



# The Adoption of Sustainable Supply Chain Finance: Advantages, Challenges and the role of technology providers

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**Abstract**

**Title:** “The Adoption of Sustainable Supply Chain Finance (SSCF): Advantages, Challenges, and the Role of Technology Providers”

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This thesis investigates the adoption of Sustainable Supply Chain Finance (SSCF) and the role of technology providers in supporting these programs. SSCF integrates Environmental, Social, and Governance (ESG) criteria into financial decision-making, encouraging sustainable practices across supply chains. The study addresses two research questions: *What are the key advantages and disadvantages of SSCF compared to other sustainable finance solutions?* and *how do technology providers influence the implementation and effectiveness of SSCF?* Using qualitative data from semi-structured interviews with professionals from banks, fintech companies, and corporate firms, the research uncovers the main benefits of SSCF, including its ability to align financial incentives with sustainability goals, foster systemic sustainability improvements, and provide a competitive advantage for suppliers. However, challenges such as the limited resources of smaller suppliers, the complexity of integrating ESG data, and the risk of greenwashing hinder broader SSCF adoption. The findings highlight the crucial role of technology providers in managing data, ensuring transparency, and enhancing SSCF scalability through innovations like AI and blockchain. This thesis contributes to the existing literature on sustainable finance by identifying key success factors for implementing SSCF, including collaboration between stakeholders and the importance of transparent communication to mitigate risks. The research also provides managerial insights into overcoming barriers related to data management, supplier participation, and technology integration, ensuring that SSCF drives long-term sustainability.

**Keywords:** Sustainable Supply Chain Finance, SSCF, ESG Performance, Fintech, Technology Providers, Sustainability, Supply Chain.

**Abstrato**

**Título:** A Adoção de Financiamento Sustentável na Cadeia de Abastecimento (SSCF): Vantagens, Desafios e o Papel dos Provedores de Tecnologia

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Esta tese investiga a adoção do Sustainable Supply Chain Finance (SSCF) e o papel dos provedores de tecnologia no suporte a esses programas. O SSCF integra os critérios de Ambiental, Social e Governança (ESG) nas decisões financeiras, incentivando práticas sustentáveis nas cadeias de abastecimento. O estudo aborda duas questões principais: Quais são as principais vantagens e desvantagens do SSCF em comparação com outras soluções de financiamento sustentável? E como os provedores de tecnologia influenciam a implementação e eficácia do SSCF? Através de entrevistas semiestruturadas com profissionais de bancos, fintechs e empresas corporativas, a pesquisa revela benefícios do SSCF, como o alinhamento de incentivos financeiros com metas de sustentabilidade, melhorias sistêmicas na cadeia de abastecimento e vantagem competitiva para fornecedores. Contudo, desafios como a falta de recursos de fornecedores menores, a complexidade na integração de dados ESG e o risco de greenwashing dificultam sua adoção. Os resultados destacam o papel crucial dos fornecedores de tecnologia na gestão de dados, garantindo transparência e aumentando a escalabilidade do SSCF por meio de inovações como IA e blockchain. Esta tese contribui para a literatura de finanças sustentáveis ao identificar fatores-chave de sucesso para a implementação do SSCF, como a colaboração entre as partes interessadas e a comunicação transparente para mitigar riscos. O estudo também apresenta implicações gerenciais sobre como superar barreiras relacionadas à gestão de dados, participação de fornecedores e integração tecnológica, assegurando que o SSCF promova a sustentabilidade a longo prazo

**Palavras-chave:** Financiamento Sustentável da Cadeia de Abastecimento, SSCF, Desempenho ESG, Fintech, Provedores de Tecnologia, Sustentabilidade, Cadeia de Abastecimento

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**List of Abbreviations**

SCF: Supply Chain Finance

SSCF: Sustainable Supply Chain Finance

ESG: Environmental, Social, and Governance

AI: Artificial Intelligence

SLL: Sustainability-Linked Loans

SMEs: Small and Medium-Sized Enterprises

CPV: Commodity Price Volatility

ROA: Return on Assets

ROE: Return on Equity

COI: Cost-to-Income

## **Chapter 1 - Introduction**

Supply Chain Finance (SCF) has become a critical tool for improving the financial flows within supply chains (Pellegrino et al., 2019), allowing businesses to optimize working capital and manage financial risks. SCF leverages the financial strength of buyers to offer favorable financing terms to suppliers, enhancing liquidity and reducing the risk of supply chain disruptions (Pellegrino et al., 2019; Wuttke et al., 2016). Various SCF instruments, such as reverse factoring, dynamic discounting, and inventory finance, have been widely adopted to improve working capital efficiency, especially among smaller suppliers who face financial constraints (Guida et al., 2021). These instruments not only benefit suppliers by providing faster access to cash but also offer buyers the flexibility to extend payment terms without negatively impacting supplier liquidity.

Recent years have seen a growing interest in integrating sustainability practices into SCF, leading to the development of Sustainable Supply Chain Finance (SSCF). SSCF goes beyond traditional SCF by linking financial incentives directly to Environmental, Social, and Governance (ESG) performance, encouraging suppliers to adopt more sustainable practices (Medina, 2023). This approach reflects the broader trend toward sustainable finance, which emphasizes the need to balance economic growth with environmental and social objectives (Edmans & Kacperczyk, 2022). However, SSCF is a more complex tool compared to traditional SCF solutions, as it requires continuous monitoring of ESG performance and the alignment of financial flows with sustainability goals (Medina et al., 2023).

Given the increasing complexity of SSCF, this study seeks to address the following research question: What are the key advantages and disadvantages of SSCF compared to other sustainable finance solutions? As SSCF programs evolve, the role of technology providers has become increasingly important. Fintech platforms and new technologies such as AI and blockchain have emerged as enablers of SSCF, helping manage the vast amounts of data required for ESG monitoring and ensuring transparency across supply chains (Hasan et al., 2024). Therefore, a second research question is introduced: How do technology providers influence the implementation and effectiveness of SSCF programs?

This thesis will explore these questions by conducting a qualitative study based on interviews with professionals involved in SSCF programs. The study aims to contribute to the existing literature on SCF and sustainable finance while offering insights into how SSCF can be leveraged to promote sustainability within global supply chains.

## **Chapter 2 – Literature Review**

### **2.1 ESG Criteria and Corporate Sustainability**

ESG criteria have become essential tools for evaluating the sustainability and ethical impact of companies. These criteria encompass a wide range of issues, including environmental impacts like climate change and carbon emissions, social responsibilities such as human rights and employee well-being, and governance practices like board independence and anti-corruption measures (Martiny et al., 2024). The integration of ESG criteria into corporate strategies signifies a shift towards more responsible and sustainable business practices, driven by increasing investor demand and evolving regulatory landscapes. (Martiny et al., 2024).

The importance of ESG criteria lies in their ability to serve as indicators of management competence and risk management. Effective ESG practices are crucial for long-term corporate sustainability and resilience (Martiny et al., 2024). However, inconsistencies in measurement and reporting standards pose significant challenges. Standardized ESG reporting frameworks are essential for ensuring consistency and comparability, which are necessary for reliable assessments and informed decision-making (Martiny et al., 2024).

ESG compliance has a notable impact on financial markets, particularly in terms of stock liquidity. Mandatory disclosure, especially when enforced by government authorities, has been found to considerably enhance stock liquidity (Krueger et al., 2024). This improvement in liquidity is primarily attributed to the reduction in adverse selection risks, as investors gain access to more comprehensive and standardized information. There is a substantial body of literature demonstrating that there is a positive correlation between company environmental performance and corporate financial performance (CFP) (Krueger et al., 2024), (Chen, Song & Gao, 2023). Companies that include ESG factors into their business strategies are more likely to generate better financial outcomes, such as reduced cost of capital, greater stock performance, and increased operating efficiency (Chen, Song & Gao, 2023). The impact is more pronounced in larger organizations or those working in high-risk situations, in which robust ESG practices increase resilience and stability. Nevertheless, there is an ideal threshold for ESG investment that maximizes financial advantages while avoiding excessive expenses. This indicates that if there is an excessive amount of money being spent on ESG efforts without a clear strategy, the returns on investment may decrease. Therefore, it is important to have a well-balanced and focused approach to ESG investment (Chen, Song & Gao, 2023).

Nevertheless, the responses of corporations to ESG ratings differ considerably depending on the extent of involvement and alignment with their strategic objectives. Firms may exhibit passive or active conformity, or alternatively, passive or active resistance to ESG ratings (Clementino & Perkins, 2021). These responses are influenced by managers' perceptions of the business value of ESG ratings and their alignment with corporate strategies (Clementino & Perkins, 2021). Active conformity involves firms not only complying with rating criteria through external reporting but also making internal organizational changes to improve their scores. These companies engage proactively with rating agencies, seeing it as an opportunity to enhance their reputation and attract investors. Passive conformity, on the other hand, involves companies responding mainly through improved communication and reporting practices without substantial internal changes, often driven by a need to meet informational demands of rating agencies with limited resources.

Active resistance is characterized by companies intently challenging or attempting to influence the methodologies of rating agencies, often through direct engagement or lobbying efforts. These firms may see ESG criteria as misaligned with their business goals and work to minimize the impact of ratings on their operations. Passive resistance involves companies largely ignoring the ratings and making few, if any, adjustments to their policies or practices. These companies do not see value in engaging with the ratings, often due to perceived misalignment with their strategic priorities or a belief that the costs of compliance outweigh the benefits. In order to create ESG strategies that are both effective and consistent with regulatory standards, as well as connected with corporate objectives, it is important to comprehend these varied responses.

Certain organizations utilize their ESG ratings as benchmarks for evaluating performance and shaping strategic planning, while others may simply participate in superficial compliance by increasing disclosures without making substantial changes. This behavior, often driven by the desire to improve ratings, highlights the potential for greenwashing and underscores the need for more relevant and aligned ESG rating criteria that accurately reflect actual sustainability performance (Clementino & Perkins, 2021).

Balanced ESG scores, which equally weigh environmental, social, and governance components, are found to be more positively associated with firm performance than rating agency-weighted ESG scores. The study by Lee, Raschke, and Krishen (2023) emphasizes that balanced ESG activities lead to better firm performance. The authors suggest that firms

benefit from maintaining a balanced focus on all three ESG components rather than emphasizing one over the others. Moreover, the study identifies potential greenwashing, where firms manipulate their ESG scores by overemphasizing subjective social and governance measures. This manipulation can mislead stakeholders and ultimately lead to lower firm performance. Thus, investors should be wary of relying solely on rating agency ESG scores and consider the benefits of balanced ESG assessments (Lee, Raschke, & Krishen, 2023).

In conclusion, the comprehensive examination of ESG and ESG disclosure, provides a foundational understanding of the significance and impact of ESG criteria in corporate sustainability. The insight from the literature highlights the need for standardized ESG reporting frameworks, balanced and targeted ESG investments, and an understanding of corporate responses to ESG ratings.

## **2.2 Sustainable finance - Definition and Importance**

Sustainable finance involves integrating environmental, social, and governance (ESG) factors into financial decision-making processes with the goal of promoting long-term sustainable growth (Edmans & Kacperczyk, 2022). This concept has obtained significant attention due to its ability to connect financial performance with wider societal goals. Sustainable finance has become a matter of great importance for CEOs, who now consider it a key component of their business plans, rather than relegating it to corporate social responsibility departments (Edmans & Kacperczyk, 2022). Investors' increasing interest in sustainable finance arises from its financial significance, its support to non-financial objectives, and its compatibility with investor preferences.

The financial relevance of sustainable finance is underscored by its potential to attract customers and employees, capture business opportunities related to societal trends such as climate change, and avoid environmental fines or regulatory interventions (Edmans & Kacperczyk, 2022). Companies with a positive societal impact may generate high risk-adjusted returns, appealing even to investors with purely financial motives. Moreover, sustainable finance supports non-financial objectives, such as the interests of pension fund beneficiaries who care about the planet's well-being alongside their financial returns. Additionally, investor preferences play a crucial role as many investors prefer to hold "green"

(environmentally friendly) stocks over "brown" (with negative environmental impact) stocks, aligning their investments with their values (Edmans & Kacperczyk, 2022).

According to Kumar et al. (2021), sustainable financing has its roots in the 1980s, although there has been substantial growth in recent years. Over time, there has been significant expansion in both the quantity and quality of activities within this field. As a result, there are now a wide range of activities and various types of financial instruments that are specifically designed to achieve sustainability goals.

The importance attributed to sustainable finance has expanded in parallel with the rise in cash generated for projects that promote environmental sustainability. In 2020, capital markets raised almost \$400 billion in fresh financing, with \$357.5 billion coming from sustainability bonds and \$76.5 billion from green bonds (Kumar et al., 2021). The arrival of this large sum of money illustrates the crucial role that financial markets play in promoting sustainable development.

### **2.2.1 Sustainability Linked Loans**

Sustainability Linked Loans (SLLs) are defined as "any types of loan instruments and/or contingent facilities for which the economic characteristics can vary depending on whether the borrower achieves ambitious, material and quantifiable pre-determined sustainability performance objectives" (Auzepy et al., 2023)

Unlike other forms, such as green bonds or green loans, SLLs do not mandate that funds be used for a specific project. Instead, they focus on ensuring that borrowers meet specific Environmental, Social, and Governance (ESG) targets within their operations across various sectors of the economy.

The design of the Key Performance Indicators (KPIs) in SLLs is crucial for their effectiveness. Auzepy, Bannier, and Martin (2023) evaluate the KPIs used in SLLs along six key dimensions: strategic relevance, materiality, measurability, benchmarking, pricing mechanism, and external review. Their study finds significant variation in KPI quality, indicating that while most SLLs include strategically relevant and measurable KPIs, many

lack materiality and proper benchmarking. For example, only 42% of the SLLs are linked to financially material KPIs, and only 15% are clearly benchmarked against relevant standards (Auzepy et al., 2023).

These findings have significant consequences for our comprehension of the extent to which sustainable development is accomplished by entering into such agreements. The average score on this scale is 3.47 out of 6, indicating that these tools may only partially encourage progress towards a higher sustainability (Auzepy et al., 2024). Therefore, while SLLs can assist in incorporating current environmental rules into financial systems, they may not necessarily lead to significant or novel changes in terms of corporations' ecological impact (Auzepy et al., 2024).

### **2.2.2 Green Loans**

Green Loans are financial instruments specifically designated for financing projects that yield environmental benefits. These endeavors may include the implementation of renewable energy generation systems, improvements in energy efficiency, and the adoption of pollution prevention measures, among other things. Green Loans are defined as "any type of loan instrument made available exclusively to finance or refinance, in whole or in part, new and/or existing eligible Green Projects." (Neagu et al. in 2024).

The primary aim of Green Loans is to provide funding for environmentally beneficial projects, thereby promoting sustainable development. By earmarking funds for specific green initiatives, Green Loans ensure that the financing directly contributes to sustainability goals. This targeted approach aligns financial resources with environmental priorities, facilitating the transition to a low-carbon economy.

Neagu et al. (2024) assert that Green Loans have a crucial function in promoting investments in sustainable initiatives. Nevertheless, the risk profile of green loans does not exhibit substantial differences compared to non-green loans. This implies that green loans are successful in directing funds towards environmental activities, but they do not necessarily provide lower credit risks. However, by linking financial resources with environmental

objectives, they facilitate the implementation of sustainable practices in firms, so contributing to wider aspects of sustainable development.

### **2.2.3 Green Bonds**

Green bonds are financial instruments specifically created to generate funds for initiatives that have a positive impact on the environment. Unlike green loans, which are privately negotiated between a borrower and lender, green bonds are publicly traded in capital markets and attract a broader range of investors. Both Green Loans and Bonds, typically focus on areas such as sustainable energy, energy efficiency, waste reduction, and renewable resources (Shah et al., 2024).

The demand for these bonds has experienced significant growth in recent years: the total amount issued surpassed \$500 billion in 2021 and is projected to surpass \$1 trillion in 2023 (Elbannan & Löffler, 2023). The expansion of the energy sector aids in closing the financial shortfalls required for the shift towards more sustainable energy systems, projected to amount to \$131 trillion globally by 2050 (Elbannan & Löffler, 2023).

Green bonds guarantee that the funds obtained are exclusively allocated to environmental-friendly initiatives by designating the funds for this specific purpose. Investors that prioritize openness and accountability are attracted to issuers who report on their use of proceeds and the environmental impact of supported projects. This helps increase confidence in the finance sector (Elbannan & Löffler, 2023).

Companies who are financially constrained or have a high credit risk are more likely to benefit from green bond financing because they are more likely to use the funds towards operations that reduce carbon emissions. Companies can utilize mechanisms to finance efforts against carbon emissions, so contributing to the achievement of corporate sustainability goals (Elbannan & Löffler, 2023).

These tools are essential components of sustainable finance packages, as they provide the required funds to support green projects and corporate sustainability activities. Their purpose is to ensure the success of global efforts against climate change. They assist firms in

harmonizing their financial strategy with environmental objectives across extended timeframes, so yielding both economic and ecological advantages. (Shah et al., 2024; Elbannan & Löffler, 2023)

#### **2.2.4 Challenges in sustainable finance - ESG-washing**

ESG washing, or greenwashing, refers to the practice where companies exaggerate or misrepresent their ESG performance to appear more sustainable than they actually are. This practice can undermine the credibility of ESG initiatives and mislead investors and stakeholders (Huang et al., 2024).

Greenwashing distorts the allocation of resources intended for genuine sustainability projects. Banks engaging in greenwashing may offer more favorable loan terms to firms with higher ESG ratings, thereby enhancing their ESG image through association rather than through genuine improvements in their sustainability practices (Huang et al., 2024). This practice can mislead investors, as they may perceive these banks as more committed to ESG principles than they actually are. (Huang et al., 2024)

The implications of ESG washing are significant for the market and stakeholders. It can lead to a loss of trust in ESG ratings and reports, as stakeholders may become skeptical about the authenticity of reported ESG practices (Huang et al., 2024). This skepticism can undermine the overall effectiveness of ESG initiatives, making it harder for genuinely sustainable firms to stand out and attract investment (Huang et al., 2024).

### **2.3 The Role of Fintech**

#### **2.3.1 Overview and Introduction**

Financial technology, or FinTech, represents a transformative force within the financial services industry, introducing a range of innovations from mobile banking and blockchain to peer-to-peer lending and robo-advisors. (Gomber et al., 2018; Hasan et al., 2024). These advancements not only improve efficiency and accessibility but also have significant implications for sustainable finance. FinTech can facilitate financial inclusion, enhance

transparency, and support the integration of environmental, social, and governance (ESG) criteria into financial decision-making processes (Gomber et al., 2018; Hasan et al., 2024).

The convergence of FinTech and sustainable finance aims to address global challenges by leveraging technology to support sustainable development goals (SDGs). This chapter explores the multifaceted role of FinTech in promoting ESG integration, focusing on its impact on financial inclusion, economic growth, environmental sustainability, and the specific mechanisms through which it enhances ESG practices

### **2.3.2 Fintech as an enabler for financial Inclusion**

FinTech plays a crucial role in enhancing financial inclusion by providing access to digital financial services for underserved populations. Innovations such as mobile payments, peer-to-peer lending, and crowdfunding platforms enable individuals and small businesses to access financial resources previously unavailable to them (Hasan et al., 2024). By reducing transaction costs and improving accessibility, FinTech promotes greater economic participation and supports poverty alleviation efforts (Hasan et al., 2024).

Moreover, the integration of FinTech with e-commerce platforms supports rural financial inclusion and promotes sustainable business development, especially in the agribusiness sector. These advancements are crucial for economic stability and growth in developing regions (Hasan et al., 2024). Another advantage that fintech brings to developing economies is financial literacy programs that are also essential to maximize the benefits of new digital technologies, ensuring that users are well-equipped to utilize digital financial services effectively (Hasan et al., 2024)

### **2.3.3 Fintech's Economic Impact**

Fintech facilitates entrepreneurship in the service sector and increases market competitiveness, both of which have a favorable effect on economic growth. Better performance metrics, such as greater returns on assets (ROA), equity (ROE), and lower cost-to-income (COI) ratios, are displayed by banks implementing classic Fin-tech advances (Bian et al., 2024). This adoption also makes it possible to diversify revenue streams away from traditional interest income and toward earnings from digital services (Bian et al., 2024).

The presence of tech-savvy managers is crucial for the successful implementation of FinTech, as they navigate the complexities of technological transitions and leverage these innovations for improved performance (Bian et al., 2024). The overall economic impact of FinTech extends to poverty reduction and income inequality alleviation, supporting broader sustainable development goals (Hasan et al., 2024).

#### **2.3.4 Fintech's Environmental Benefits**

FinTech supports environmental sustainability by promoting investments in renewable energy and green projects. Blockchain technology, for instance, ensures transparency and traceability in transactions, building trust among investors and promoting sustainable financing solutions (Huang et al., 2024). Smart contracts automate compliance and reporting, reducing administrative burdens and enhancing the efficiency of green bond issuance (Huang et al., 2024).

In regions with advanced FinTech infrastructure, such as certain cities in China, the impact of FinTech on environmental efficiency is more pronounced. These areas benefit from better collaboration and communication facilitated by FinTech platforms, enhancing the efficiency of green bond issuance and other sustainable finance initiatives (Huang et al., 2024). However, challenges such as verifying the environmental impact of projects and addressing the complexity and costs associated with these verifications remain significant barriers (Huang et al., 2024).

#### **2.3.5 Fintech for ESG Integration**

FinTech influences ESG integration through two primary mechanisms: reducing financial constraints and increasing stakeholder attention. By lowering the cost of equity and increasing the volume of equity and short-term loan issuances, FinTech eases financial constraints, enabling companies to invest more in ESG activities (Ding et al., 2024). Additionally, the digital availability of information attracts more stakeholder attention, pressuring companies to enhance their ESG practices to meet investor and regulatory expectations (Ding et al., 2024).

## **2.4. Supply Chain Finance - An alternative method of financing**

### **2.4.1 Supply Chain Finance (SCF) Definition**

Supply Chain Finance (SCF) is a strategic approach designed to optimize financial flows within supply chains. It leverages the financial strengths of buyers to provide favorable financing terms to suppliers, thereby enhancing working capital efficiency and managing financial risks (Pellegrino et al., 2019; Wuttke et al., 2016). SCF encompasses a range of financial solutions and practices that facilitate the conversion of non-liquid assets like inventory and accounts receivable into cash, providing liquidity to small and medium-sized enterprises (SMEs) (Chen et al., 2020). This alignment of financial flows with product and information flows aims to improve cash flow management from a supply chain perspective (Pellegrino et al., 2019).

### **2.4.2 SCF's Products and Instruments**

Various products in supply chain finance (SCF) are specifically developed to enhance the efficiency of working capital and provide risk management support:

*Reverse Factoring:* Reverse factoring involves a buyer confirming an invoice with a financial institution, which then pays the supplier immediately, minus some interest based on the buyer's credit rating. This practice benefits suppliers with weaker credit ratings and allows buyers to extend their payment terms without negatively impacting their suppliers' liquidity (Wuttke et al., 2016).

*Confirming:* In confirming, the buyer issues an authorization to a financial institution to pay its suppliers, making the institution the manager of trade payables. This solution often includes a binding commitment regarding the availability and recourse to the seller (Guida et al., 2021).

*Purchase Order Finance:* This short-term commercial finance option provides advance funding to suppliers for verified purchase orders, covering related working capital needs. The

buyer commits to pay once the seller ships the goods and meets stipulated conditions (Guida et al., 2021).

*Dynamic Discounting:* In dynamic discounting, the supplier offers a discount on the invoice's nominal value for every day of advance payment compared to the commercial terms (Guida et al., 2021).

*Inventory Finance:* The lender loans money to a firm with the maximum amount of the loan linked to the firm's inventory assets, providing a means to finance physical goods held in stock (Guida et al., 2021).

### **2.4.3 Factors influencing the adoption of Supply Chain Finance (SCF)**

The adoption of SCF is driven by various factors, including the need to improve cash flow, manage financial risks, and enhance supply chain efficiency (Wuttke et al., 2019; Pellegrino et al., 2019). Financial constraints, especially among SMEs, and the desire to reduce financing costs are significant motivators for adopting SCF solutions (Wuttke et al., 2019).

Additionally, the integration of digital technologies like big data analytics, machine learning, and blockchain has facilitated the implementation and efficiency of SCF practices, improving transparency and decision-making within supply chains (Chen et al., 2020; Huang et al., 2022).

Stakeholder engagement is another critical driver, involving collaborative actions that help a corporation address environmental problems and develop proactive strategies (Wu et al., 2016). Strong buyer-supplier partnerships also drive SCF adoption by creating win-win situations and improving service supply chain efficiency (Cho et al., 2012). Furthermore, the economic value of transactions between buyer and supplier influences SCF solution selection, with higher transaction volumes favoring more structured solutions like reverse factoring and confirming (Guida et al., 2021).

### **2.4.4 Key Success Factors for implementing Supply Chain Finance**

To effectively implement Supply Chain Finance (SCF), the literature, including studies by Carnovale et al. (2019), Chen et al. (2020), Pellegrino et al. (2019), Huang et al. (2022), and

Wuttke et al. (2019), highlights several key success factors that are crucial for achieving desired outcomes:

*Network Power and Cohesion:* Network power and cohesion are critical determinants of financial performance in SCF (Carnovale et al., 2019). Network power refers to the influence or control a company has over its supply chain partners, enabling it to negotiate favorable terms and conditions. Network cohesion, on the other hand, refers to the degree of connectedness and collaboration among the members of the supply chain network. Higher network cohesion contributes to financial efficiency by facilitating smoother interactions and resource sharing among partners, while network power is associated with improved earnings performance (Carnovale et al., 2019).

*Risk Management:* Effective risk management strategies are essential for SCF, particularly for managing credit and bankruptcy risks. Advanced forecasting methods and collaborative approaches can enhance these efforts (Huang et al., 2022). The integration of SCF with non-financial risk mitigation strategies provides a comprehensive approach to managing risks such as Commodity Price Volatility (CPV) (Pellegrino et al., 2019).

*Technological Integration:* The role of technology platforms is crucial in SCF implementation, enabling seamless transactions and transparency. These platforms facilitate the rapid onboarding of suppliers and support the scalability of SCF programs (Wuttke et al., 2019). The adoption of digital technologies plays a crucial role in enabling SCF by improving transparency, reducing information asymmetry, and supporting innovative financial solutions (Chen et al., 2020; Huang et al., 2022).

*Economic Factors and Managerial Flexibility:* Economic factors such as long-term commodity prices and purchasing volumes significantly impact the effectiveness of SCF strategies. The value of managerial flexibility is crucial for effective risk mitigation and financial performance (Pellegrino et al., 2019). Firms need to carefully assess these factors to determine the viability of SCF solutions like switching suppliers or substituting commodities.

#### **2.4.5 Sustainable Supply Chain Finance**

Sustainable Supply Chain Finance (SSCF) involves integrating sustainable practices into SCF solutions to promote the development of more environmentally and socially responsible supply chains (Medina, 2023). The objective is to achieve equilibrium among economic, environmental, and social factors by providing financial incentives to providers who adhere to sustainability criteria (Medina, 2023).

Various methods for attaining this objective involve conducting supplier assessments using ESG criteria, which involves analyzing suppliers' compliance with sustainability standards, followed by offering them improved financial terms, such as lower interest rates or extended payment periods (Medina et al., 2023). Furthermore, third-party brokers such as ESG information providers, NGOs, and certification authorities play a role in SSCFs by evaluating suppliers' sustainability performance. This involvement improves transparency among buyers, sellers, and financiers (Medina et al., 2023).

In addition, sustainable supplier development is an integral component of SSCFs, in which buyers engage in collaborative efforts with their suppliers to enhance their environmental sustainability. This can be achieved through various means such as training programs, technical support, and the implementation of green initiatives (Medina et al., 2023). Integrating SCPD initiatives into SSFCs will allow enterprises to develop more environmentally friendly supplier bases, therefore enhancing overall chain sustainability (Medina, 2023).

For instance, there may be situations when specific sustainable supply chain finance strategies entail providing incentives to suppliers that successfully decrease their carbon emissions or enhance energy efficiency. This not only provides support, but also ensures that buyers' financial interests are in line with larger environmental goals (Medina, 2023).

SSCF can also help to alleviate sustainability-related issues. SSCF achieves this by providing a systematic approach to funding sustainable activities. It achieves this by linking financial profits to sustainability performance. Under the Supplier Sustainable Compliance Framework (SSCF), suppliers are incentivized to adopt more environmentally friendly practices. Their payments are contingent upon their level of compliance with environmentally sound methods in their business operations. This framework aims to mitigate environmental and social risks

within the supply chain (Medina et al., 2023)

## 2.5 Research Gap

Supply Chain Finance (SCF) has been extensively studied, highlighting its benefits in optimizing financial flows, enhancing working capital efficiency, and managing financial risks (Pellegrino et al., 2019; Wuttke et al., 2016). The literature emphasizes the various instruments of SCF, such as reverse factoring, confirming, and dynamic discounting, and their roles in supporting supply chain operations (Guida et al., 2021). Additionally, recent studies have explored the integration of advanced technologies like big data analytics, machine learning, and blockchain to further enhance SCF practices (Chen et al., 2020; Huang et al., 2022).

The integration of sustainability practices within SCF, leading to Sustainable Supply Chain Finance (SSCF), has also been discussed in the literature. SSCF aims to balance economic, environmental, and social aspects by providing financial incentives and support to suppliers who meet sustainability criteria (Tseng et al., 2018; Medina et al., 2023). Sustainable supplier assessments, development initiatives, and incentives for sustainability performance are key components of SSCF (Medina et al., 2023).

Despite these advancements, there remains a research gap concerning the specific advantages that SSCF programs offer compared to other sustainable finance solutions. While SSCF has been recognized for its potential to enhance supply chain sustainability, the literature lacks a comprehensive analysis of how SSCF programs compare with other sustainable finance initiatives in promoting sustainability across supply chains. Moreover, the impact of technology providers in facilitating SSCF practices has not been thoroughly examined.

Therefore, this study aims to address the following research questions:

- 1. What are the potential advantages and disadvantages of Sustainable Supply Chain Finance (SSCF) programs compared to other sustainable finance solutions?*
- 2. How do technology providers (fintech) influence the implementation and effectiveness of SSCF practices?*

## **Chapter 3 - Methodology**

### **3.1 The choice of a Qualitative Approach**

This study adopts a qualitative research approach to explore the dynamics of Sustainable Supply Chain Finance (SSCF) and the role of technology providers. Qualitative research is particularly suited for examining complex, context-dependent phenomena where a deep understanding of stakeholders' perspectives is essential (Birkinshaw, Brannen, & Tung, 2011). Given the evolving nature of SSCF, the Gioia Methodology (Gioia, Corley, & Hamilton, 2013) was selected for its capacity to build theory inductively, allowing for the emergence of new concepts from the data, rather than imposing predefined hypotheses (Magnani & Gioia, 2022).

The choice of a qualitative approach is supported by the need to explore how SSCF programs are implemented across different industries and how technology providers facilitate these processes. Feyisa Mulisa (2022) underscores that qualitative methods are ideal for understanding subjective experiences and complex processes, which aligns with the goals of this study. The study's emphasis on capturing the contextual realities of SSCF adoption makes a qualitative approach more appropriate than quantitative or mixed methods, which might overlook the nuanced interactions between stakeholders (Pettigrew, 2012).

### **3.2 Sampling Strategy**

A purposive sampling strategy was employed to select interview participants. This approach is recommended in qualitative research when the goal is to gather rich, detailed data from individuals with relevant experience and knowledge of the topic (Vehovar et al., 2016). In this study, participants were selected from the author's personal network, they were contacted through LinkedIn or e-mail.

The sample included 14 professionals from banks, fintech companies, and corporate firms in Spain, France, and Italy, ensuring a diverse range of perspectives. The inclusion criteria focused on individuals who had direct experience in SSCF implementation or were involved in decision-making processes related to the integration of technology in financial sustainability initiatives. The participants included the following professio

Identification	Position	Role in SCF program	Experience with SSCF (years)	Geographical Location
MG	Bank ESG Specialist	Financial Institution	5	Spain and Portugal
AC	Supplier Relationship Manager	Technology provider	2	Europe-wide
SP	SCF Manager	Financial Institution	4	France
EM	Banks Relationship Manager	Technology provider	3	Europe-wide
GL	Chief Procurement Officer (CPO)	Buyer	3	Italy
MDB	Project Manager	Buyer	3	Spain
IC	Project Manager	Buyer	4	Italy
HK	Procurement Analyst	Buyer	7	France
LB	Financial Analyst	Buyer	5	Italy
MS	Investment Fund Analyst	Advisor	5	Spain
AA	Manager at big supplier company	Supplier	4	Italy
TB	Logistics Operations Manager	Buyer	2	Italy
GA	Compliance Specialist	Financial Institution	2	Italy
PP	Finance Manager	Buyer	1	Spain

*Table 1 Interview participants*

### 3.3 Data Collection

The primary method of data collection was semi-structured interviews conducted via Google Meet, Microsoft Teams, or WhatsApp, depending on the participants' preferences. The use of online platforms enabled flexibility and facilitated access to participants across different geographies. Each interview was recorded with participants' consent and transcribed using Fireflies.ai, a transcription tool that ensured accuracy.

Participants were informed of the study's purpose, and their consent was obtained before the interviews. They were assured that their responses would remain confidential and anonymous. The interviews were designed to explore the participants' experiences with SSCF programs, their perspectives on the role of technology providers, and the challenges they faced in implementing these initiatives. The semi-structured format allowed for the exploration of key themes while maintaining flexibility to follow up on interesting insights that emerged during the conversations (Gioia, 2021). The interview protocol was structured as follows:

*Introduction and Consent:* Participants were introduced to the purpose of the study, which is to explore the key advantages and disadvantages of Sustainable Supply Chain Finance (SSCF) programs compared to other sustainable finance solutions, and to understand how technology providers influence the implementation and effectiveness of SSCF practices. Participants were assured that their insights would be valuable for the research, and that all data collected would be kept confidential and anonymous. Before proceeding, participants were asked for their consent to participate and to have their responses used for the study.

*Background Information:* Participants were asked to describe their current role and their experience in the fields of supply chain finance and sustainability. This information provided context on their expertise and involvement with SSCF.

*Familiarity with SSCF:* Participants were questioned about their level of familiarity with SSCF programs, specifically how they have interacted with such programs in their professional capacity. This helped gauge their depth of understanding and experience with SSCF initiatives.

*Examples of SSCF Programs:* To gain insight into practical applications, participants were asked to provide examples of SSCF programs they had been involved with or were aware of. They were also encouraged to describe the structure and impact of these programs within the supply chain.

*Advantages and Disadvantages of SSCF Programs:* Participants were asked to reflect on the benefits of SSCF programs compared to other sustainable finance solutions. They were also asked to describe any disadvantages or challenges they have encountered in SSCF implementation, allowing for a balanced view of the potential and limitations of SSCF.

*Impact on Supply Chain Sustainability* The participants were questioned on how SSCF programs enhance the sustainability of supply chains. This included exploring how SSCF contributes to long-term environmental, social, and governance goals within supply chains.

*Challenges in SSCF Implementation:* Participants were asked to share the challenges they have encountered during the implementation of SSCF programs. This section focused on identifying the barriers that prevent the full adoption of SSCF, including operational, financial, and strategic challenges.

*Comparison with Other Sustainable Finance Solutions:* To better understand how SSCF compares to other financial tools, participants were asked to provide a comparison between

the challenges and benefits of SSCF and other sustainable finance solutions. This helped highlight the unique features of SSCF and its place within the broader sustainable finance ecosystem.

*Role of Technology Providers:* Participants were asked to reflect on how technology providers influence the success of SSCF programs. They were prompted to discuss the role of fintech platforms, data management, and other technological innovations in supporting SSCF implementation.

*Technological Innovations in SSCF:* Participants were encouraged to discuss how technological innovations are influencing the implementation of SSCF practices. This section sought to understand how advancements in areas such as AI and blockchain are affecting the efficiency and transparency of SSCF.

*Future Trends in Technology and SSCF:* To conclude, participants were asked to provide their insights on future trends in technology that may further influence SSCF practices. This included discussions on emerging technologies that could play a role in advancing sustainable finance initiatives in the future.

### **3.4 Data Analysis**

The data analysis followed the Gioia Methodology, which provides a structured approach to analyzing qualitative data and building grounded theory (Gioia, Corley, & Hamilton, 2013). This methodology emphasizes the need for rigor and transparency in qualitative research, ensuring that the analysis remains closely tied to participants' experiences while generating meaningful theoretical insights (Magnani & Gioia, 2022).

#### **3.4.1 First-Order Concepts**

The analysis began with the identification of first-order concepts, which represent the participants' direct experiences and language. In this stage, the focus was on capturing the participants' descriptions of how SSCF programs were implemented and how technology providers contributed to these processes. No attempt was made to categorize the data; instead, the goal was to ensure that the informants' voices were faithfully represented (Gioia, 2021).

#### **3.4.2 Second-Order Themes**

In the second phase of the analysis, the first-order concepts were distilled into second-order themes. This process involved moving from descriptive accounts to more abstract, theory-driven themes that could explain the patterns emerging from the data (Magnani & Gioia,

2022). For example, discussions about the integration of fintech platforms were grouped into broader themes around digital transformation and data management in SSCF. This step required constant comparison, a technique where new insights were continuously compared with existing literature to refine the emerging themes (Gioia et al., 2013).

### **3.4.3 Aggregate Dimensions**

The final step in the analysis was the identification of aggregate dimensions, which represent the highest level of abstraction in the data. These dimensions encapsulated the key findings of the study, such as the relationship between ESG performance and financial incentives, and the role of technology in facilitating transparency and data integration in SSCF. Aggregate dimensions helped build a grounded theory model that explained the dynamics of SSCF implementation and the enabling role of technology providers (Gioia et al., 2021).

By following this systematic approach, the study ensures rigor and transparency, allowing for the generation of new insights into the role of SSCF and technology providers in promoting sustainable finance.

## **Chapter 4 – Findings**

Figure 1 presents a condensed overview of the analysis conducted using Gioia's methodology, capturing the three hierarchical levels of analysis: first-order concepts (represented by direct quotes from interviewees), second-order themes, and aggregate dimensions. The interview data was systematically processed and organized into five core aggregate dimensions: the state of SSCF adoption, key benefits of SSCF over traditional sustainable finance, challenges in SSCF implementation, the role of technology providers, and key success factors. These dimensions will be discussed in detail throughout this chapter.

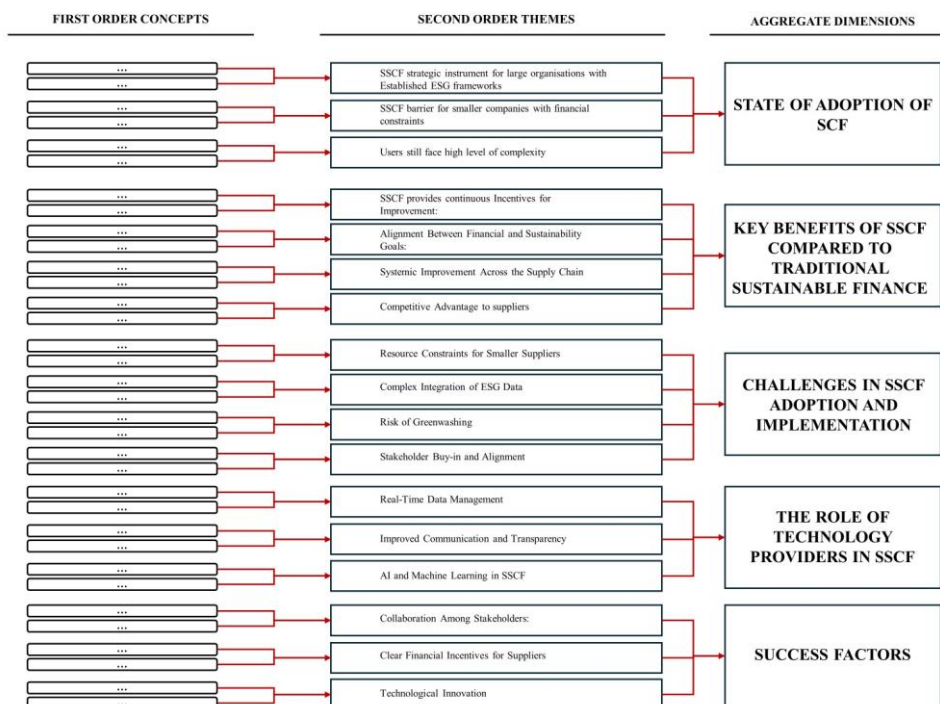


Figure 1 Overview of qualitative content analysis using Gioia's methodology

#### 4.1 State of Adoption of SSCF

Sustainable Supply Chain Finance (SSCF) has garnered significant attention, particularly among large organizations that already have well-established Environmental, Social, and Governance (ESG) frameworks in place. According to the interviewees, these firms see SSCF as a powerful strategic instrument that enables them to align their financial objectives with their sustainability goals. As one interviewee, MG, noted, "SSCF is seen as a natural progression for large companies, especially those already invested in ESG practices, as it enables them to meet both financial and sustainability targets." However, despite the enthusiasm in larger firms, smaller companies often face barriers when trying to adopt SSCF. Interviewees highlighted that resource constraints and the complexity of SSCF programs hinder adoption for these organizations. As AC explained, "Smaller companies simply don't have the financial resources or capacity to meet the stringent ESG requirements needed for SSCF programs."

Additionally, the inherent complexity of SSCF programs emerged as a major challenge. Unlike more traditional sustainable finance solutions, SSCF requires continuous engagement with suppliers and a high degree of coordination. As SP mentioned, "SSCF demands a higher

level of coordination and ongoing engagement with multiple stakeholders, which makes it more complex than one-off solutions like green bonds.” These factors create significant barriers to entry for smaller firms or those that are less experienced in managing sustainability initiatives at scale.

#### **4.2 Key Benefits of SSCF Compared to Traditional Sustainable Finance**

According to interviewees, SSCF provides several distinct benefits compared to other sustainable finance options, making it a compelling solution for promoting sustainability across supply chains. One of the most frequently cited benefits is the continuous incentives SSCF programs provide for ESG improvements. Unlike traditional finance tools that may focus on one-off projects, SSCF offers ongoing motivation for suppliers to enhance their sustainability practices. As AC explained, “SSCF programs directly link sustainability improvements to financial rewards, encouraging suppliers to continuously upgrade their ESG performance.” This dynamic fosters long-term growth and improvement, positioning SSCF as a tool for ongoing development rather than a static, short-term fix.

Another benefit highlighted by participants is the alignment between financial and sustainability goals, which is seen as a key driver for participation in SSCF programs. EM noted, “The ability to directly link ESG performance with better financial terms creates a virtuous cycle that benefits both buyers and suppliers.” This alignment supports the integration of sustainability within business strategies, ensuring that companies are motivated not only by regulatory compliance but also by tangible financial incentives.

SSCF also promotes systemic improvement across the supply chain. Unlike traditional sustainable finance solutions, which may target specific projects, SSCF integrates sustainability into the broader business model. As SP remarked, “It’s not just about one project—SSCF embeds sustainability throughout the entire supply chain.” This broad scope encourages systemic changes and helps firms adopt more sustainable practices across their operations.

Finally, interviewees noted the competitive advantage SSCF provides to suppliers. Those that meet ESG criteria are better positioned to attract business from buyers prioritizing sustainability. EM highlighted this advantage, stating, “Being part of an SSCF program helps suppliers differentiate themselves, especially in industries where sustainability is becoming a key purchasing criterion.” This strategic advantage is crucial in increasingly competitive markets where sustainability can be a decisive factor.

### **4.3 Challenges in SSCF Adoption and Implementation**

Despite its many benefits, SSCF also presents significant challenges, particularly for smaller suppliers. Several interviewees highlighted the difficulties that smaller companies face in meeting ESG criteria, citing limited resources as the primary obstacle. AC shared, “The upfront costs to meet ESG standards can be prohibitive for smaller suppliers, even though the long-term benefits are clear.” This challenge creates a divide between larger, more resource-rich firms that can invest in sustainability, and smaller companies that struggle to participate fully in SSCF programs.

A related challenge is the complex integration of ESG data into existing financial and operational systems. MG observed, “Integrating ESG data is not just a matter of collecting it—it requires significant investment in tools and technology to ensure it’s used effectively.” For companies that are new to ESG monitoring, this adds another layer of complexity to SSCF adoption and management, further increasing the barriers to entry.

The risk of greenwashing also emerged as a critical concern. Several interviewees raised the issue of companies inflating their ESG scores without making substantial changes, thereby undermining the integrity of SSCF programs. AC explained, “We’ve seen cases where suppliers claimed to have improved their ESG performance, but upon further inspection, the actual progress was minimal.” This emphasizes the need for robust verification mechanisms to ensure that ESG improvements are genuine.

Finally, interviewees pointed out the challenge of achieving stakeholder buy-in and alignment. Successfully implementing SSCF programs requires not only the cooperation of suppliers and buyers but also the internal alignment of various departments within a company. As SP noted, “One of the main hurdles we faced was getting everyone aligned—internally and externally—on the goals and processes of the SSCF program.” Without this coordination, SSCF initiatives are likely to encounter significant delays or fail altogether.

### **4.4 The Role of Technology Providers in SSCF**

Technology providers play an increasingly important role in the success of SSCF programs, according to the interviewees. Real-time data management, enabled by fintech platforms, is critical for the continuous monitoring of ESG performance. EM noted, “The ability to collect and analyze data in real-time has been a game-changer for SSCF programs, allowing us to track ESG performance and ensure compliance.” This capability enables companies to

maintain high standards and quickly address any discrepancies or areas requiring improvement.

Additionally, technology platforms have improved communication and transparency between buyers and suppliers. AC remarked, “The platform we use has streamlined communication across the supply chain, making it easier to align suppliers with the program’s goals.” This transparency fosters greater trust and cooperation, which are essential for SSCF programs to function effectively.

Looking to the future, interviewees expressed optimism about the potential of AI and machine learning in SSCF. MDB explained, “We’re just beginning to scratch the surface with AI. These technologies will play a significant role in predicting risks, optimizing ESG performance, and driving future SSCF initiatives.” The ongoing development of AI tools promises to make SSCF more efficient and accessible, further expanding its adoption in the coming years.

#### **4.5 Success Factors for SSCF**

Several success factors emerged from the interviews as critical to the effective implementation of SSCF programs. The first is strong collaboration among stakeholders, particularly between buyers, suppliers, and technology providers. GL emphasized, “Collaboration is key—without close coordination between all parties, the program simply won’t work.” This underscores the need for alignment and cooperation across the supply chain.

Another key factor is the provision of clear financial incentives for suppliers. Interviewees emphasized that SSCF programs must offer tangible financial benefits tied to measurable ESG improvements. EM remarked, “If suppliers don’t see a clear financial incentive, they won’t be motivated to participate in SSCF.” This highlights the importance of structuring SSCF programs in a way that directly links financial rewards to sustainability outcomes.

Finally, technological innovation is seen as a crucial driver of SSCF success. Advanced technologies such as AI and machine learning are helping companies monitor ESG performance in real-time and ensure continuous improvement. AC explained, “The right technology is essential for SSCF to work effectively. AI tools are already helping us track and enhance ESG performance across the supply chain.” These tools will continue to shape the future of SSCF, making it more accessible and scalable for companies of all sizes.

## **Chapter 5 - Discussion**

This study analyzes the factors influencing the adoption and effectiveness of Sustainable Supply Chain Finance (SSCF) programs, particularly focusing on how technology providers contribute to the process. The findings from the interview series confirm much of the existing literature while also offering new insights into the specific advantages of SSCF compared to other sustainable finance solutions. These findings have important theoretical and managerial implications, as they shed light on both the strengths and challenges of implementing SSCF.

### **5.1 Theoretical and managerial contributions**

Supply Chain Finance (SCF) has been extensively studied, with a significant focus on its ability to optimize working capital and manage financial risks (Pellegrino et al., 2019; Wuttke et al., 2016). This study confirms that SSCF builds on these benefits by integrating sustainability into financial flows, thus creating a more holistic approach that balances economic, environmental, and social objectives (Medina et al., 2023). In line with the literature, this research found that SSCF encourages the adoption of ESG criteria among suppliers by offering financial incentives (Medina et al., 2023). As noted by several interviewees, the primary advantage of SSCF lies in its ability to create a direct link between ESG performance and financial health, motivating suppliers to make long-term sustainability improvements.

However, this study expands the literature by highlighting some advantages and disadvantages of SSCF that have been underexplored. For instance, interviewees frequently mentioned that SSCF provides a continuous incentive structure, encouraging ongoing improvements rather than one-off changes. This dynamic process contrasts with traditional sustainable finance mechanisms like green bonds or sustainability-linked loans, which typically target individual projects rather than fostering systemic change (Neagu et al., 2024). This insight suggests that SSCF has the potential to drive broader sustainability across supply chains, a point that deserves further exploration in future studies.

The findings also confirm the importance of fintech platforms in enabling SSCF. Technology providers are instrumental in managing the vast amounts of ESG data required for SSCF programs and ensuring real-time monitoring of suppliers' performance. As previous studies have shown, fintech facilitates ESG integration by reducing information asymmetry and increasing transparency (Gomber et al., 2018; Hasan et al., 2024). This study supports these

conclusions, emphasizing that technology platforms are critical to managing the complexity of SSCF. However, it also reveals a new challenge: the risk of over-dependence on a single technology provider, which could disrupt the program if the provider fails to deliver continuous support.

On the side of the specific challenges that hinder SSCF adoption, the literature highlights those financial constraints, particularly among SMEs, are a significant barrier to adopting SCF (Wuttke et al., 2019). This research confirms that smaller suppliers often struggle to meet the ESG criteria required by SSCF programs due to limited resources. The disparity between large buyers and smaller suppliers creates an uneven playing field, as smaller companies find it difficult to invest in the necessary upgrades to qualify for SSCF participation. This challenge underscores the need for targeted support mechanisms, such as capacity-building initiatives, to help smaller suppliers access the benefits of SSCF.

Additionally, the integration of ESG data into existing financial systems emerged as a significant challenge. The literature discusses the role of technology in facilitating transparency (Gomber et al., 2018; Hasan et al., 2024), but this study reveals the practical difficulties companies face in integrating ESG data into their financial platforms. Many organizations, especially those new to ESG monitoring, struggle to align sustainability data with their traditional financial reporting systems. This finding suggests that companies must invest not only in technology but also in the internal capabilities needed to manage and analyze ESG data effectively.

A particularly notable contribution of this study is its identification of greenwashing as a persistent risk in SSCF. While the literature warns about greenwashing in sustainable finance (Huang et al., 2024), this research shows that suppliers may exaggerate their ESG improvements to secure better financing terms. Interviewees noted that some suppliers manipulated their ESG scores without making substantive changes, highlighting the need

The findings of this study also have more practical implications. First, managers should recognize that while SSCF offers substantial benefits, its success depends on strong collaboration between suppliers, buyers, and technology providers. A shared commitment to ESG goals is essential for aligning incentives and ensuring that all parties benefit from SSCF programs. Managers must foster open communication channels and provide suppliers with the tools and support they need to meet ESG criteria.

Lastly, this study highlights the importance of transparent communication in preventing greenwashing and ensuring that SSCF programs genuinely contribute to sustainability goals. Managers must implement rigorous ESG verification processes and avoid shortcuts that could undermine the credibility of their programs.

## **5.5 Limitations and Further Research**

The semi-structured interviews conducted in this study provided high internal validity, as the researcher gained an in-depth understanding of the context surrounding Sustainable Supply Chain Finance (SSCF) and the role of technology providers in facilitating its adoption. However, due to the use of non-probabilistic sampling methods, the generalizability of the findings cannot be claimed (Vehovar et al., 2016). While qualitative research methods offer rich insights into participant experiences, they are also subject to potential biases, as interviewees may have certain predispositions about SSCF and fintech solutions. To mitigate this, an iterative analysis approach was employed to ensure the closeness of the data to the findings, following the Gioia Methodology (Gioia, Corley, & Hamilton, 2013). Nonetheless, biases cannot be fully eliminated and may have influenced the results. To enhance the external validity and objectivity of the findings, future research could be complemented by quantitative studies.

### **5.5.1 Sampling and Participant Perspectives**

The sample included professionals from banks, fintech companies, and corporate firms involved in SSCF in Spain, France, and Italy. While this diversity provided valuable insights, the sample size was limited by time and resource constraints, which may affect the theoretical saturation of the findings. Additionally, the study focused on stakeholders actively involved in SSCF programs, which means perspectives from smaller suppliers—who may struggle to meet the ESG criteria—were not fully explored. Future research could broaden the scope to include more small and medium-sized enterprises (SMEs), whose experiences with SSCF might differ significantly from larger firms.

### **5.5.2 Geographical Scope and Cultural Considerations**

This study was geographically limited to three European countries—Spain, France, and Italy—which may not reflect the broader global landscape of SSCF adoption. Cultural, economic, and political factors in other regions may influence how SSCF programs are implemented and perceived, suggesting that cross-cultural research would be beneficial. A geographical extension to regions such as Asia or North America could help identify the

macroeconomic factors that influence SSCF adoption in different cultural and regulatory environments.

### **5.5.3 SSCF Verification and Technology Integration**

While this research highlights the importance of technology providers in SSCF, it did not deeply explore the verification processes used to ensure the authenticity of ESG improvements. Given the concerns about greenwashing, future studies could focus on the effectiveness of various verification tools, such as blockchain technology or third-party audits, to safeguard against false reporting in SSCF programs. Additionally, as AI and machine learning evolve, their role in enhancing the transparency and scalability of SSCF programs merits further investigation.

### **5.5.4 Longitudinal Research on SSCF and Technology Evolution**

This study provides insights into the current state of SSCF adoption based on interviews conducted within a specific timeframe. However, SSCF is likely to evolve as new technologies, such as AI and blockchain, become more integrated into supply chain finance. Conducting a longitudinal study would offer the opportunity to track the long-term effects of these technologies on SSCF and assess how technology-driven advancements impact the scalability and effectiveness of SSCF programs over time. Such research would also help determine whether the success factors identified in this study remain relevant as market conditions and technologies continue to evolve.

## **Chapter 6 - Conclusion**

This study has explored the adoption and effectiveness of Sustainable Supply Chain Finance (SSCF) programs, focusing on how SSCF compares to traditional sustainable finance solutions and the role of technology providers in facilitating SSCF implementation. The research highlights that SSCF offers unique advantages by linking financial incentives to ESG performance, thereby promoting long-term sustainability improvements within supply chains. However, the complexity of SSCF, particularly in terms of ESG data integration and the challenges faced by smaller suppliers, presents significant barriers to widespread adoption.

The findings underscore the importance of collaboration between buyers, suppliers, and technology providers in ensuring the success of SSCF programs. Fintech platforms have an important role in managing the complexity of SSCF, enabling real-time monitoring of ESG performance and supporting transparency across the supply chain. Additionally, the study

reveals that SSCF programs face risks such as greenwashing, where suppliers may overstate their ESG improvements, highlighting the need for robust verification processes.

From a managerial perspective, companies aiming to implement SSCF should invest in the right technological infrastructure and foster a culture of transparency to ensure that ESG improvements are genuine. Moreover, providing support for smaller suppliers to meet ESG criteria is crucial for ensuring that SSCF benefits are accessible to all supply chain participants.

This research contributes to the broader understanding of SCF by showing how SSCF can be leveraged to promote sustainability in supply chains. As SSCF programs continue to evolve, the integration of emerging technologies such as AI and blockchain will likely play an even greater role in enhancing the scalability and effectiveness of these programs. Further research is needed to explore how these technologies can be leveraged to address the challenges identified in this study and to ensure that SSCF continues to drive positive environmental and social outcomes.

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## **Appendix**

### **Appendix I – Semi structured interview protocol**

#### **Introduction and Consent**

Thank you for agreeing to participate in this interview. The purpose of this interview is to understand the key advantages and disadvantages of Sustainable Supply Chain Finance (SSCF) programs compared to other sustainable finance solutions, and to explore how technology providers influence the implementation and effectiveness of SSCF practices. Your insights will be invaluable for our research. All data from this interview will be kept confidential and anonymous. Do you consent to participate in this interview and for the information to be used in this study?

#### **Background Information**

Can you please describe your current role and experience in the field of supply chain finance and sustainability?

#### **Familiarity with SSCF**

How familiar are you with Sustainable Supply Chain Finance (SSCF) programs?

#### **Examples of SSCF Programs**

Could you provide examples of SSCF programs you have been involved with or are aware of?

#### **Advantages/Disadvantages of SSCF Programs**

In your experience, what are the benefits of SSCF programs compared to other sustainable finance solutions? And what are the disadvantages?

#### **Impact on Supply Chain Sustainability**

How do SSCF programs enhance the sustainability of supply chains?

#### **Challenges and Implementation**

What challenges have you encountered in implementing SSCF programs?

#### **Comparison with Other Sustainable Finance Solutions**

How do the challenges and benefits of SSCF programs compare to other sustainable finance solutions you have encountered?

#### **Role of Technology Providers**

How do technology providers influence the implementation and effectiveness of SSCF programs?

#### **Technological Innovations**

How do you see the influence of technological innovation in implementing SSCF practices?”

### **Future Trends in Technology and SSCF**

In your opinion, what are the future trends in technology that will further influence SSCF practices?

### **Appendix II – Interview Participants**

<b>Identification</b>	<b>Position</b>	<b>Role in SCF program</b>	<b>Experience with SSCF (years)</b>	<b>Geographical Location</b>
MG	Bank ESG Specialist	Financial Institution	5	Spain and Portugal
AC	Supplier Relationship Manager	Technology provider	2	Europe-wide
SP	SCF Manager	Financial Institution	4	France
EM	Banks Relationship Manager	Technology provider	3	Europe-wide
GL	Chief Procurement Officer (CPO)	Buyer	3	Italy
MDB	Project Manager	Buyer	3	Spain
IC	Project Manager	Buyer	4	Italy
HK	Procurement Analyst	Buyer	7	France
LB	Financial Analyst	Buyer	5	Italy
MS	Investment Fund Analyst	Advisor	5	Spain
AA	Manager at big supplier company	Supplier	4	Italy
TB	Logistics Operations Manager	Buyer	2	Italy
GA	Compliance Specialist	Financial Institution	2	Italy
PP	Finance Manager	Buyer	1	Spain