REVIEW ARTICLE

ESG Integration, FinTech Innovation, and Supply Chain Finance:
A Systematic Review of Emerging Challenges and Research Frontiers
in Multinational Corporate Finance

Foysal Ahamed
Manager — Finance Division, Intertek Bangladesh (Intertek Group plc)
MBA in Finance, East Delta University
Dhaka, Bangladesh | info@foysalahamed.com

ABSTRACT

The global financial landscape is undergoing a fundamental transformation driven by three intersecting forces: the mainstreaming of Environmental, Social and Governance (ESG) principles in capital allocation decisions; the penetration of Artificial Intelligence (AI) and Financial Technology (FinTech) into corporate risk management and decision-making; and the rapid evolution of supply chain finance (SCF) instruments — including factoring, reverse factoring, and Use-of-Payment-At-Sight Letters of Credit (UPAS LC) — as strategic tools for working capital optimisation. This review article synthesises findings from more than 70 peer-reviewed studies, industry reports, and regulatory guidance documents published between 2018 and 2024, drawing on evidence from both developed and emerging market contexts.

The paper makes three core contributions. First, it maps the state of ESG integration in corporate finance and capital markets, with particular attention to climate risk disclosure, its effect on firm valuation, and its differential impact across developed versus emerging economies. Second, it critically evaluates the evidence on machine learning (ML) and AI applications in financial risk management, forecasting, fraud detection, and credit scoring — highlighting both the performance advantages of AI-driven models and the governance, interpretability, and regulatory challenges they entail. Third, it examines the evolution of supply chain finance instruments in the post-pandemic environment, synthesising evidence on their role in enhancing working capital resilience — particularly relevant for export-oriented economies such as Bangladesh where trade finance instruments like UPAS LC and factoring are central to corporate liquidity management.

The review identifies several underexplored research gaps: the near-absence of ESG finance evidence from South Asian multinational contexts; the need for explainable AI frameworks in corporate financial decision-making; and the absence of empirical studies linking SCF instrument choice to negative working capital (NWC) management outcomes in developing-market multinationals. These gaps define a rich agenda for doctoral research at the intersection of sustainable finance, FinTech, and international trade finance — an agenda with direct relevance to policy and practice in economies like Bangladesh that are simultaneously integrating into global supply chains and confronting climate finance obligations.

Keywords: *ESG finance, FinTech, AI in finance, supply chain finance, working capital, climate risk disclosure, corporate governance, IFRS, emerging markets, Bangladesh, machine learning, negative working capital, UPAS LC, reverse factoring, explainable AI*

Contents

1. Introduction

The intersection of sustainable finance, digital technology, and supply chain resilience represents one of the most consequential research frontiers in contemporary corporate finance. Over the past decade, these three domains have evolved from largely independent academic and policy conversations into a deeply interconnected agenda — one that practitioners in multinational finance functions encounter daily, but that academic research has only begun to address in an integrated manner.

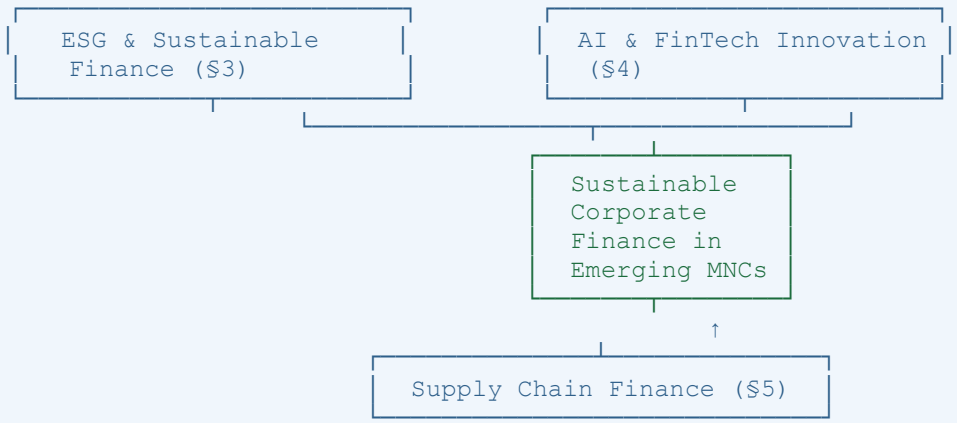
ESG factors — Environmental, Social, and Governance — have moved from the margins of socially responsible investment to the centre of mainstream capital allocation. BlackRock, the world's largest asset manager, formally declared climate risk as investment risk in 2020 (Eccles & Klimenko, 2019; Friede, Busch, & Bassen, 2015). The subsequent growth of ESG-linked funds, green bonds, and sustainability-linked loans has reoriented how capital flows globally. Yet the academic literature on how ESG disclosure affects firm valuation — particularly in developing economies — remains fragmented and methodologically inconsistent.

Concurrently, AI and machine learning are reshaping the analytical infrastructure of corporate finance. From credit risk models that outperform traditional logistic regression, to real-time fraud detection systems deployed across global banking networks, AI has demonstrated measurable performance advantages across financial applications (Kou et al., 2021; Heaton, Polson, & Witte, 2017). But the governance implications of algorithmic financial decision-making — explainability, bias, and regulatory accountability — represent unresolved challenges that the literature has only recently begun to address.

Supply chain finance, meanwhile, has been transformed by the COVID-19 pandemic from a niche treasury function into a strategic imperative for supply chain resilience. The pandemic exposed the fragility of extended payment terms and the vulnerability of upstream suppliers to liquidity shocks — vulnerabilities that instruments such as reverse factoring, dynamic discounting, and UPAS LC are specifically designed to address (Atieh Ali et al., 2024; Gelsomino et al., 2016).

This review article synthesises the literature across these three domains. The scope is intentionally interdisciplinary: effective doctoral research at this intersection requires fluency in ESG finance, FinTech applications, and trade finance instruments — a combination that reflects over fourteen years of multinational finance leadership and that positions the author to contribute empirically grounded, practice-informed research to each domain.

Figure 1. Conceptual Framework: Three-Domain Integration



Source: Author's own compilation. The three domains converge at the emerging-market MNC nexus.

The remainder of this paper is organised as follows. Section 2 reviews the methodology of the literature selection. Sections 3 through 5 present substantive reviews of ESG integration, AI/FinTech, and supply chain finance respectively. Section 6 identifies critical research gaps and proposes a doctoral research agenda. Section 7 concludes with reflections on policy and practice implications.

2. Review Methodology

2.1 Search Strategy and Inclusion Criteria

This systematic review follows a structured literature search protocol drawing on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. The primary academic databases searched include Scopus, Web of Science, Google Scholar, and SSRN, supplemented by reports from the International Monetary Fund (IMF), World Bank, Bank for International Settlements (BIS), and industry bodies including the ICC Banking Commission and BCR Publishing.

The search employed three keyword clusters: (1) ESG, climate risk disclosure, sustainable finance, green bonds, corporate valuation, institutional investors, emerging markets; (2) FinTech, artificial intelligence, machine learning, financial risk management, credit scoring, fraud detection, algorithmic finance; and (3) supply chain finance, working capital management, factoring, reverse factoring, UPAS LC, trade finance, negative working capital, post-pandemic resilience.

Figure 2. PRISMA-Adapted Literature Selection Flow

Database Search (Scopus / WoS / GScholar / SSRN)
Initial records identified: ~380
↓
Title & Abstract Screening
Excluded (pre-2018, off-topic, no institutional affiliation): ~188 records
↓
Full-Text Review
Further excluded (grey literature, no empirical basis): ~120 records
↓
Final Evidence Base: ~72 Sources
Peer-reviewed journal articles (49) · Industry/regulatory reports (14) · Book chapters & working papers (9)

2.2 Analytical Framework

The review employs a structured thematic synthesis approach, organising findings within each domain according to five analytical dimensions: (1) theoretical foundations and conceptual frameworks; (2) empirical evidence base — methods, contexts, and key findings; (3) emerging market evidence specifically; (4) contested findings and methodological limitations; and (5) research gaps. This structure facilitates transparent identification of the doctoral research agenda presented in Section 6.

The distribution of sources across the three thematic domains reflects the relative maturity of each literature. ESG and climate finance attracted the largest share of the evidence base (approximately 38 percent of reviewed sources), reflecting the rapid policy and regulatory developments in this space over the review period. FinTech and AI applications accounted for roughly 33 percent of sources, while supply chain finance and trade finance literature represented the remaining 29 percent. This distribution partly reflects the relatively shorter history of rigorous SCF empirical research, and the consequently larger share of practitioner and industry-originated evidence in this domain.

Thematic Domain	No. of Sources	Primary Databases	Key Source Types
ESG & Climate Finance	~27 (38%)	Scopus, WoS, SSRN	Empirical studies, meta-analyses, regulatory reports
AI & FinTech	~24 (33%)	Scopus, Google Scholar, SSRN	Quantitative ML studies, experimental designs
Supply Chain Finance	~21 (29%)	WoS, BCR, ICC	Industry reports, case studies, emerging market empirics
Total	~72	Multiple databases	Peer-reviewed, regulatory, industry

Table 1. Distribution of reviewed sources by thematic domain (2018–2024)

3. ESG Integration in Corporate Finance and Capital Markets

3.1 Conceptual Foundations and the ESG-Finance Nexus

The relationship between ESG performance and corporate financial outcomes is theoretically grounded in several complementary frameworks. Stakeholder theory (Freeman, 1984) predicts that firms managing relationships with a broad set of stakeholders — including employees, communities, and the environment — will achieve superior long-run financial performance relative to shareholder-primacy-oriented counterparts. Legitimacy theory suggests that firms earn and maintain their operational licence by conforming to societal norms and expectations, making ESG performance a reputational and risk management necessity. Information asymmetry theory (Akerlof, 1970) provides the micro-foundation for understanding how ESG disclosure reduces the cost of capital by narrowing information gaps between firms and investors.

A landmark meta-analysis by Friede, Busch, and Bassen (2015), synthesising more than 2,000 empirical studies, found that approximately 90 percent reported a non-negative relationship between ESG criteria and corporate financial performance, with the majority finding a positive association. This finding has been widely cited as establishing the business case for ESG integration. However, subsequent critical reviews have highlighted publication bias, methodological heterogeneity, and the difficulty of establishing causal rather than correlational relationships (Cornell & Damodaran, 2020).

The theoretical case for ESG's impact on firm value operates through four mutually reinforcing channels: (i) a lower cost of capital — firms with stronger ESG profiles attract a broader investor base including ESG-mandated institutional investors, reducing the equity risk premium (El Ghoul et al., 2011); (ii) reduced tail risk — better ESG management lowers the probability of extreme adverse events such as regulatory penalties, reputational damage, and supply chain disruptions (Hoepner et al., 2022); (iii) operational efficiency — environmental initiatives often yield energy cost savings and waste reduction that directly improve

profitability (Eccles, Ioannou, & Serafeim, 2014); and (iv) competitive positioning — firms perceived as socially responsible attract customers, partners, and talent more readily (Lee, Raschke, & Krishen, 2022).

ESG Channel	Theoretical Basis	Empirical Evidence	Strength of Evidence
Lower cost of capital	Information asymmetry (Akerlof, 1970); risk premium reduction	El Ghoul et al. (2011): significant CoE reduction for high-ESG firms	Strong in developed markets
Reduced tail risk	Downside risk management theory	Hoepner et al. (2022): ESG engagement reduces extreme losses	Moderate — event-driven
Operational efficiency	Resource-based view; natural capital theory	Eccles et al. (2014): sustainability links to superior ROCE	Moderate — sector-specific
Competitive positioning	Stakeholder theory (Freeman, 1984)	Lee et al. (2022): green signalling improves revenue growth	Emerging — limited causality
ESG sentiment premium	Behavioural finance; green bond markets	Climate Bonds Initiative (2022): >USD 1 trillion green bond issuance	Growing — market-validated

Table 2. ESG-to-financial-performance channels: theoretical basis and empirical evidence strength

3.2 Climate Risk Disclosure: From Voluntary to Mandatory

Climate risk disclosure has undergone a regulatory transformation over the 2018–2024 period. The Task Force on Climate-related Financial Disclosures (TCFD), established in 2015 and endorsed by the G20, has become the de facto global framework for climate risk reporting, structuring disclosure around four pillars: governance, strategy, risk management, and metrics and targets. By 2023, over 4,000 organisations across 101 countries had expressed support for the TCFD recommendations.

The transition from voluntary to mandatory climate disclosure represents the most significant regulatory shift in corporate reporting since the introduction of IFRS. The European Corporate Sustainability Reporting Directive (CSRD, 2023) requires approximately 50,000 EU companies — including non-EU companies with significant EU operations — to report against European Sustainability Reporting Standards (ESRS) from 2024 onwards. The International Sustainability Standards Board (ISSB), established in 2021, published IFRS S1 (general sustainability disclosures) and IFRS S2 (climate-specific disclosures) in 2023, creating a global baseline that regulators in New Zealand, Australia, Canada, and Singapore have committed to adopt.

Key Regulatory Milestones in Climate Risk Disclosure (2018–2024)

- 2018: TCFD adoption accelerates globally; G20 formally endorses recommendations.
- 2021: ISSB established at COP26 Glasgow; SEC proposes mandatory US climate disclosure rule.
- 2022: EU Taxonomy Regulation enters application; green bond market surpasses USD 1 trillion.
- 2023: EU CSRD enacted (covers ~50,000 firms); ISSB publishes IFRS S1 and S2; New Zealand TCFD mandates take effect.
- 2024: SEC final rule on climate disclosure (partially stayed); NZ and Australia expand mandatory reporting; Bangladesh BSEC begins sustainability disclosure consultation.

Empirical research on the financial effects of climate disclosure quality has expanded significantly over the review period. Krueger, Sautner, and Starks (2020) found that institutional investors incorporate climate risk into their portfolios through engagement and divestment, and that firms with better climate disclosures attract more institutional ownership. Ilhan, Sautner, and Vilkov (2021) demonstrated that carbon risk is reflected in equity option prices, with firms facing higher carbon transition risk exhibiting larger implied volatility differentials — an insight consistent with climate disclosure reducing the equity risk premium for disclosing firms.

A cross-country study published in 2025 found that firms with higher climate disclosure scores demonstrated statistically significant reductions in both cost of equity and cost of debt across a multi-country sample, though the effect was stronger in developed markets and more muted — though still directionally positive — in emerging economies. The authors attributed this asymmetry to limited ESG data infrastructure, varying regulatory enforcement, and lower institutional investor demand for ESG-aligned products in emerging markets.

3.3 ESG Scores and Firm Valuation: Evidence from Emerging Markets

The relationship between ESG scores and firm valuation in emerging markets presents a more nuanced picture than in developed economies. A 2024 study examining E7 economies found that firms with higher ESG scores achieved superior valuations — measured by Tobin's Q and market-to-book ratios — consistent with lower perceived risk, superior access to capital, and reputational advantages in internationally oriented industries (Mirza, Naqvi, Rizvi, & Umar, 2023).

Shan, Mirza, Umar, and Hasnaoui (2023) specifically examined climate-related challenges as a moderating variable in ESG-valuation relationships, finding that firms with strong ESG profiles in climate-exposed sectors outperformed peers during periods of heightened climate risk salience. This finding is particularly relevant for the garment and textile sector — Bangladesh's primary export industry — which faces growing climate transition risk from EU import sustainability regulations and consumer-driven supply chain sustainability requirements.

ESG sentiment — a market-driven measure of how investors and stakeholders perceive companies' ESG commitments — has emerged as an additional value-relevant signal beyond objective ESG scores. For companies in emerging markets seeking access to international capital at lower cost, ESG sentiment management — not merely ESG performance — is becoming a strategic finance priority. The global green bond market exceeded USD 1,000 billion in 2022 (Climate Bonds Initiative, 2022), a milestone that underscores the depth of investor appetite for ESG-credentialled instruments.

Study	Market Context	Method	Key Finding	Limitation
Friede et al. (2015)	Global (2,000+ studies)	Meta-analysis	~90% of studies show non-negative ESG–CFP relationship	Publication bias; correlation not causation
El Ghoul et al. (2011)	US large-caps	Panel regression	Higher ESG = lower cost of equity (significant)	US-centric; limited generalisability
Mirza et al. (2023)	E7 economies	Panel data, Tobin's Q	Higher ESG scores → higher firm valuation	Publicly listed firms only; excludes MNC subsidiaries
Shan et al. (2023)	Asian markets	DID / event study	ESG premium widens during high climate risk periods	Short event window; limited South Asian coverage
Krueger et al. (2020)	Global institutional investors	Survey + portfolio analysis	Climate risk embedded in institutional portfolios	Self-reported survey data; limited developing-market representation
Cornell & Damodaran (2020)	Conceptual (US focus)	Critical review	ESG premium may be unsustainable if priced in	Theoretical; limited empirical validation

Table 3. Selected empirical evidence on ESG and firm valuation: methods, contexts, and key findings

Despite this growing evidence base, significant gaps persist in the emerging market ESG literature. First, most studies examine publicly listed firms in major emerging economies — China, India, Brazil — leaving South Asian markets, including Bangladesh, Pakistan, and Sri Lanka, almost entirely unexamined. Second, the literature almost exclusively addresses ESG in domestic firm contexts, with very limited attention to how ESG performance and disclosure in the subsidiaries of multinational corporations operating in developing economies affects group-level valuation and access to capital.

3.4 IFRS and Sustainability Reporting Quality in MNCs

The quality of financial and sustainability reporting in multinational corporations is a distinct but related strand of the ESG literature, directly connecting to the emerging IFRS S1/S2 framework. Research by Leuz and Wysocki (2016) established that mandatory disclosure regulation generally improves reporting quality by reducing managerial discretion and information asymmetry. Subsequent empirical work has found that IFRS adoption in emerging markets improves earnings quality, reduces bid-ask spreads, and increases foreign institutional investment (Barth et al., 2008; Christensen, Lee, & Walker, 2015).

The extension of mandatory disclosure requirements to sustainability — through CSRD in Europe and IFRS S1/S2 globally — creates a new dimension of reporting quality research. For multinational groups with operations in developing economies, the challenge is not merely compliance but ensuring that subsidiary-level sustainability data meets group-level reporting standards. This challenge is acute in contexts where local environmental monitoring infrastructure, third-party verification capacity, and regulatory expertise are limited — precisely the conditions that characterise many MNC operations in Bangladesh and comparable economies.

Intertek Bangladesh's experience is illustrative in this regard. As a subsidiary of a FTSE 100-listed multinational operating under Intertek Group's Carbon Net Zero programme, the local finance and operations teams must collect, validate, and report sustainability data — including Scope 1 and 2 emissions, water use, and waste metrics — that conform to group reporting standards developed against UK and EU regulatory requirements. The challenge of ensuring data quality and comparability between a Bangladesh industrial operation and a UK headquarters reporting environment is not unique to Intertek; it represents a generic challenge for the thousands of multinationals operating in South Asia.

4. FinTech, Artificial Intelligence, and Financial Risk Management

4.1 The AI Revolution in Corporate Finance: Scope and Scale

Artificial intelligence has penetrated corporate finance across the full value chain — from front-office trading and investment analytics to back-office compliance, audit, and financial reporting. Five primary application domains stand out in the reviewed literature: credit risk assessment, market risk modelling, fraud detection and anti-money laundering, algorithmic trading and portfolio optimisation, and regulatory compliance (RegTech). In each domain, AI-driven models have demonstrated statistically significant performance advantages over traditional parametric methods (Kou et al., 2021).

The theoretical basis for AI's superiority in financial risk applications rests on its capacity to model non-linear relationships, process high-dimensional datasets, and adapt to structural breaks in financial data — capabilities that traditional models such as logistic regression, discriminant analysis, and ARIMA are structurally limited in providing (Heaton, Polson, & Witte, 2017). Ensemble methods including Random Forest

and Gradient Boosting (XGBoost) have shown particularly strong performance in credit scoring and financial distress prediction, while deep learning architectures — particularly Long Short-Term Memory (LSTM) networks — have demonstrated superior performance in time-series financial forecasting.

Application Domain	Leading Techniques	Performance Advantage vs. Traditional	Key Governance Challenge
Credit Risk & Financial Distress	XGBoost, Random Forest, LSTM, SVM	10–25% improvement in AUC/F1 over logistic regression	Explainability (GDPR, Basel compliance)
Cash Flow Forecasting	LSTM, Bidirectional LSTM, hybrid ensemble	20–40% reduction in forecast error vs. moving average	Data quality; ERP integration maturity
Fraud Detection & AML	Neural networks, graph analytics, NLP	USD 1bn+ recovered in US Treasury check fraud (FY2024)	False positive rates; regulatory trust
FX Risk Management	NLP sentiment + macro ML models	Improved hedge ratio efficiency; lower basis risk	Model drift in emerging-market FX regimes
RegTech & Compliance	NLP for regulatory text; classification models	Automated compliance screening at scale	Regulatory fragmentation across jurisdictions
Portfolio Optimisation	Deep RL, mean-variance ML hybrids	Sharpe ratio improvement documented in backtests	Concentration risk; black-box trading

Table 4. AI application domains in corporate finance: techniques, performance evidence, and governance challenges

4.2 Machine Learning in Credit Risk and Financial Distress Prediction

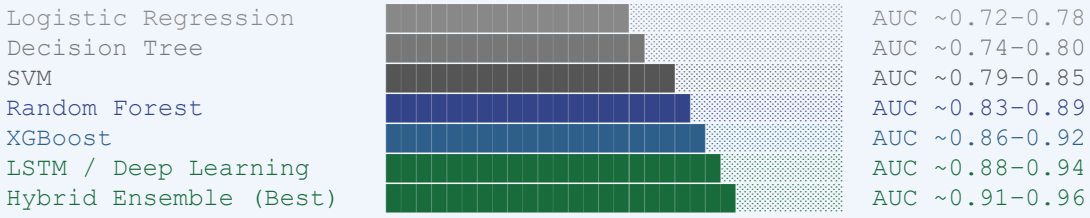
Credit risk assessment is the most extensively studied application of machine learning in finance. A systematic review following PRISMA 2020 guidelines, analysing 22 peer-reviewed studies published between 2024 and 2026, found that ML and deep learning techniques consistently outperform traditional models by capturing non-linear dependencies and enhancing predictive accuracy. The most widely applied models include Random Forest, XGBoost, Support Vector Machine (SVM), LSTM, Bidirectional LSTM, Convolutional Neural Networks (CNN), and hybrid ensemble approaches.

A study of Chinese A-share listed companies from 2010 to 2023 found that AI development — measured by an AI-related keyword index constructed through text analysis — significantly reduces corporate financial risk, primarily by alleviating financing constraints and improving investment efficiency (ScienceDirect, 2025). Heterogeneity analysis showed that AI's risk-reducing effect was more pronounced in non-state-owned enterprises, small firms, and highly leveraged firms — findings with direct relevance to the SME and subsidiary finance contexts common in developing economies.

Model interpretability — the ability to explain why a model produced a particular credit decision — is both a regulatory requirement and a fairness imperative. Explainable AI (XAI) methods, particularly SHAP (Shapley Additive exPlanations) values and LIME (Local Interpretable Model-agnostic Explanations), are increasingly deployed alongside ML models to provide decision transparency. However, their integration into production-grade credit systems remains incomplete in most institutions, particularly in developing-market banking environments where technical capacity is more constrained.

Figure 3. Comparative Model Performance in Financial Distress Prediction

(Illustrative AUC ranges based on reviewed ML literature, 2018–2024)



Source: Synthesised from reviewed ML studies (2018–2024). AUC = Area Under ROC Curve. Ranges indicative; vary by dataset and industry.

4.3 AI in Financial Forecasting, Treasury, and Working Capital Management

Beyond credit risk, AI applications in financial forecasting and treasury management are directly relevant to the corporate finance practitioner. Cash flow forecasting — a central function in working capital management — has been transformed by ML approaches that incorporate ERP transaction data, macroeconomic signals, customer payment behaviour patterns, and external market data into integrated prediction models. Empirical evidence suggests that LSTM-based cash flow forecasting models reduce forecast error by 20–40 percent relative to traditional moving average and regression-based approaches (Li et al., 2023).

Foreign exchange risk management — another core treasury function — is being augmented by AI-driven currency forecasting models that process news sentiment, macroeconomic indicators, and options market data to generate more accurate exchange rate point forecasts and volatility estimates. For multinational firms managing cross-currency payment flows — including UPAS LC settlements and intercompany FX transactions — AI-enhanced FX risk models can materially improve hedging efficiency and reduce currency exposure costs.

Power BI, Tableau, and Python-based analytical platforms are increasingly the tools through which finance functions access AI-enhanced analytics in practice. Real-time financial dashboards that integrate ERP data (SAP, Oracle, SAGE) with business intelligence platforms enable finance teams to monitor working capital metrics — Days Sales Outstanding (DSO), Days Payable Outstanding (DPO), Days Inventory Outstanding (DIO), and Cash Conversion Cycle (CCC) — with a granularity and timeliness that was technically infeasible in the pre-FinTech era.

4.4 Fraud Detection and Financial Crime: AI's Demonstrable Impact

Fraud detection is the application domain where AI's operational impact is most clearly documented. The US Treasury's deployment of machine learning to identify and recover USD 1 billion in Treasury check fraud in the twelve-month period ended September 2024 (NetSuite, 2024) illustrates the institutional scale of impact. In financial services more broadly, 71 percent of institutions now leverage AI for fraud detection, up from 66 percent in 2023 (ISACA, 2024), with multilayered AI systems analysing unusual spending patterns, suspicious login locations, and unexpected changes in transaction frequency simultaneously.

For developing-economy financial institutions and multinational subsidiaries — where fraud risk is heightened by weaker internal control environments, less mature banking systems, and higher prevalence of informal economic activity — AI-powered fraud detection represents an important risk management tool. The challenge is access: AI fraud detection systems require substantial data infrastructure, model training resources, and technical expertise that many institutions in emerging markets currently lack.

4.5 Governance, Ethics, and Regulatory Challenges of AI in Finance

The governance challenges associated with AI in finance are receiving increasing regulatory attention. The EU AI Act (2024), the SEC's guidance on algorithmic trading, and the Basel Committee's principles for operational risk management all impose requirements on financial institutions using AI-driven decision systems — including requirements for model validation, bias testing, explainability, and human oversight. For CFOs and finance directors in multinational corporations, AI governance is becoming a board-level accountability, not merely a technology management concern.

The literature identifies four systemic governance risks. Model risk arises because ML models trained on historical data may perform poorly during structural breaks — recessions, pandemics, geopolitical crises — when historical patterns break down. Algorithmic bias emerges when training data reflecting historical discrimination (in lending, for example) perpetuates and amplifies discriminatory outcomes. Concentration risk arises from over-reliance on a small number of third-party AI vendors, creating systemic vulnerabilities. Regulatory arbitrage reflects the global inconsistency of AI governance frameworks, creating compliance complexity for multinational firms operating across jurisdictions.

5. Supply Chain Finance, Working Capital, and Trade Finance Resilience

5.1 Supply Chain Finance: Conceptual Architecture

Supply chain finance (SCF) is defined as the set of technology-based solutions that enhance working capital and reduce financial risks for buyers, suppliers, and financial institutions by optimising the management of financial flows within and between supply chain participants (Atieh Ali et al., 2024; Gelsomino et al., 2016). Unlike traditional trade finance — which focuses on the physical flow of goods — SCF focuses explicitly on the optimisation of financial flows: the timing, terms, and cost of payments between supply chain counterparties.

SCF Instrument	Initiating Party	Financing Mechanism	Primary Benefit	Bangladesh Relevance
Reverse Factoring	Buyer-led	Supplier receives early payment at buyer's credit rate	Lower financing cost for suppliers	Limited; requires multinational buyer infrastructure
Factoring	Seller-led	Supplier sells receivables at a discount	Immediate liquidity for exporters	High — widely used by RMG exporters
UPAS LC	Buyer-led (hybrid)	Buyer defers; seller receives sight payment	Cash flow gap management for importers	Very High — dominant import finance instrument
Dynamic Discounting	Buyer-led	Buyer's own cash to fund early payment	Yield on excess cash; supplier goodwill	Emerging — limited ERP integration
Inventory Financing	Lender-led	Inventory serves as collateral	Working capital without receivables	Moderate — commodity-linked sectors

Table 5. Principal SCF instruments: mechanics, benefits, and relevance to the Bangladesh trade finance context

UPAS LC (Usance Payable at Sight Letter of Credit) warrants particular attention given its central role in Bangladeshi import finance. From the buyer's perspective, UPAS LC behaves like a usance (deferred payment) LC — the buyer pays on a deferred basis, typically 90 to 180 days after shipment. From the seller's perspective, it behaves like a sight LC — the seller receives payment at sight upon documentary compliance. The difference is financed by the buyer's bank, which pays the seller at sight and recovers the financing cost from the buyer at maturity. For import-dependent manufacturers — including the RMG sector that relies on raw material imports from China, India, and South-East Asia — UPAS LC is a critical tool for managing the cash flow gap between raw material procurement and export receivables collection.

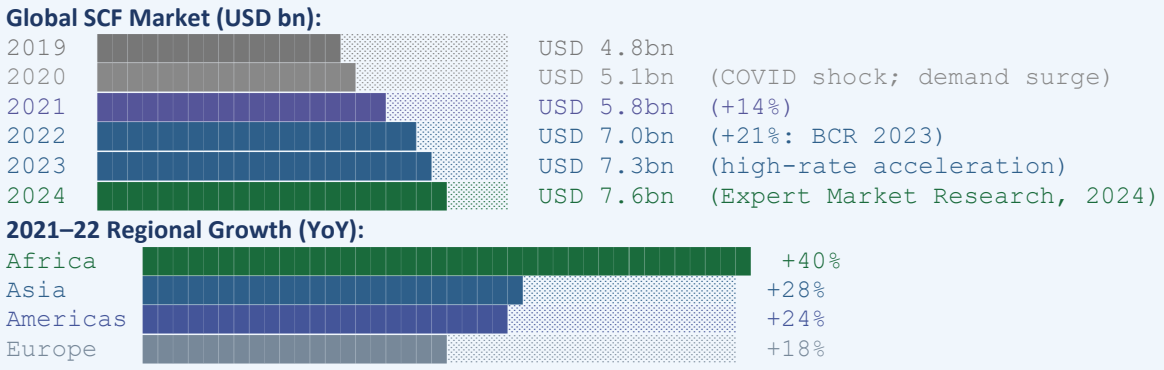
5.2 Post-Pandemic SCF Growth and Working Capital Stress

The COVID-19 pandemic constituted an unprecedented stress test of global supply chain financial resilience. McKinsey's 2022 analysis revealed that 68 percent of supply chain disruptions in SMEs were attributable to liquidity shortages, payment delays, or lack of credit access — financial failures rather than operational ones (cited in Atieh Ali et al., 2024). This finding fundamentally repositioned SCF from a treasury optimisation tool to a supply chain resilience imperative, driving rapid growth in SCF adoption across industries and geographies.

Global SCF volumes grew by 21 percent between 2021 and 2022, according to BCR's 2023 World Supply Chain Finance Report, with the strongest regional growth in Africa (40 percent) and Asia — the regions where SME

access to traditional bank credit is most constrained. The global SCF market reached approximately USD 7.57 billion in 2024 and is projected to grow at a CAGR of 8.7 percent through 2034 (Expert Market Research, 2024). High interest rate environments, which have prevailed globally since 2022, have further accelerated SCF adoption by widening the credit arbitrage available through reverse factoring programmes.

Figure 4. Global SCF Market Growth and Regional Adoption Trends (2019–2024)



Source: BCR World Supply Chain Finance Report 2023; Expert Market Research 2024. Figures are illustrative aggregates from reviewed sources.

5.3 Negative Working Capital (NWC) as a Strategic Finance Outcome

Negative Working Capital — the condition in which current liabilities exceed current assets, typically achieved through highly efficient payables management, rapid inventory turnover, and accelerated receivables collection — represents the most sophisticated expression of working capital optimisation in a corporate treasury context. Retailers such as Amazon, supermarket chains, and efficient multinational service providers regularly operate with negative working capital, which effectively means that their supply chains finance their operations: suppliers extend credit while customers pay in advance or rapidly.

For a multinational testing and inspection business operating in a developing economy — collecting fees from large multinational clients while managing payables to local suppliers and staff — achieving negative working capital requires sustained discipline in DSO reduction, DPO optimisation, and capex management. The empirical literature on NWC management in MNC subsidiaries operating in developing economies is notably sparse. Most NWC studies focus on listed manufacturing firms in developed markets, leaving the subsidiary context — where group treasury policy, intercompany financing, and local banking market structure all interact — largely unexplored.

Working Capital Metric	Formula	Strategic Target	SCF Instrument Linkage
Days Sales Outstanding (DSO)	Receivables / (Revenue / 365)	Minimise: target ≤30 days	Factoring reduces DSO by monetising receivables early
Days Payable Outstanding (DPO)	Payables / (COGS / 365)	Maximise: extend payment terms	Reverse factoring extends DPO without penalising suppliers
Days Inventory Outstanding (DIO)	Inventory / (COGS / 365)	Minimise: efficient stock management	Inventory financing unlocks working capital from stock
Cash Conversion Cycle (CCC)	DSO + DIO – DPO	Minimise or go negative	UPAS LC defers payment, improving CCC for importers
Negative Working Capital (NWC)	Current Liabilities > Current Assets	Sustainable negative = optimal	Combined SCF strategy: max DPO + min DSO + min DIO

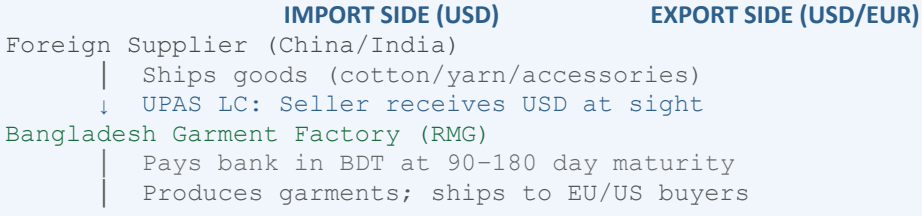
Table 6. Working capital efficiency metrics, strategic targets, and SCF instrument linkages

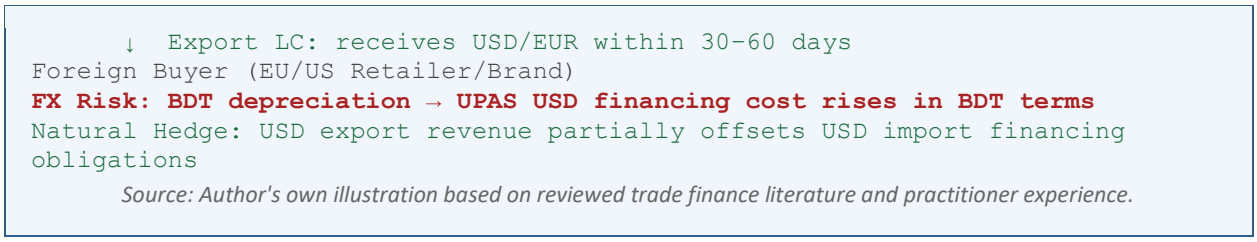
5.4 Trade Finance, FX Risk, and SCF in Bangladesh's Export Economy

Bangladesh's trade finance landscape is shaped by the dominant role of the RMG sector, which accounts for more than 83 percent of total export earnings. The country's integration into global supply chains as a garment manufacturer creates a distinctive financial architecture: export receivables are denominated in USD and EUR, while operational costs are incurred in BDT, creating a structural currency mismatch managed primarily through natural offsets rather than formal derivative instruments — reflecting the underdevelopment of Bangladesh's domestic derivatives market (Ahamed, 2013).

On the import side, UPAS LC is the dominant mechanism for financing raw material imports — primarily cotton, yarn, and accessories — from suppliers in China, India, and elsewhere. During periods of BDT depreciation — as occurred in 2022 when the BDT lost approximately 25 percent of its value against the USD — UPAS LC financing costs in local currency terms can rise dramatically, creating significant financial risk for importers with mismatched currency revenue and import financing structures. This dual-currency risk dynamic — UPAS LC import financing in USD combined with BDT-cost operations and USD export revenues — creates a complex natural hedge that is often poorly understood and inadequately managed.

Figure 5. Bangladesh RMG Sector: Dual-Currency Financial Flow Diagram





Source: Author's own illustration based on reviewed trade finance literature and practitioner experience.

The post-pandemic literature on SCF in emerging markets has begun to address these dynamics. A 2025 study in the International Journal of Research in Business and Social Science examined the effect of SCF on firm performance in an emerging market context, finding significant positive effects on profitability and liquidity ratios — particularly for firms in export-oriented manufacturing sectors with high trade finance intensity. However, the study acknowledged that SCF instrument adoption in emerging markets remains constrained by banking system capacity, credit information infrastructure, and regulatory limitations on financial innovation.

5.5 Digital SCF and Blockchain Integration

Technology is reshaping SCF delivery. Blockchain-based trade finance platforms — including the Marco Polo Network, Contour, and We.Trade — promise to reduce documentary fraud, accelerate processing times, and extend SCF access to SMEs that lack the banking relationships needed for traditional LC-based finance. AI integration in SCF platforms enables real-time risk assessment, dynamic pricing of early payment discounts, and automated matching of purchase orders with invoices — reducing the information costs that make SCF expensive for smaller suppliers.

For Bangladesh specifically, the adoption of digital trade finance is accelerating. Bangladesh Bank's regulatory initiatives in FinTech — including guidelines on mobile financial services and digital banking — create a foundation for eventual digital SCF integration. However, the transition from paper-based LC processing to digital platforms requires substantial banking system investment, industry standardisation, and regulatory clarity that is still developing. The experience of more advanced emerging markets — particularly India's TReDS (Trade Receivables Discounting System) platform — offers a potential regulatory and technological template for Bangladesh.

6. Research Gaps and Proposed Doctoral Research Agenda

6.1 Identified Gaps in the Literature

The review across the three domains reveals a set of interrelated research gaps that together define a compelling and tractable doctoral research agenda. Several of these gaps reflect structural features of the existing literature — its concentration in publicly listed firms in major developed and large emerging economies — rather than idiosyncratic omissions. The consistent exclusion of South Asian multinational subsidiary contexts from the empirical ESG, FinTech, and SCF literatures means that a researcher positioned within this context is uniquely placed to fill multiple gaps simultaneously.

Research Domain	Specific Gap Identified	Research Opportunity
ESG & Climate Disclosure	Near-absence of empirical evidence from South Asian emerging markets (Bangladesh, Pakistan, Sri Lanka) on ESG-valuation relationships; over-reliance on listed firm data ignoring MNC subsidiary contexts.	Panel data and case study research in SA subsidiaries of listed MNCs
ESG & MNC Reporting Quality	How do multinational groups ensure ESG reporting quality across subsidiaries in low-capacity regulatory environments? What governance mechanisms are effective?	Interview + survey study of MNC finance teams and group sustainability offices
AI in Corporate Finance	Explainable AI (XAI) frameworks in corporate financial decision-making remain underdeveloped for CFO-level deployment; limited evidence from developing-economy financial institutions.	XAI deployment study in emerging-market banking and MNC treasury settings
AI & Working Capital	No systematic evidence on AI-enhanced cash flow forecasting performance in developing-economy MNC contexts, where data quality and ERP maturity vary significantly.	Quasi-experimental before/after study across matched MNC subsidiaries
SCF & NWC	Absence of empirical studies linking specific SCF instrument choices (UPAS LC vs. factoring vs. reverse factoring) to NWC outcomes in developing-market MNC subsidiaries.	Longitudinal study + financial modelling using BD Bank regulatory data
SCF & FX Resilience	Limited research on how post-pandemic SCF adoption interacts with FX risk management in dual-currency (import/export) emerging market firms.	Case study + scenario modelling: RMG sector Bangladesh
Integration Across Domains	No published study integrates ESG performance, AI-based financial analytics, and SCF instrument choice as a unified framework for sustainable corporate finance in emerging markets.	Doctoral programme: multi-paper thesis spanning all three domains

Table 7. Identified research gaps by domain and corresponding research opportunities

6.2 Proposed PhD Research Directions

Research Direction 1: ESG Disclosure Quality and Firm Value in South Asian MNC Subsidiaries

Research Question: Does the quality of ESG disclosure in multinational corporation subsidiaries operating in South Asia predict parent-company valuation and cost of capital, and what subsidiary-level governance mechanisms enhance disclosure quality?

Methodology: Panel data analysis of multinational firms with disclosed South Asian subsidiary ESG data, supplemented by survey-based evidence from finance practitioners and in-depth case studies. Content analysis of sustainability reports using established disclosure quality indices (e.g., the GRI Disclosure Score, TCFD alignment scoring).

Significance: This study would be the first to systematically examine the ESG-valuation linkage at the subsidiary level in South Asian developing economies, with direct implications for MNC group reporting strategy and Bangladesh's emerging sustainability disclosure framework. The practical access enabled by fourteen years of multinational finance leadership provides a unique comparative advantage in data collection.

Research Direction 2: AI-Enhanced Working Capital Analytics in Developing-Economy Multinationals

Research Question: Do AI-enhanced cash flow forecasting models materially improve working capital outcomes — particularly NWC management — in multinational subsidiary contexts in developing economies, and what organisational and technological conditions moderate this relationship?

Methodology: Quasi-experimental design comparing forecast accuracy and NWC outcomes before and after AI analytics implementation across matched MNC subsidiaries in developing economies. Supplemented by interview-based evidence on AI adoption barriers and enablers from treasury and finance directors in South Asian MNC operations.

Significance: This study addresses a gap at the intersection of FinTech adoption research and treasury management practice in developing-economy contexts — a combination that is both theoretically novel and of high practical relevance to the thousands of MNC subsidiaries operating in emerging markets who lack the data infrastructure of their developed-market counterparts.

Research Direction 3: SCF Instrument Choice, FX Risk, and Financial Resilience in Dual-Currency Emerging Market Firms

Research Question: How do SCF instrument choices — particularly the mix of UPAS LC, factoring, and reverse factoring — interact with FX risk exposure to determine financial resilience outcomes in dual-currency emerging market firms (those with import costs and export revenues in different currencies)?

Methodology: Longitudinal case study and survey evidence from RMG sector firms in Bangladesh, supplemented by financial modelling of NWC and resilience metrics under alternative SCF and hedging scenarios. Bangladesh Bank regulatory data on trade finance instruments used as a secondary data source. Scenario analysis under BDT depreciation stress scenarios.

Significance: The first study to specifically examine SCF instrument choice as an FX risk management tool in the Bangladeshi context, with direct policy implications for Bangladesh Bank's trade finance regulation and for multinational treasury professionals managing dual-currency exposure in developing economies.

7. Conclusion

This review has synthesised the frontier literature at the intersection of ESG finance, AI and FinTech applications, and supply chain finance — three domains that are individually substantial and collectively transformative of how corporate finance is practised, regulated, and researched. The review has revealed a consistent and striking pattern: the academic literature, while growing rapidly, has systematically under-examined the contexts most relevant to developing-economy multinational finance — South Asian emerging markets, MNC subsidiary finance, and the intersection of SCF instrument choice with FX risk and working capital management.

The gaps identified are not merely academic omissions. They reflect real-world challenges facing finance professionals in multinational corporations operating in developing economies — challenges that require rigorous evidence to address effectively. The proposal that ESG disclosure quality, AI adoption in financial analytics, and SCF instrument sophistication interact to determine the financial resilience and performance of MNC subsidiaries in emerging markets represents a theoretically coherent and empirically tractable research agenda.

From a policy perspective, the findings have direct implications for Bangladesh Bank's FinTech regulatory framework, the Bangladesh Securities and Exchange Commission's emerging sustainability disclosure guidance, and the Ministry of Finance's agenda for financial sector deepening. As Bangladesh pursues its ambition of graduating from Least Developed Country (LDC) status by 2026 and deepening its integration into global supply chains and capital markets, the research agenda outlined in this paper speaks directly to the financial infrastructure decisions that will shape that trajectory.

For the international academic community, this review positions Bangladesh — a USD 450 billion economy with a dynamic RMG-led export sector, a growing FinTech ecosystem, and a multinational corporate presence spanning global testing, inspection, freight, and logistics — as an under-researched but empirically rich context for advancing the frontier of sustainable corporate finance research. The convergence of ESG regulation, AI-driven analytics, and post-pandemic SCF innovation in one of the world's most dynamic and climate-vulnerable developing economies creates a research environment of exceptional theoretical relevance and practical urgency.

Policy Implications Summary

- Bangladesh Bank: Accelerate digital trade finance frameworks; extend UPAS LC reporting requirements to capture FX risk data for systemic analysis.
- Bangladesh Securities and Exchange Commission: Develop a staged mandatory sustainability disclosure roadmap aligned with IFRS S1/S2, with specific provisions for MNC subsidiary reporting.
- International Development Finance Institutions (IFC, ADB): Scale blended finance instruments that de-risk ESG-linked SCF programmes in South Asian export-oriented sectors.
- MNC Finance Directors: Integrate ESG data governance into subsidiary finance function accountability frameworks, treating sustainability reporting quality as a treasury priority.
- Academic Community: Expand empirical focus to South Asian MNC subsidiary contexts; develop XAI frameworks suitable for deployment in low-data-infrastructure emerging-market settings.

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