

A sustainable supply chain finance ecosystem: A review and conceptual framework

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ABSTRACT

Supply chain finance (SCF) is a set of instruments for optimizing working capital and improving supply chain efficiency. The evolving field of sustainable supply chain finance (SSCF) extends SCF with a growing focus on sustainability. While existing research has primarily focused on the economic benefits of SCF, its potential to generate broader sustainability benefits across environmental, social, and governance dimensions has received limited attention. Moreover, discussions on SSCF solutions and stakeholder interactions remain insufficient, necessitating further exploration to consolidate current research. This study seeks to explore the role of sustainability in SCF and proposes an SSCF ecosystem. A systematic literature review (SLR) of SCF and sustainability resulted in the analysis of 70 interdisciplinary journal papers published between 2008 and 2023. The SSCF ecosystem is defined as a collaborative network of stakeholders leveraging financial tools and sustainability metrics to create shared value and sustainability goals across the supply chain. By applying stakeholder theory and CIMO logic, the study develops a conceptual framework to explain how SSCF mechanisms and interventions produce desirable outcomes for stakeholders. Key influencing factors were identified across four sustainability dimensions—economic, environmental, social, and governance—along with core stakeholders, including buyers, financial institutions, and suppliers, supported by technology/logistics providers and ESG information providers. The study contributes by linking stakeholders to two distinct categories of SSCF solutions: buyer-centric accounts payable financing and supplier-centric accounts receivable financing. Lastly, it proposes future research directions by examining SSCF as an independent subject and capturing its links to traditional SCF.

1. Introduction

Supply Chain Finance (SCF) is an umbrella term for a number of solutions designed to optimise and balance working capital across supply chains by leveraging the relationships between buyers and suppliers (Kouvelis, 2023). In recent years, SCF has experienced rapid growth due to the economic recession post-COVID-19 pandemic and the need for working capital optimization in the supply chain companies (Chen et al., 2023a). According to the *World Supply Chain Finance Market Report (2023)*, the global SCF market size is approximately \$6.23 billion. It is further expected to grow at a compound annual growth rate of 10.1 %, demonstrating enormous prospects for SCF. This has prompted academic discussions regarding its potential to not only deliver undeniable economic benefits, but also enhance environmental and social value under the background of global sustainable development goal, calling for the integration of SCF with sustainability (Gelsomino, 2024; Jia

et al., 2020a). While profit maximisation is typically a primary objective, financial incentives also hold the potential to enhance sustainability performance within supply chains. Thus, it is worth examining the role of SCF in promoting sustainability along the supply chain. In this context, the emerging theme of sustainable supply chain finance (SSCF) helps build the connection and equilibrium between economic benefits and sustainability principles (Tseng et al., 2019).

SSCF was first defined as “SCF practices and techniques that support trade transactions, in a manner that minimizes negative impacts and creates environmental, social and economic benefits for all stakeholders involved in bringing products and services to markets” (Business for Social Responsibility BSR, 2018, p.5). As a relatively fresh concept, SSCF research in the literature is still limited, while some companies have already started exploring SSCF practice. For example, Puma and Nestle added sustainability criteria to their SCF projects and incentivised sustainable performance in the supply chain (Jia et al., 2020a). After the outbreak of

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COVID-19, some multinational companies have introduced SCF programs that specifically target sustainability improvements (Medina et al., 2023). These initiatives aim to integrate environmental and social responsibility into their supply chain operations, while also providing financial support to their suppliers.

Heretofore, SSCF has attracted growing research interest (Bal and Pawlicka, 2021). Jia et al. (2020a) illustrated a comprehensive development of the concept of SSCF by conducting a systematic literature review (SLR), while other scholars attempted to demonstrate that SCF positively impacts sustainable performance within supply chains (Abdel-Basset et al., 2020; Chen et al., 2023a; Zhan et al., 2018). However, there has been a lack of investigation into how SSCF distinguishes itself from traditional SCF solutions as a suite of more sustainable options (Medina et al., 2023). Recent research acknowledges that financial support can enhance sustainable performance, while not many answers on how to achieve it in the extant literature and most of the extant evaluation criteria remain predominantly economic (Lai et al., 2023; Ma et al., 2023; Shi et al., 2023). Moreover, considering growing real-world SSCF practice, a deeper understanding of the evolution from SCF to SSCF, and how SSCF impacts different stakeholders is needed to set the latest research agenda and clearly state the interactions and relationships between key stakeholders and SSCF solutions (Parida et al., 2022).

Since existing research remains fragmented or limited to certain industries (Ma et al., 2023; Nguyen et al., 2023; Tseng et al., 2019), this study aims to consolidate the current research and propose an SSCF ecosystem as a dynamic network of stakeholders collaboratively leveraging financial tools and sustainability metrics to create shared value and achieve sustainability goals across the supply chain. The following research questions were formalised.

1. *What are the implications of introducing sustainability into SCF?*
2. *What is the context, intervention, mechanism and outcome of the SSCF ecosystem?*

To answer these research questions, this study employed an SLR to present a comprehensive overview of SSCF. It defined an SSCF ecosystem to illustrate the clear evolutionary path from SCF to SSCF, offering insights into SSCF solutions, key stakeholder initiatives, and their corresponding outcomes. Additionally, the study proposed a conceptual CIMO framework, highlighting the unique mechanisms of SSCF adoption from a stakeholder perspective.

The remaining part of the paper proceeds as follows: Section 2 will present the research methodology adopted for conducting the systematic literature review. Section 3 and Section 4 present descriptive and thematic analyses respectively to illustrate the findings of the research. Section 5 presents a conceptual framework of SSCF along with future research directions. Section 6 concludes with theoretical and practical contributions and limitations.

2. Research methodology

Since research on SCF is more abundant than on SSCF, this paper seeks to identify the gaps between SCF and SSCF research as a foundational step before selecting relevant papers. This approach ensures that understanding the evolution from SCF to SSCF guides the review process. Table 1 summarises the research focus of current SCF reviews and highlights how the research gaps they identified point toward SSCF. When SSCF was first recognised as a potential research direction in 2018 (Xu et al., 2018), coinciding with its initial introduction by the BSR, scholarly attention has since shifted toward integrating sustainability into various aspects of SCF, including risk management, technological advancements, corporate collaboration, stakeholder perspectives, and performance metrics. However, these aspects are underdeveloped in SSCF. Despite its growing relevance, a comprehensive understanding of SSCF remains lacking, calling for more focused and systematic

Table 1
Overview of current reviews on SCF and progression to SSCF.

Reviews	Research Topic	Research Focus	Progression from SCF to SSCF
Gelsomino et al. (2016)	What are SCF concepts and solutions from two main perspectives?	Finance oriented SCF: short-term financial solutions; payables and receivables. Supply chain oriented SCF: working capital optimization; the object of financing.	Addressed SCF topic from “supply chain oriented” and “finance oriented” perspective but overlooked SSCF.
Xu et al. (2018)	How SCF research developed in 46 years?	Publication year, journals, citations, paper rank, research methods, research directions, etc.	Proposed relating sustainability to SCF as a future research direction.
Chakuu et al. (2019)	What are the SCF instruments and the enablers/inhibitors of their implementation?	Actors: buyer; supplier; banks; non-bank financial institutions; logistics; technical providers. Instruments: reverse factoring; inventory financing; warehouse financing; leasing; purchase order financing; dynamic discounting, etc. Adoption: credit rationing; risk management; transaction costs; collaborations etc.	Highlighted sustainability in SCF risk management, technology adoption, and corporate collaboration, suggesting opportunities for deeper exploration within SSCF.
Bals (2019)	How can a comprehensive framework for the SCF ecosystem be conceptualized?	Identified 6 dimensions of SCF: supply chain collaboration; organization; finance; technology; market and regulation; product	Clarified the life cycle and stakeholders of SCF, which can be extended to SSCF research
Jia et al. (2020a)	What are the enablers and barriers of SSCF solutions and how the solutions facilitate SC performance?	Motivations: sustainability-oriented; finance-oriented; technology-oriented; moral-oriented. Outcomes: environmental; social; economic. Barriers: lack of financial resources; inadequate short-term returns; poor supplier management	Addressed the early stage of SSCF and its impact on supply chain performance, suggesting more research is needed on SSCF practice and motivations.
Huang et al. (2022)	What is the expanded interface of SCF concepts, operations and novel applications?	Concepts: SCF; financial supply chain management; SSCF. Instruments: trade credit; reverse factoring; inventory financing; buyer financing, etc Adoption: risk management;	Reviewed SSCF as a part of SCF, noting that environmental and social aspects remain crucial yet underdeveloped.

(continued on next page)

Table 1 (continued)

Reviews	Research Topic	Research Focus	Progression from SCF to SSCF
Parida et al. (2022)	What are the trends and scenarios in SCF research?	credit rating; working capital management; SCF outcomes Identified 4 clusters of SCF: SCF decision, SCF performance, technology and strategy, process and modelling.	Identified SSCF as a new and emerging field rooted in SCF practices, highlighting that ethical and legal issues remain underexplored.

investigations in this emerging field.

Given this background, SLR offers a structured and methodical approach to synthesising existing research on a specific topic, which follows a predefined protocol to ensure transparency and rigour (Tranfield et al., 2003), and also acts as a carrier for knowledge development (Durach et al., 2017, 2021). Compared to traditional literature review, SLR extends the existing research scope and offers a more transparent way to avoid bias (Denyer and Tranfield, 2009; Seuring et al., 2020). Hence, this study uses SLR to examine current research on SSCF and answer the identified research questions. The process consists of four main stages: identify, select, analyze, and disseminate. This approach is based on the methods proposed by Tranfield et al. (2003) and Ghadge et al. (2012), as outlined in Fig. 1.

2.1. Identification of data sources

Data identification is a preliminary stage in the SLR, as it shapes the scope and quality of the review by determining the types and sources of data that will be included in the analysis (Swanson et al., 2018). The first step is to identify keywords followed by data sources. Fig. 2 illustrates the approach for keyword selection. The left side of figure is adapted from Jia et al. (2020a), which reviews SSCF research by separately

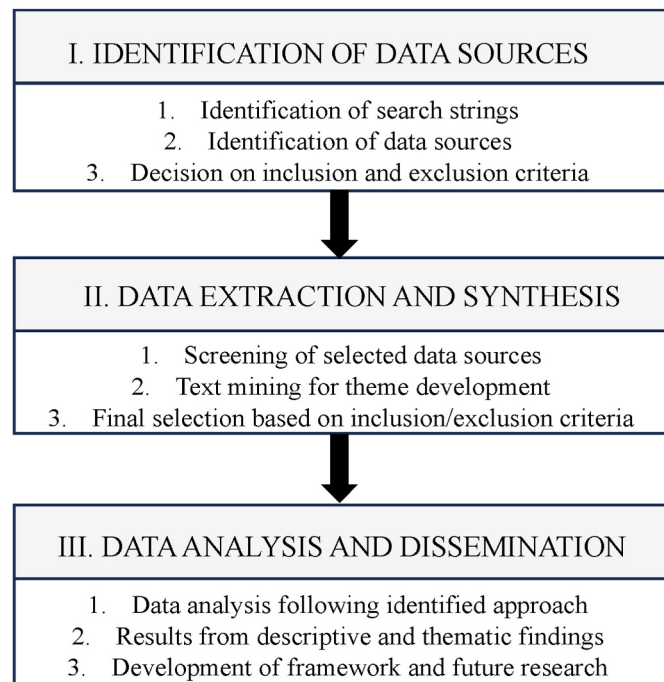


Fig. 1. Systematic literature review process.
(Adopted from Tranfield et al., 2003; Ghadge et al., 2012)

considering ‘supply chain,’ ‘finance,’ and ‘sustainability.’ Three distinct themes emerge while examining the intersections between these fields: SCF, Sustainable Supply Chain Management, and Sustainable Finance. However, SSCF is not simply a combination of these three themes; it requires a unique and integrated framework that goes beyond known overlaps. SCF is a consolidated research stream as illustrated by the various literature reviews published in the last decade (e.g., Gelsomino et al., 2016; Huang et al., 2022; Parida et al., 2022). SCF focuses on financial efficiency and liquidity as key parts of supply chain operations, alongside the management of information and material flows (Kouvelis, 2023). Therefore, building on the work of Jia et al. (2020a), an arrow connects this to the improved approach (seen in right side of figure), that reviews SCF as an independent research area with sustainability. The selection especially focused on SCF solutions and sustainability dimensions to sharpen the research focus, providing a clearer understanding of SSCF’s unique features. To ensure the selection of reviewed papers was comprehensive and relevant, major SCF solutions like reverse factoring, dynamic discounting and trade credit (Hofmann et al., 2021) were included in the search strings. Table 2 illustrates the keywords and associated search strings selected based on extensive reading of existing literature on the related field.

This study considered relevant literature from January 2008 to December 2023. This time horizon was chosen because today’s SCF research can only be dated back to the last global financial crisis in 2008–2009 (Gelsomino et al., 2016; Hofmann et al., 2021; Huang et al., 2022). At the same time, the concept of sustainability emerged from simply environmental discourse to wider aspects, including social and economic elements (Giovannoni and Fabbietti, 2013). Since 2009, certain governments, such as the US Securities and Exchange Commission, have required listed companies to disclose environmental data in their annual reports. Major databases, namely Scopus, ProQuest and Web of Science, were selected to obtain interdisciplinary research results. Inclusion and exclusion criteria were established to filter the initial search results, allowing for the identification of the most relevant studies for the data synthesis. Only English, peer-reviewed journal papers were considered, while conference papers, books, book chapters and other grey literature (e.g. newspapers, reports, manuscripts, etc.) were excluded due to limited access to well-curated databases, and its challenge to data management, extraction and meaningful synthesis (Ghadge et al., 2012; Sauer and Seuring, 2023).

2.2. Data extraction and synthesis

The second step was confirming the final database by extracting highly relevant and good-quality papers. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) is a reporting guideline designed to plan and conduct SLR to ensure that all necessary information is captured (Page et al., 2021). Fig. 3 shows the 4-stage process in the PRISMA diagram followed for the data screening. In total, 709 papers in Scopus, 405 papers in ProQuest, and 1,137 papers in Web of Science were screened. After removing duplicates and applying inclusion and exclusion criteria, 1,262 papers were left for further screening. Following the synthesis of the titles and abstracts to examine if the paper discussed SCF and sustainability together or attempted to establish a link between these two aspects, 65 papers were filtered. During the full-text assessment, 5 additional papers from references and citations of filtered papers were included using the snowballing method (Abidi et al., 2014). Consequently, following a systematic screening process, 70 papers were selected for the final review.

2.3. Data analysis and dissemination

The data analysis and dissemination stage followed by both descriptive and thematic analyses can effectively analyze and interpret the collected data (Tranfield et al., 2003), and disseminate the results by proposing a conceptual framework following CIMO logic. Examining the

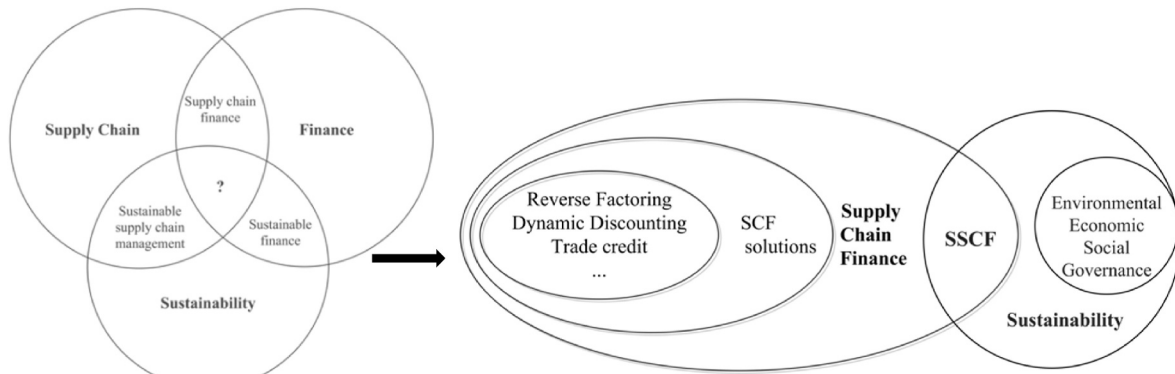


Fig. 2. Approach for keyword selection.

Table 2

Keywords with search strings.

Keywords	Search Strings
Supply Chain Finance	"Supply chain finance" OR "SCF" OR "value chain finance" OR "supplier financing" OR "trade finance" OR "network finance" OR "trade credit" OR "cash flow optimization" OR "working capital optimization" OR "reverse factoring" OR "factoring" OR "dynamic discounting" OR "invoice financing" OR "inventory financing" OR "buyer financing" OR "purchase-order financing" OR "captive factoring" OR "accounts payable financing" OR "accounts receivables financing" OR "fixed asset financing"
Sustainability	"Sustainability" OR "Corporate Social Responsibility" OR "CSR" OR "circularity" OR "green" OR "ESG" OR "Triple Bottom Line"

context, intervention, mechanism, and outcome of SSCF offers a structured understanding of its evolution and provides insights into the dynamics within the SSCF ecosystem. We adopted text mining by VOSviewer to establish the gaps to be explored in SSCF compared to SCF. Fig. 4 shows the obtained cluster diagrams of the selected papers. The left cluster is centred on SCF, showing several key research areas linking SCF with sustainability, such as SSCF and sustainable SCM. The right cluster centred on SSCF shows a more limited research focus only on SCF and sustainability. As an emerging field, SSCF offers new opportunities for integrating sustainability into supply chain operations by financing support. However, it is also notable that research in performance, challenges and solutions in SSCF research are blank compared to SCF research, as suggested by the missing blue, purple, and red lines in the SSCF cluster (right) compared to the SCF cluster (left).

To fill this gap and further locate the research trends in SSCF, we also used SciMAT to analyze emerging themes in SSCF research. SciMAT enables users to conduct studies based on multiple bibliometric networks and offers a range of clustering algorithms for data segmentation (Cobo et al., 2012). Through SciMAT, we analyzed the most frequently used keywords in the selected papers to identify key research trends in SSCF. Results in Fig. 5 emphasise diverse elements, such as stakeholder engagement, SCF solutions, risk management, technological innovations, and different dimensions of sustainability. It evidences that research on SSCF remains fragmented, with different focuses on factors that influence SSCF, different stages of the SSCF process, and the potential impacts of SSCF adoption. Identification of these gaps was translated into themes to analyze the evolvement of SSCF solutions and performance.

3. Descriptive analysis

This section captures a brief overview of the evolution of SSCF research over the past 15 years. The publication trend demonstrated a growing interest among researchers in exploring the intersection of SCF and Sustainability. Fig. 6 displays the distribution of the 70 selected

papers by year and adopted research method. Peer-reviewed academic papers began to appear primarily from 2019 onwards and reached the highest number of studies published in 2023. The increasing trend showcased the growing research interest in the SSCF field. Mixed research methods have gained significant attention as Scholars exhibit an equal distribution of interest between qualitative and quantitative methods. The quantitative modelling approach is the most prevalent in the SSCF domain. Additionally, advanced techniques such as the Stackelberg game model, regression analysis, and the difference-in-difference model are frequently employed to analyze complex data and phenomena. The most popular qualitative method is the case study.

The selected papers are published in operations, supply chain, as well as various interdisciplinary international journals. SSCF-related papers were most frequently published in interdisciplinary journals such as *Industrial Marketing Management*, and *International Journal of Information Management*. The top three operations, supply chain-focused journals that featured the most research on SSCF were *International Journal of Production Economics* (13 papers), *Journal of Cleaner Production* (11 papers), and *Journal of Purchasing and Supply Management* (5 papers). Finance-oriented journals such as *Accounting and Finance*, *Economic Modelling*, and *Finance Research Letters* also showed good interest in this topic. The diverse range of sources for selected papers highlighted the multifaceted nature of SSCF and the need for further exploration from multi-dimensional perspectives, as well as the potential for its application in different areas/sectors.

Table 3 provides a comprehensive overview of the theories utilized in the selected papers, highlighting a particular emphasis on the stakeholder and network theory as the most frequently adopted theoretical lenses in SSCF. The theories can be broadly categorized into two groups: those that focus internally on enhancing a company's competitive edge or leveraging internal resources—such as Transaction Cost Economics (TCE) or Resource-Based View (RBV)—and those that concentrate on inter-organizational relationships, such as stakeholder theory, network theory, agency theory, signaling theory, social exchange theory, and the relational view. Additionally, some papers explored innovative SSCF strategies using analytical frameworks like game theory and fuzzy set theory to model complex decision-making processes and uncertain environments.

4. Thematic analysis

The thematic analysis illustrates the detailed interpretive findings (Ghadge et al., 2023) emerging from the analysis of the SSCF-related literature as shown in Fig. 7. We located these themes following the identification of unique clusters (Fig. 5) and full-text review. Accordingly, this section focuses on exploring the influencing factors for SSCF, proposing an SSCF ecosystem, detailing SSCF solutions and illustrating the benefits of SSCF for different stakeholders.

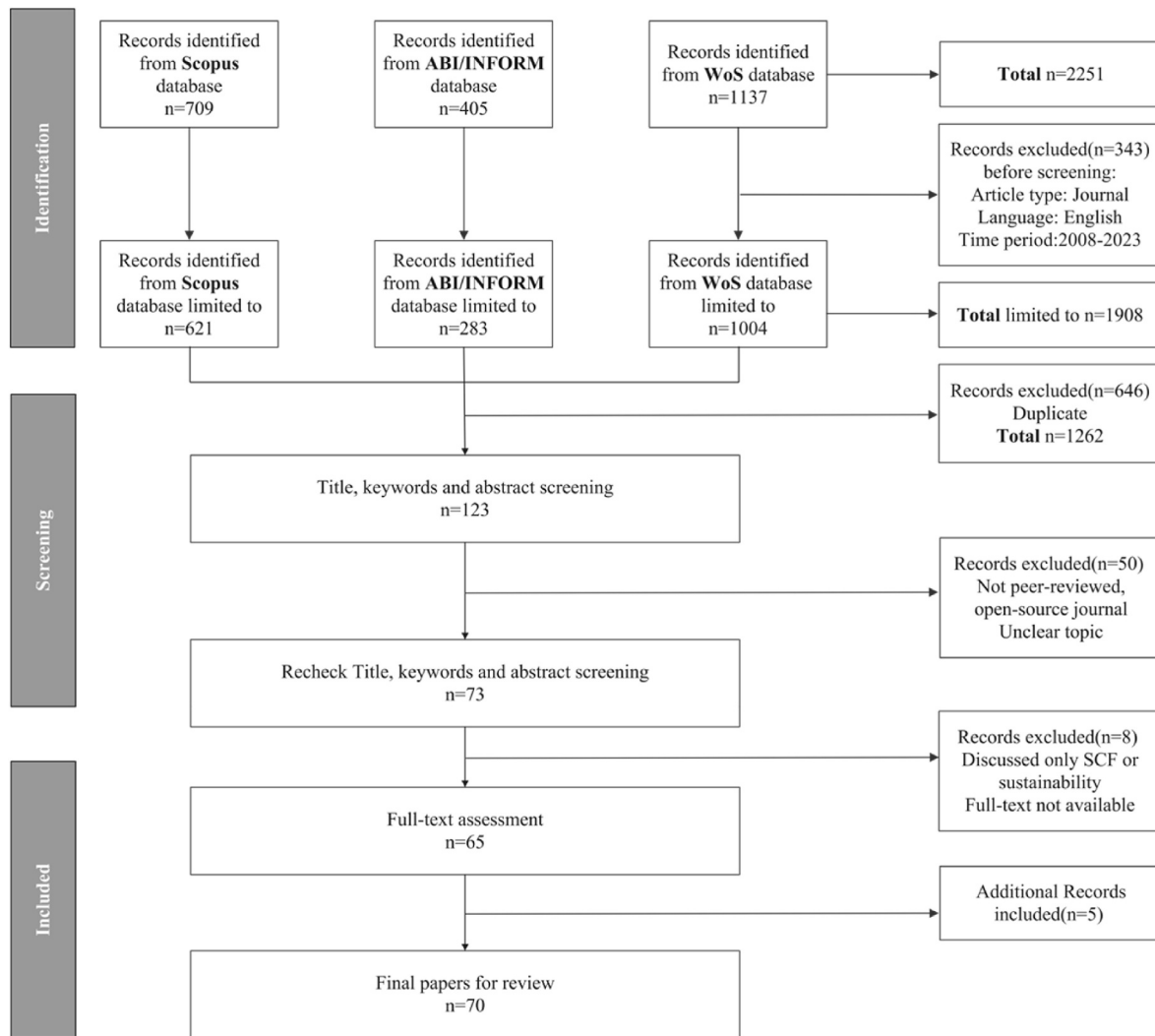


Fig. 3. PRISMA flow diagram.

4.1. Influencing factors for SSCF

To establish how SCF evolves into SSCF, as SCF itself has economic attributes (Gelsomino et al., 2016), it is necessary to identify the sustainability factors (environmental, social and governing) that affect SCF before exploring this field in detail.

4.1.1. Environmental sustainability factors

Environmental sustainability factors mainly include the regulations and stakeholder expectations towards carbon emission mitigation (Ahmad et al., 2021). These requirements arise not only from internal long-term operational goals, but also from external sustainable development consensus. 17 Sustainable Development Goals endorsed by the United Nations for Sustainable Development have raised the emphasis on environmental concerns (Shi et al., 2023). These concerns lead to both environmental regulations and stakeholder expectations changes. Several countries have introduced measures for carbon emission restriction to regulate corporate carbon discharge (Cong et al., 2020; Li and Jia, 2017). These carbon emission policies compel companies to embrace innovative technologies to enhance their products' environmental friendliness, and exhibit higher production costs for the use of new, cleaner technology and equipment (Wu et al., 2019). The policy pressure transferred to the financial sector, making it harder to obtain financial support (loans) from banks without evidencing environmental initiatives. For example, in 2019, French bank BNP Paribas introduced a

green credit policy targeting power generation companies. Under this policy, power generators emitting more than 491g CO₂/kWh were ineligible for green credit support from banks (An et al., 2021). ABN AMRO Bank in the Netherlands has also introduced a low-carbon accelerator fund that invests directly in companies dedicated to reducing carbon emissions and enhancing energy efficiency (Qin et al., 2020).

Stakeholders in the supply chain are now expecting companies to commit to higher levels of sustainability engagement (Jia et al., 2020a; Tseng et al., 2018). According to stakeholder theory, stakeholder identification and engagement are essential in the decision-making process (de Gooyert et al., 2017). It is particularly important to consider stakeholder interests in business activities to achieve sustainability (Luo et al., 2023). These expectations encompass a broad range of actions, from reducing carbon footprints and minimizing waste to implementing sustainable sourcing practices and enhancing resource efficiency (Ahi and Searcy, 2015), which influences the financing decisions of banks by transmitting the environmental and operational signal to stakeholders (Lin and Pan, 2023). The above practices indicate that environmental criteria will extend to the wider financing sector including SCF, influencing both the ease of access to SCF and the preferential support for SCF initiatives. Thus, integrating sustainability into SCF may not be optional, but rather a mandatory strategy in the future.

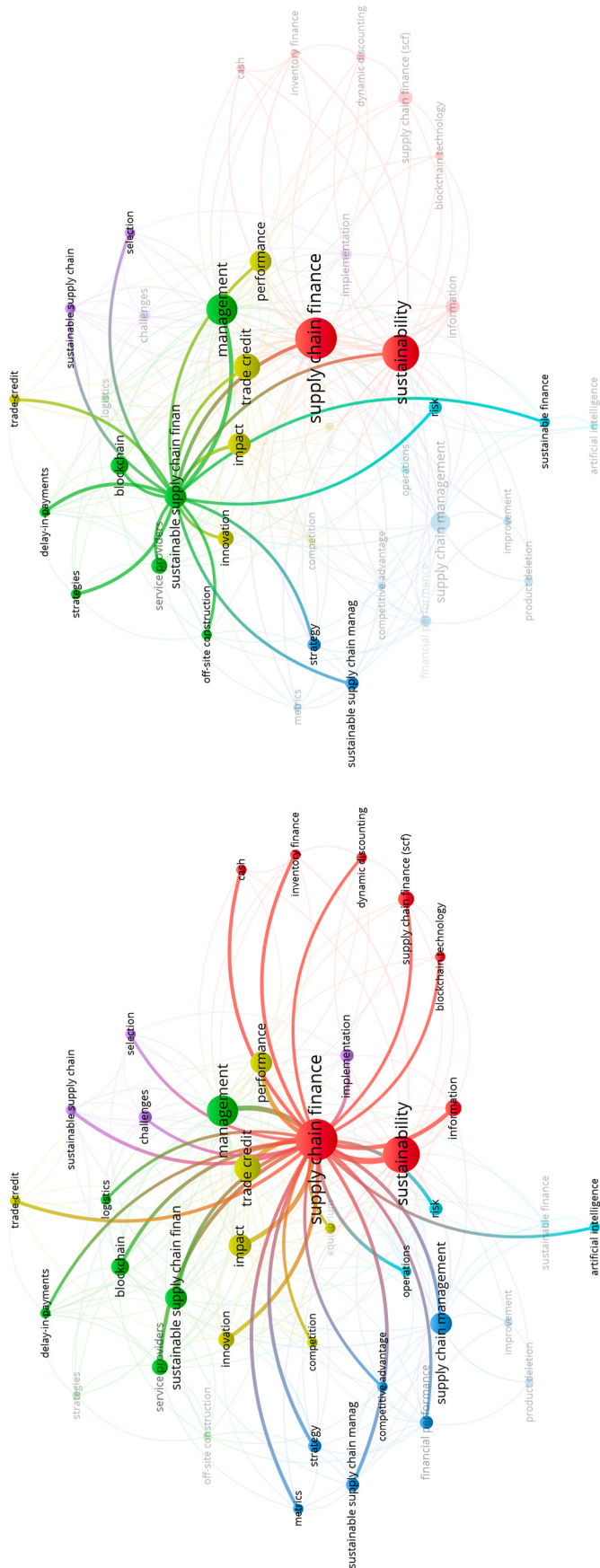


Fig. 4. Cluster diagram of selected papers by SCF and SSCF.

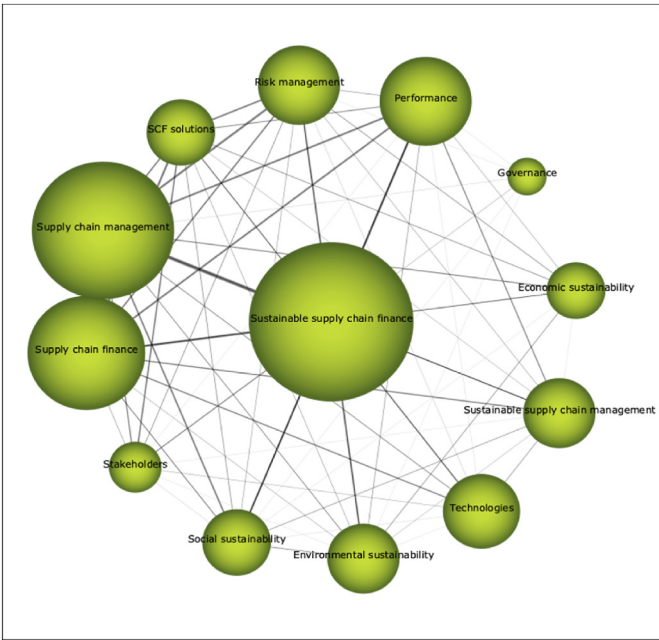


Fig. 5. Emerging themes on SSCF from selected papers.

4.1.2. Social sustainability factors

Social sustainability factors mainly include labour practice, human rights, and diversity (Carter et al., 2019). Many scholars investigated corporate social responsibility (CSR) when looking into social sustainability in SSCF. This aligns with the stakeholder theory that CSR performance creates shared value for a wider group of stakeholders (Wei et al., 2023). Companies must demonstrate compliance with some CSR regulations to qualify for certain financing options, as the policies are mandatory and banks increasingly require proof of ethical labour practices (Chen et al., 2023b; Lin and Pan, 2023; Liu et al., 2019). Engaging in CSR initiatives also significantly motivates implementing SSCF by enhancing a company’s image and establishing and preserving trust-based relationships with various stakeholders (Mishra and Modi, 2016).

Although academic research has yet to provide substantial evidence on the impact of other social factors on SSCF, real-world practices demonstrated their influence one step further. Some transnational corporations have integrated labour rights standards into their supply chain practices; same standards are also transmitted to financial institutions in SCF programs. BMW, Volkswagen, and Mercedes-Benz are now enhancing their compliance with Germany’s Supply Chain Due Dilligence Act (SCDDA), which mandates thorough checks and transparency in their supply chains to prevent forced labour (Geraint, 2023). On the financial side, financial institutions in Germany must also comply with the SCDDA. This act mandates that financial services provided to businesses must include assessments of the human rights and social risks within the lender’s supply chain (Kaufmann et al., 2023), thus mitigating the default risks in SSCF. Thus, it is foreseeable that social compliance toward the supply chain will be transmitted to the financial sector affecting the financing decisions and company credit rankings, through the adoption of SSCF.

4.1.3. Governing sustainability factors

Governance, widely known as the ‘G’ in ‘ESG,’ supports environmental and social goals by ensuring ethical, transparent, and accountable decision-making (Billio et al., 2021). The evolution from SCF to SSCF requires changing the governance patterns of key stakeholders, and how they operate and interact with each other (Tseng et al., 2019). While environmental and social factors explain external sustainability principles and criteria of SSCF, governing factors introduce internal and

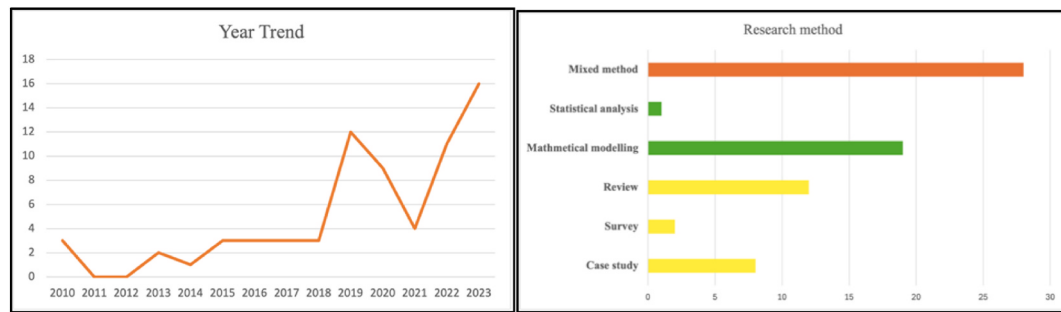


Fig. 6. Publication by year and research method.

inter-organizational changes necessary to align corporate operations with sustainability principles within the SSCF framework (Chen et al., 2022). Effective internal governance mechanisms help firms improve sustainability performance (Hussain et al., 2018). The review of current SSCF research shows that increasing supply chain transparency (Gualandris et al., 2021) and collaboration (Chowdhury and Quaddus, 2021) are frequently mentioned in promoting operational efficiency and legitimacy under sustainability.

Supply chain transparency is often blocked by information asymmetry, which invariably leads to inefficient credit allocation and an increase in the cost of credit (Hong and Andersen, 2011). The adoption of Industrial 4.0 technology like Blockchain (Tseng et al., 2021), artificial intelligence (AI) (Olan et al., 2022), cloud computing and big data analytics (Abdirad and Krishnan, 2021), has led to a greater level of automation in SSCF programs and improved transparency and accountability in green loan utilisation (Jia et al., 2020b). For example, the National Bank of Australia utilises Blockchain technology to track agricultural green loan data, enhancing its ability to oversee capital usage. Increased supply chain transparency enables the management and assessment of sustainable practices among supply chain members, boosting SSCF implementation (Abdel-Basset et al., 2020; Jia et al., 2020a).

SSCF and supply chain collaboration show an interactive relationship in current research. First, the adoption of SSCF promotes both supplier's and customer's green integration (Tseng et al., 2021), it also motivates suppliers to comply with focal firms' sustainable strategy by enhancing trust between supply chain members and guaranteeing the loan (Guo et al., 2022; Zhan et al., 2018). Second, supply chain collaboration promotes the adoption of SSCF. Guo et al. (2022) provided empirical evidence that green supply chain integration acts as a positive mediator in the relationship between SSCF and firm performance (Jia et al., 2020a, 2020b), which in turn, boosts the firm's reputation and fosters innovation (Wellalage et al., 2022). The financial gains achieved by different participants in SSCF are directly linked to the overall financial performance of the supply chain (Chakuu et al., 2019). Hence, supply chain collaboration contributes to SSCF and in turn benefits from SSCF.

4.2. SSCF ecosystem

SSCF ecosystem evolves from the traditional SCF ecosystem by integrating sustainability principles that align financial processes with environmental, social, and governing objectives; and engaging a broader range of stakeholders to support collaborative sustainability efforts. Viswanadham and Samvedi (2013) defined supply chain ecosystem as encompassing supply chain elements and external entities that influence the flow of goods, information, and finances through regulations, technology, and management. Expanding this, Bals (2019) introduced a SCF ecosystem framework, integrating SCF solutions with information and financial flows among stakeholders such as suppliers, buyers, financial institutions, and solution providers (e.g., technology and logistics

providers), a view also supported by Chakuu et al. (2019). Choi et al. (2023) elaborated on the SCF ecosystem's core value of 'to fund,' enabling collaborative value creation beyond individual firm capacities and aligning with Bals (2019) stakeholder identification. Thus, the SCF ecosystem is an integrated network optimizing working capital and liquidity through financial solutions, technology, and collaboration.

Building on this notion, SSCF ecosystem expands on SCF ecosystem by embedding sustainability into financing processes and engaging new stakeholders. Regulators influence financing terms through environmental and social policies (Lai et al., 2022), while ESG information providers assess suppliers and assign sustainability scores, determining their eligibility for preferential financing rates (Liang et al., 2021; Medina et al., 2023). For example, ASDA launched an SSCF program in partnership with HSBC and EcoVadis, which uses ESG scores to allocate tiered financing rates. Buyers also conduct sustainability audits to guide SSCF decisions (Wilhelm et al., 2016). Additionally, NGOs and third-party validators advocate for ethical practices, provide certifications (e.g., Fair Trade, Rainforest Alliance), and support sustainability efforts, improving suppliers' access to financing (Medina et al., 2023; Tian and Tian, 2022).

SCF solutions are commonly classified into accounts payable finance, fixed-asset finance, and accounts receivable finance (Chakuu et al., 2019; Hofmann et al., 2021; Wang et al., 2020). While SSCF retains these categories, it distinguishes itself by introducing new initiatives, innovative implementation methods, and broader sustainability-driven outcomes. Fig. 8 illustrates the SSCF ecosystem, with terms representing traditional SCF components along with additional SSCF stakeholders and their roles. These stakeholders contribute through various initiatives, as shown by arrows linking them to the core system. For example, ESG information providers offer measurable criteria to guide SSCF practices through sustainability assessment. Hence, the interaction among diverse stakeholders is a key element differentiating SSCF from traditional SCF. SSCF ecosystem is a dynamic and interconnected network where stakeholders actively collaborate to integrate financial solutions with sustainability metrics, fostering shared value creation and advancing sustainability goals across the supply chain.

4.3. SSCF solutions

SSCF is frequently described as solutions instead of being classified as an advanced financial product or service (Tseng et al., 2021). While some SSCF solutions have been discussed in the literature, others are only examined within the SCF context. By incorporating stakeholder theory, analysing the roles of key stakeholders responsible for initiating these solutions can provide valuable insights into the evolution of SSCF solutions.

4.3.1. Buyer-centric solutions: accounts payable financing

Accounts payable financing is a group of SCF solutions in which firms use their accounts payable as collateral to secure short-term funding from financial institutions (Hofmann et al., 2021). We consider these

Table 3
Dominant Theories adopted in the selected papers.

Theories	Applications in SSCF	References
Stakeholder theory (9)	How different stakeholders influence sustainability goals and sustainability practices within SCF.	(Alvarez et al., 2010; Bals, 2019; Leonidou et al., 2013; Li et al., 2023; Luo et al., 2023; Shou et al., 2020; Wei et al., 2023; Zhang et al., 2014; Zhong et al., 2023)
Network theory (7)	How network structures affect the flow of financial resources and information by understanding the interactions between different supply chain members and their impact on SCF and SSCF practices.	(Alvarez et al., 2010; Blackman et al., 2013; Gelsomino et al., 2016; Medina et al., 2023; Nguyen et al., 2023; Olan et al., 2022)
Agency theory (6)	Adopted to analyze the dynamics between principals (buyers) and agents (suppliers) to identify and avoid agency problems like information asymmetry and conflicting goals in SSCF.	(Gelsomino et al., 2016; Jia et al., 2020b; Martin and Hofmann, 2019; Medina et al., 2023; Tian and Tian, 2022; Zhong et al., 2023)
Transaction cost economics (TCE) (5)	Explore the efficiency and effectiveness of SCF and SSCF solutions based on make-or-buy decisions, which serves as an explanation for the application and selection of SCF and SSCF practices.	(Alvarez et al., 2010; Gelsomino et al., 2016; Luo et al., 2023; Martin and Hofmann, 2019; Soni et al., 2022)
Signalling theory (5)	Explore how SSCF practice can signal a company's commitment to sustainability, thereby influencing financial risk and relationships with stakeholders	(Chen et al., 2023a; Lam, 2018; Lin and Pan, 2023; Luo et al., 2023; Shou et al., 2020)
Resource-based view (RBV) (3)	How firms can leverage their unique resources and capabilities to achieve sustainable competitive advantage by SCF.	(Ali et al., 2018; Hung et al., 2020; Wei et al., 2023)
Social exchange theory (SET) (2)	How SSCF adoptions influence firm performance, particularly highlighting the roles of reciprocal relationships and mutual benefits among supply chain partners.	(Guo et al., 2022; Martin and Hofmann, 2019)
Contingency theory (1)	Underline differences in contingency variables to explain the selection of different SCF practices	(Martin and Hofmann, 2019)
Resource dependence theory (1)	How firms manage dependencies and power imbalances with their partners in SSCF.	(Olan et al. (2022)
Strategic choice theory (1)	Engagement in SSCF initiatives can help firms strengthen their financial position, and strategic collaborations, then develop a foundation for achieving organizational sustainability.	(Nguyen et al. (2023)
No theories adopted (51)	/	/

solutions to be buyer-centric, because accounts payable are initiated by buyers (Chakuu et al., 2019). Consequently, buyers who prioritize environmental concerns are spearheading the shift from traditional SCF to SSCF in the context of accounts payable financing. SSCF research in accounts payable financing concentrates on reverse factoring (RF) and purchase order financing, which are commonly used SCF solutions in practice (Libel et al., 2016).

Tanrisever et al. (2015) defined RF as a financing arrangement where a large buyer enables its suppliers to access cheaper financing based on the buyer's creditworthiness. The RF is found to better promote supply

chain effectiveness and efficiency of both buyers and suppliers within SSCF (Jia et al., 2020a; Wang et al., 2020, 2021) by implementing sustainability standards. For instance, the renowned clothing retailer PUMA collaborates with the World Bank to facilitate supplier payments, leveraging PUMA's creditworthiness and ensuring supplier compliance with its social and environmental standards (Zhan et al., 2018). Other companies, like Levis and H&M, are adopting comparable strategies to incentivize sustainability through SSCF. Financial institutions prefer lending to sustainable buyers, as providing factoring services to several suppliers simultaneously allows them to access a large pool of potential new customers (Libel et al., 2016).

In purchase-order financing, the supplier can obtain loans according to the contract value (Shen et al., 2020). It is considered buyer-centric because the lending decision relies on the buyer's credit and purchase order, requiring the buyer's confirmation and payment after the transaction to secure financing (Huang et al., 2018). Some buyers encourage suppliers to be more sustainable by providing purchase order priority. Walmart's 'Supplier Energy Efficiency Program' provided suppliers with a five-year purchasing commitment for those who have sustainable sourcing and surety of supply (Shi et al., 2023). Similarly, Ikea's 'Suppliers Go Renewable' showed comparable conditions (Nguyen et al., 2019). Financial supporters have the same preference as buyers. Citibank launched the SSCF program in Asia-Pacific, where suppliers who demonstrate strong or improved sustainability performance can access financing at preferential rates.

To summarize, accounts payable financing in SSCF is mainly driven by buyers' increasing sustainability requirements throughout the transaction process, including supplier selection, financing preference, credit transmission, supplier payment and order priority. These changes are transmitted to suppliers and financial institutions to make the whole SSCF ecosystem more sustainable.

4.3.2. Supplier-centric solutions: accounts receivable financing

Accounts receivable financing is a category of solutions where firms leverage their accounts receivable as collateral to obtain short-term funding from financial institutions. Supplier is the key actor in generating and managing accounts receivable. Compared to buyers, suppliers are more likely in a poor position with weaker bargaining power and greater capital constraints, forcing them to choose SCF over bank credit (Ali et al., 2018; Arcuri and Pisani, 2023; Hofmann and Kotzab, 2010). In this context, sustainability standards in SSCF are more like passive requirements for suppliers than active choices. Centred on accounts receivable financing, trade credit has attracted the most attention in the SSCF research.

Trade credit is the provision of credit by suppliers to their buyers, which is one of the most commonly used SCF solutions facilitating the purchase of goods and services with delayed payment (Dong and Liu, 2022; Wang et al., 2018). Trade credit and sustainability mutually reinforce each other. Some scholars adopt trade credit as a control variable to build optimal operational models under sustainability pressure (An et al., 2021; Luo et al., 2023; Shah and Shroff, 2022). Wu et al. (2019) found that increased suppliers' environmental investment leads buyers to place larger orders, extending economic sustainability. This effect is more pronounced in SSCF than in traditional SCF. Some researchers investigated whether improved sustainability performance positively affects trade credit. Improved sustainability performance can decrease corporate information and operational risks, thereby enhancing the company's capacity for trade credit (Tian and Tian, 2022). When sustainable financing policies take effect, supply chain dynamics restrict bank loans for supplier-buyer transactions, making suppliers heavily reliant on the trade credit (Bai et al., 2022; Cao et al., 2019). Higher CSR scores can also increase the level of trade credit provided to companies (Arcuri and Pisani, 2023; Li et al., 2023; Xu et al., 2020) by enhancing trust and thereby increasing trade credit availability (Luo et al., 2023; Wei et al., 2023). Contrary to this, Shou et al. (2020) found that the impact of CSR performance on trade credit exhibits a

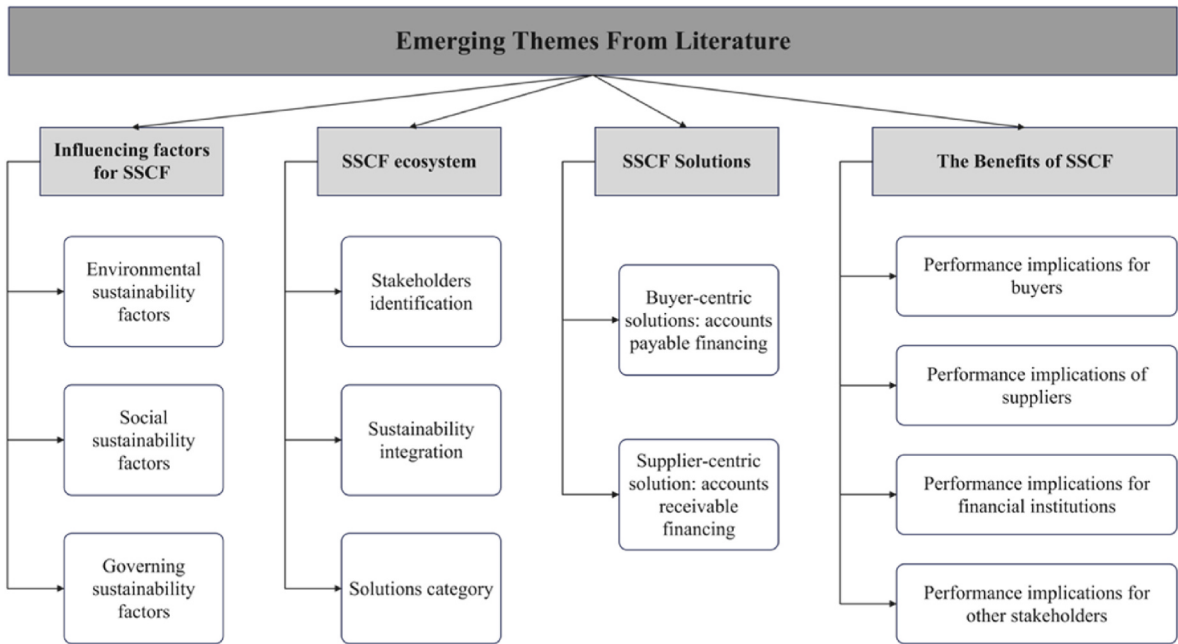


Fig. 7. A framework for thematic analysis.

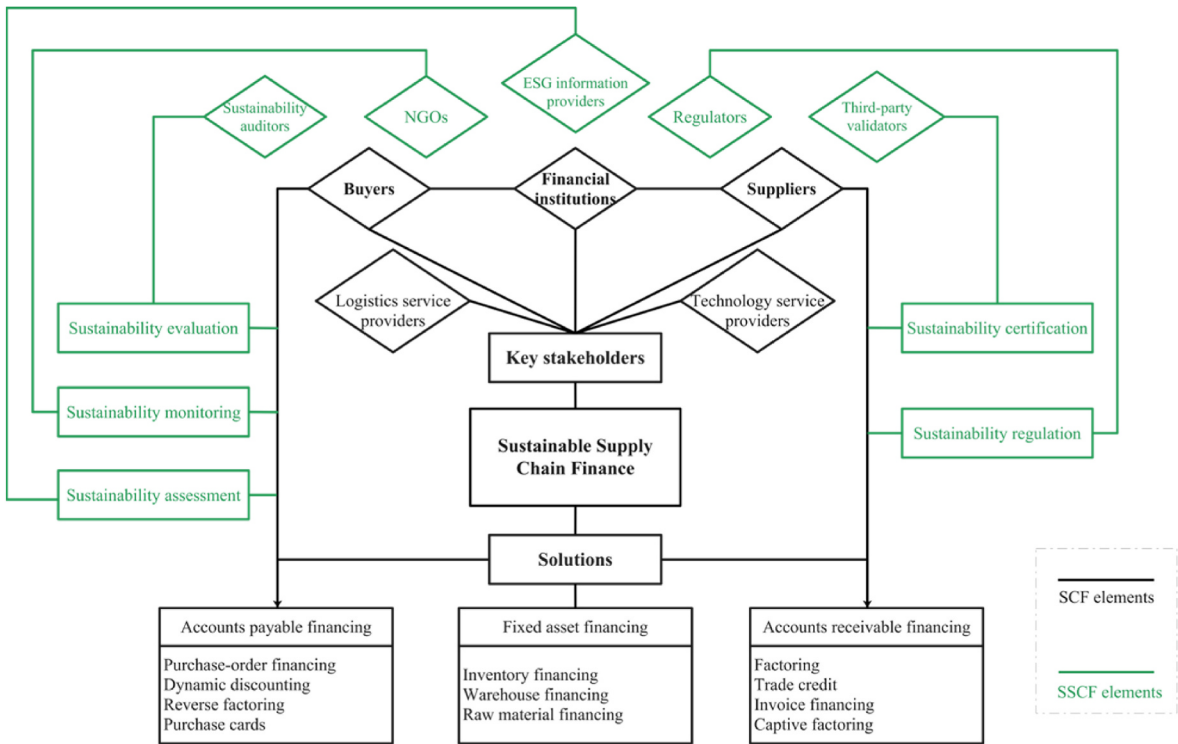


Fig. 8. The SSCF ecosystem.

reversed U-shaped relationship due to suppliers' perceptions that high CSR initiatives indicate ample cash flow, suggesting a reduced need for trade credit. This explains why improved CSR performance is more helpful for companies in obtaining trade credit at the beginning, but likely to diminish over time.

The integration of sustainability with accounts receivable financing presents a dual-edged scenario in practice. Adopting sustainable practices can improve suppliers' access to financial support through SSCF, enhancing cash flow. However, the high costs of implementing these

practices may offset the benefits, so suppliers must carefully evaluate their trade-offs.

4.4. The benefits of SSCF

The benefits of SSCF are of multidimensional measure that evaluates the effectiveness of financial strategies and tools in a supply chain, considering not only economic outcomes but also environmental and social impacts (Jia et al., 2020a; Medina et al., 2023; Nguyen et al.,

2023). It assesses how well SSCF practices contribute to the overall sustainability and financial health of the supply chain. According to the literature, SSCF could have a positive impact on the performance of different stakeholders, though it differs from buyers, suppliers, financial institutions and other stakeholders.

4.4.1. Performance implications for buyers

In buyer-centric accounts payable financing, buyers gain economic and operational benefits, along with enhanced customer reputation. For buyers, there is a mutually reinforcing relationship between their sustainability performance and their SCF adoption. As they improve in one area, it tends to positively influence the other, creating a virtuous cycle of continuous improvement.

In the SSCF ecosystem, buyers act as brokers, gathering information from suppliers and relaying it to financial and technology providers (Medina et al., 2023) to reduce information asymmetry. Dye and Yang (2015) found that as carbon prices rise due to emission regulation policies, the buyer will shorten the credit period given to customers to lower carbon emissions. This adjustment is driven by the increased costs associated with higher carbon prices affecting the buyer's inventory operations. Buyers can quicken cash inflow and minimize the risks of extending credit by offering shorter credit periods.

Buyers' behaviour also impacts other supply chain members in the SSCF ecosystem through effective coordination and collaboration. To suppliers, buyer's preference for sustainability could be reflected in SSCF practice by placing more orders (Nguyen et al., 2019) and promising a preferential rate (Lin and Pan, 2023) to sustainable suppliers. To financial institutions, buyers' sustainability performance improves their rating score and reduces the default risks (Lai et al., 2023). To other stakeholders, buyers' sustainable preferences also bring new chances like information and transportation system updates (Olan et al., 2022). In this context, SSCF can serve as a strategic tool to boost the overall performance of a coordinated supply chain.

4.4.2. Performance implications for suppliers

Despite having limited incentives and capital to adopt more sustainable operations, suppliers can still benefit from SSCF in various ways. First, being more sustainable enables suppliers to gain better access to SCF resources (Lai et al., 2022; Tian and Tian, 2022). The competition among upstream suppliers, heightened by downstream buyers' green innovation practices, acts as an incentive for SSCF (Li et al., 2023). SSCF effectively supports both financial stability and environmental quality by strategically reallocating credit resources and altering the financial composition of highly polluting suppliers (Chen et al., 2023b). Lai et al. (2022) found that suppliers rely more on external financing when they act as creditors in SSCF; thus the collaboration can not only reduce the default risk but also promote sustainable development. Arcuri and Pisani (2023) verified that green SMEs tend to receive more trade credit, are more profitable and in superior financial health compared to non-green SMEs. This effect is achieved by mitigating information asymmetry, improving corporate efficiency and reducing corporate risk (Luo et al., 2023).

Second, SSCF practice leads to suppliers' sustainable performance improvement. When unit production costs are low and green investment costs are high, suppliers are more likely to choose SSCF over bank credit, thereby enhancing the supply chain's environmental sustainability (Li et al., 2022). Zhan et al. (2018) compared several SCF solutions, finding that the payment terms influence suppliers' commitment to improving supply chain sustainability and efficiency. Reinvesting SSCF savings in skill development centers, libraries, recreational facilities, or community parks enhances the social responsibility of suppliers (Aljazzar et al., 2018). Yang et al. (2019) found that SSCF enhances product environmental friendliness and boosts profits for buyers and suppliers, as well as enhancing their CSR initiatives (Moraux et al., 2023), achieving a win-win situation among supply chain members.

4.4.3. Performance implications for financial institutions

Financial providers play a critical yet limited role in SSCF, focusing solely on offering financial resources and incentives to suppliers. This highlights the need for SSCF solutions to expand the range of participating stakeholders and enhances collaboration among them. The adoption of SSCF reshapes the lending criteria of financial institutions and educates investor behavior through its impact on financial institutions' lending practices and by transmitting environmental signals into the capital market. The adoption of SSCF will directly restrict bank lending, thereby reducing the total external financing available to highly polluting companies (Lin and Pan, 2023). The bank's interest rate influences the carbon emission reduction effectiveness in SSCF rather than SCF (An et al., 2021).

Implementing SSCF policies increases restrictions on heavily polluting enterprises by commercial banks. If heavily polluting companies commit to green transformation and engage in ongoing green projects, commercial banks will provide financing support under SSCF policies (Lin and Pan, 2023). This encourages financial institutions to improve their SSCF as an alternative to debt financing (Chen et al., 2023a). Other changes are risk management and supplier admission. Suppliers' sustainability performance has increased proportion of importance in SSCF decision making process (An et al., 2021; Li et al., 2023; Zhang et al., 2014).

4.4.4. Performance implications for other stakeholders

Except for the above key stakeholders, other stakeholders in the SSCF ecosystem, like regulators, ESG information providers, and logistics/technology service providers, are also important elements. Regulators serve as both instructors and monitors by introducing environmental and social policies, while SSCF adoption allows them to evaluate the real-world impact of these policies across a broader range of firms within the supply chain (Zhong et al., 2023). ESG information providers play a crucial role by offering quantitative sustainability assessments, which serve as key references for fund providers during financing decisions (Tian and Tian, 2022). SSCF adoption incentivizes ESG information providers to actively collect sustainability data from deeper tiers of the supply chain, and provide necessary help for firms that may lack the necessary records, systems, or resources to undergo ESG assessments (Shou et al., 2020). Logistics service providers act as information hinges in SSCF, as transactions must be based on product flow, verified by logistics providers (Lekkakos and Serrano, 2016). They also implement sustainable shipping practices and report key sustainability metrics, such as carbon footprint, waste reduction, and resource efficiency to help buyers and financial institutions assess a supplier's sustainability performance (Fahim and Mahadi, 2022).

Technology service providers offer the platforms like supporting tools that underpin SSCF programs, playing a crucial role in facilitating information sharing within these solutions (Medina et al., 2023). The evolution of SCF to SSCF would result in the upgrade of information systems and the adoption of new technologies like Blockchain and AI on these platforms. For example, the impact of carbon regulation plays a significant role in driving authenticity through Blockchain adoption (Soni et al., 2022; Olan et al., 2022). The integration of AI in supply chain networks can reduce default or bankruptcy risks by sourcing the cash flow and matching it with real good flows (Dolgui et al., 2020), alleviating information asymmetry to key stakeholders, thereby promoting SSCF. In practice, advancements in AI enhance the comprehension of complex issues within a system, emphasizing the significance of alternative financial services (Yakavenka et al., 2020). The integration also grants enhanced power to involved parties for resource sharing and ensuring precise control over dependencies in the SSCF process.

5. Discussion

Following the findings from the thematic analysis, a CIMO framework for the SSCF ecosystem is developed (Fig. 9), along with the

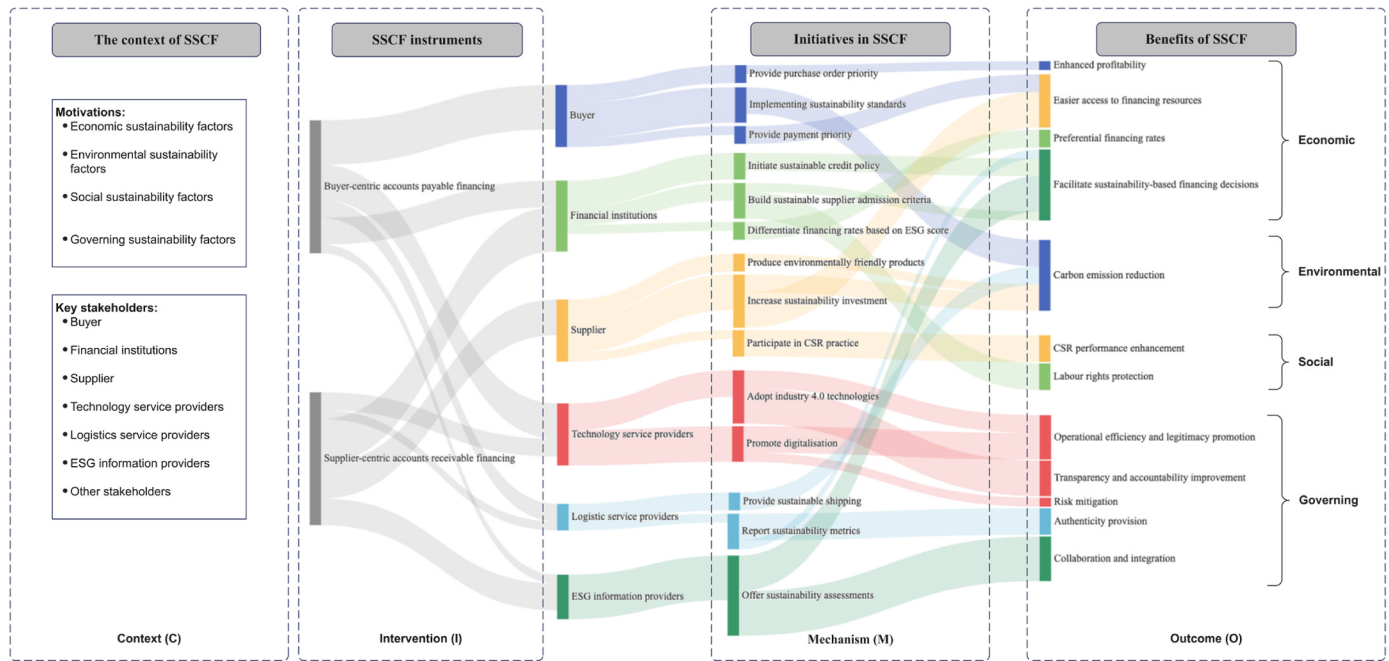


Fig. 9. Conceptual framework for the SSCF ecosystem.

identification of future research avenues.

5.1. Development of conceptual framework

From the thematic analysis, the stakeholder theory emerges as a prominent theory aligning with the SSCF ecosystem, offering a reliable theoretical foundation through which the complexities of SSCF can be better explained. The conceptual framework offered in Fig. 9 illustrates the SSCF ecosystem, highlighting the interaction among key stakeholders by detailing the context, intervention, mechanism, and outcomes by adopting stakeholder theory as a theoretical lens.

The context section outlines the motivations behind SSCF, which include economic, environmental, social, and governing sustainability factors, along with key stakeholders identified in SSCF, namely-buyers, suppliers, financial institutions, technology and logistics service providers, and ESG information providers. They play critical roles in influencing and driving the adoption of SSCF practices.

The intervention section in the CIMO framework focuses on two categories of SSCF instruments: buyer-centric accounts payable financing and supplier-centric accounts receivable financing. Each category links with key stakeholders shown in Fig. 9. Other identified stakeholders are currently not mentioned much in SSCF research, and their role needs further discussion.

The mechanism section describes identified initiatives different stakeholders seized to promote SSCF. Buyers provide orders and payment priority for more sustainable suppliers by implementing sustainability standards, which leads to enhanced profitability and easier access to financing resources for suppliers but also incentivize the adoption of environmentally friendly practices, thereby contributing to carbon emission reduction. Additionally, the framework outlines the initiatives undertaken by key stakeholders based on current studies. Each mechanism is linked to specific interventions, providing a clear pathway to understanding the role and impact of SSCF on individual stakeholders, as illustrated in Fig. 9.

The outcome section highlights the wider benefits of SSCF across four sustainability dimensions: economic, environmental, social, and governing. SSCF significantly contributes to economic benefits, including enhanced profitability, easier access to financing resources,

preferential financing rates, and facilitating sustainability-based financing decisions for various stakeholders. Unlike traditional SCF, SSCF involves logistics service providers and ESG information providers, who play a critical role in supporting financial institutions by supplying essential sustainability data and assessments to inform financing decisions. Identified environmental benefits focus mainly on carbon emission reduction, but result from most stakeholders' involvement, meaning that the whole SSCF ecosystem can benefit from environmental sustainability. Social benefits in SSCF involve CSR performance enhancement and labour rights protection, primarily facilitated by financial institutions and suppliers. These efforts highlight the importance of engaging a broader range of stakeholders to further promote social welfare through SSCF initiatives. Governing benefits, while mainly contributed by technology and logistics service providers and ESG information providers, focus more on operational improvements, such as authenticity provision, risk mitigation, transparency and accountability improvement and collaboration enhancement. The developed conceptual framework brings together comprehensive insights into the context, intervention, mechanism and outcome of the SSCF ecosystem.

5.2. Research gaps and future research directions

Thematic analysis and the proposed CIMO framework supported the identification of several research gaps, paving the way for the assessment of related research avenues/questions.

• How does SSCF promote social sustainability?

Current research on SSCF has primarily focused on its economic and environmental aspects. The CIMO framework only identified the benefits of SSCF in CSR engagement and labour rights protection in social sustainability. However, the social dimension of sustainability presents significant potential for further exploration. While some studies have concentrated on how better CSR practices increase access to SSCF (Luo et al., 2023; Wei et al., 2023; Zhong et al., 2023), they fail to test the reverse relationship between social sustainability and SSCF. Social sustainability encompasses crucial elements such as labour practices, community engagement, human rights, and social equity (Zhang et al.,

2014). Future research in SSCF could investigate other factors instead of CSR to thoroughly measure social sustainability, and whether economic benefits from SSCF might enhance social sustainability impacts. Such research would provide a thorough understanding of SSCF, including the potential incentives for businesses to prioritize social sustainability alongside economic and environmental considerations. This holistic approach would contribute to a more balanced and complete framework for SSCF, ensuring that all three pillars of sustainability receive adequate attention in both research and practice.

• **How does power asymmetry between buyers and suppliers influence SSCF decisions?**

Upon critical analysis of the literature, it is noteworthy that the power imbalance among parties in SSCF transactions has been a prevalent assumption, wherein buyers are frequently posited to wield greater influence compared to their suppliers. Meanwhile, suppliers frequently face financial constraints (Luo et al., 2020). This observation is supported by real-world evidence that supplier-centric trade credit is the most widely used SCF solution globally (Dong and Liu, 2022; Wang et al., 2018). It reveals that economic goals always take precedence over environmental and social benefits (Bals and Tate, 2018; Montabon et al., 2016). This is evidenced by companies primarily using economic incentives to drive environmental and social practices in SSCF. For suppliers facing capital constraints, prioritizing economic benefits may be a pragmatic necessity. However, powerful buyers have the potential to support suppliers in adopting environmentally and socially beneficial practices. Moreover, buyers can potentially improve suppliers' profitability by encouraging enhanced environmental and social behaviours. Therefore, it is worth exploring the extent of buyers' impact on suppliers through SSCF to create a sustainable supply chain and whether SSCF can create a win-win scenario for both parties.

• **How do SSCF solutions impact different tiers of supply chain members?**

The current literature on SSCF primarily focuses on transactions between focal buyers and their immediate suppliers, with a significant portion of existing research exploring optimal financing and operational strategies, often assuming simplified supply and demand relationships (Lai et al., 2022; Ma et al., 2023). While empirical evidence in the field, though limited, has been gathered through interviews and case studies involving buyers and their direct suppliers, this approach fails to encompass the full breadth of modern supply chains, which typically extend far beyond these dyadic relationships. As Medina et al. (2023) note, a comprehensive supply chain network often includes second-tier suppliers, wholesalers, retailers, and end customers, each playing a crucial role in the overall ecosystem. The impact of SSCF solutions on these extended stakeholders remain largely unexplored, representing a significant research gap. To address this limitation, future research should consider investigating deep-tier financing solutions that directly engage multiple levels within the supply chain network (Medina et al., 2023), potentially uncovering new opportunities for enhancing sustainability and financial resilience throughout the entire network.

5.2.1. How does fixed asset financing evolve in SSCF?

Fixed asset financing is an indispensable part of SCF, including inventory financing, warehouse financing, and raw material financing (Chakuu et al., 2019; Zhi et al., 2022). However, fixed asset financing is ignored in SSCF research. This might be because fixed assets do not generate carbon emissions or do not directly affect human rights conditions. Limited research mentioned fixed assets and sustainability mainly concentrated on economic benefits. Bouchery et al. (2012) introduced sustainability criteria into inventory models to obtain Pareto optimal solutions and later investigated its impact on minimizing cost and meeting strict emission regulatory requirements while facing

environmental pressures. Apart from this, there is no research establishing the direct link between fixed asset financing and sustainability, thus needing further exploration. Fixed asset financing could indirectly contribute to sustainability by using renewable energy, recyclable materials and clean technology. This potential has already been discussed in other financing areas like Public-Private Partnership (PPP) funding or green bonds (Cui et al., 2018). Thus, fixed asset financing in SSCF requires further research to understand its potential fully.

• **What are the mechanisms for effective stakeholder collaboration in SSCF?**

While current research emphasizes the triangular relationship among key SSCF stakeholders—buyers, suppliers, and financial institutions—there is limited focus on other critical participants, such as ESG information providers, regulators, and logistics service providers. These additional stakeholders are foundational in facilitating information flows that support financing decision-making (Ma et al., 2020; Medina et al., 2023). However, how these stakeholders interact, exchange information, and align incentives to enhance the effectiveness and implementation of SSCF remains largely unexplored. Given this context, future research should investigate how these stakeholders collaborate in the SSCF ecosystem to improve efficiency. One possible direction is to investigate how sustainability-related data like ESG scores or compliance records could be shared securely and transparently among stakeholders, without breaching confidentiality or causing competitive risks.

6. Conclusion

This research explored SSCF research and developed a conceptual framework following a systematic literature review. The selected literature linking SCF and sustainability was reviewed and analyzed using descriptive and thematic approaches. The descriptive analysis provided clear insights into SSCF research trends, covering publication years, research methods, the progression from SCF to SSCF along with commonly adopted theories. This study further unveiled the influencing sustainability factors, proposed as SSCF ecosystem, and identified SSCF solutions and benefits through a structured thematic analysis. A CIMO framework was developed to explain how different stakeholders interact with and benefit from the SSCF ecosystem.

This comprehensive review of SSCF literature has elucidated the context, interventions, mechanisms, and outcomes that constitute an SSCF ecosystem. The SSCF framework is fundamentally influenced by four key sustainability factors: economic, environmental, social, and governing. Economic factors derive from traditional SCF issues like liquidity pressure and payment delay. Environmental factors encompass carbon emission mitigation strategies, compliance with environmental policies, alignment with stakeholder expectations regarding ecological responsibility, and management of environmental renewal costs. Social factors comprise CSR initiatives, the implementation of ethical labour practices, and the promotion of human rights and diversity within the supply chain. Governing factors include enhancing supply chain transparency, fostering technological innovation, and strengthening supply chain collaboration.

Buyers, financial institutions, and suppliers were observed to be primary stakeholders, with other stakeholders like logistics and technology service providers, government, NGOs, and ESG information providers playing auxiliary roles in the SSCF ecosystem. Main SSCF solutions mapped with key stakeholders explained the mechanism through which these stakeholders adopt and benefit from SSCF initiatives. The SSCF solutions were categorized as buyer-centric accounts payable financing and supplier-centric accounts receivable financing. By comparing these with traditional SCF solutions, the evolution of SCF into SSCF as a structured sustainable financing tool is evident through this comprehensive review. It is also revealed that different stakeholders undertake distinct initiatives, leading to varied performance outcomes

within the SSCF ecosystem. To illustrate these complex relationships, a CIMO framework grounded in stakeholder theory was developed. This framework establishes relationships between SSCF solutions, key stakeholders, their respective initiatives, and the resulting performance metrics, providing a robust structure for understanding and implementing SSCF strategies.

6.1. Theoretical contribution

This research makes theoretical contributions to established literature on SCF and emerging literature on SSCF in various ways. First, this paper filled in the gap in SCF literature by systematically reviewing SSCF as an independent subject. Prior literature discussed SCF and sustainability separately, or only considered SCF as a tool to boost supply chain sustainable performance, without understanding how it would evolve with sustainability. This review bridged this unexplored connection by combining SSCF initiatives with sustainability factors. Second, to the best of the authors' knowledge, it is the first study that analyzed the evolution from SCF to SSCF, as well as proposed an SSCF ecosystem and demonstrated it by identifying different SSCF solutions beyond those conventionally used. A conceptual CIMO framework explaining how SSCF solutions can be leveraged to enhance performance from different stakeholders' perspectives, thereby justifying the topical feasibility of SSCF - a unique theoretical contribution. Third, by identifying research gaps and suggesting future research directions, this review facilitated the comprehensive advancement of the SSCF ecosystem as a concept, capturing the multifaceted nature of the field and its potential to drive sustainable practices across the supply chain. Valuable insights generated are expected to pave the way for targeted and effective future research in SSCF.

6.2. Managerial contribution

This study contributes to practice by providing a broad overview of SSCF for various involved stakeholders. It elucidates critical factors for SSCF engagement and proposes tailored initiatives for different stakeholders to optimise their SSCF adoption strategies. Supply chain practitioners can leverage this research to refine their approaches and anticipate other stakeholders' responses, when implementing SSCF solutions. By examining the interaction of SCF and sustainability, this study serves as a guide in the SSCF decision-making process, illustrating how supply chain members can derive benefits from these innovative financial solutions. Furthermore, the research contributes to the development of SSCF standards, potentially facilitating both economic and environmental advantages for supply chain participants. The proposed framework is designed to assist companies in gaining a more nuanced understanding of SSCF and its practical applications, enabling them to integrate these solutions effectively into their supply chains. Ultimately, this can lead to optimized cash flow management and enhanced supply chain sustainability, offering a competitive edge in an increasingly eco-conscious business landscape.

6.3. Limitations

While this review provides valuable insights into SSCF ecosystem, several limitations warrant acknowledgement. Firstly, this SLR only considered 70 papers published between 2008 and 2023, with a primary focus on recent years to capture advancements in the field. This selective approach may have missed some SCF literature and few indirect contributions to SSCF from a broader interdisciplinary perspective. Secondly, the exclusion of grey literature, such as conference papers and research reports, potentially limits our understanding of this emerging field, where such sources could offer valuable, cutting-edge insights. Thirdly, our conceptual framework, while partially informed by stakeholder theory, was not exclusively grounded in a specific theoretical foundation. This approach, emerging from the current literature, may

have overlooked potential analytical depths offered by other relevant theories. For instance, network theory, transaction cost economics, and the resource-based view have been successfully applied in few empirical (S)SCF studies, suggesting that future research could benefit from such theory-driven analytical approaches. These limitations highlight the need for expanded, interdisciplinary investigations and more diverse theoretical applications in future SSCF research to enhance our understanding of this complex and evolving field.

CRedit authorship contribution statement

Ziling Liao: Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Lorenzo Bruno Pratavia:** Writing – original draft, Visualization, Supervision, Investigation. **Abhijeet Ghadge:** Validation, Supervision, Methodology. **Ismail Abushaikha:** Supervision, Resources, Data curation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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