (2010)
	BP4	The market position or market reach of our enterprise has improved during the past three years.	Flynn et al. (2010)
	BP5	Overall, the business performance of our enterprise has improved during the past three years.	Flynn et al. (2010)
Business Sustainability (BS)	BS1	Our enterprise is able to continue its operations when unexpected supply, market, or economic problems occur.	Chowdhury & Quaddus (2016)
	BS2	Our enterprise can adjust its sourcing, products/services, or business methods when conditions change.	Chowdhury & Quaddus (2016)
	BS3	Our enterprise is capable of maintaining stable operations and supporting the livelihood of people dependent on the business over time.	Chowdhury & Quaddus (2016)
	BS4	Our enterprise uses materials, energy, and water carefully and tries to reduce unnecessary waste.	Chowdhury & Quaddus (2016)
	BS5	Our enterprise maintains safe and hygienic working conditions for the people involved in the business.	Chowdhury & Quaddus (2016)
	BS6	Our enterprise maintains good relationships and a positive reputation within the local community.	Chowdhury & Quaddus (2016)

Construct	Item code	Measurement item	Source
	BS7	We believe our enterprise has the ability to remain viable and continue operating successfully in the long term.	Chowdhury & Quaddus (2016)

Note. Items were measured using a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). SCP = supply chain practices; OE = operational efficiency; BP = business performance; BS = business sustainability. Item wording and source attributions are reproduced from the supplied measurement-instrument file.