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## Article

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# A Systematic Literature Review of the Roles, Financing Mechanisms, and Working Capital Under Supply Chain Finance

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This article presents the results of a systematic literature review aimed to identify articles, using Web of Science, from over 250 journals focusing on supply chain finance (SCF). We carried out a further content analysis of 161 papers on working capital and trade credit, identifying gaps to propose areas for additional research. To understand the current state of the art in SCF and working capital research, we counted the frequencies of keywords in the articles, finding that "capital-constrained" and "replenishment" were the most commonly used field-specific terms. Our study demonstrates that the working capital structure, capital constraints, and financial performance of SMEs are of paramount importance, particularly in Taiwan.

*Keywords:* Supply chain finance, capital-constrained, text analysis, TF-IDF, working capital

*JEL:* D24, P33

Supply chain finance (SCF) is a technology-based business model that companies use to ensure the upstream and downstream participants in their supply chains can access trade credit and improve cash flow at a low cost (Camerinelli, 2009; Lamoureux and Evans, 2011). SCF refers to "the inter-company optimization of financing as well as the integration of financial processes with customers, suppliers, and service providers in order to increase the value of all participating companies" (Gomm and Pfohl, 2009).

From the collateral perspective, SCF builds on mutual trust or offers non-binding options in contractual relationships. Borrowers and lenders register creditworthiness and trade history when utilizing financial instruments such as advance payment and dynamic discounts, as well as trade credit (Navas-Alemán *et al.*, 2012). From the perspective of risk mitigation, SCF constitutes a wide spectrum of effective instruments, tools, and models that enable firms to reduce their working capital requirements (Babich and Kouvelis, 2018) without damaging the health of the supply chain. One short-term financing option available to businesses is trade credit, in which suppliers allow a small business to postpone payment for the products or services it purchases. More complex credit requirements are addressed by obtaining loans from financial institutions. Extended by sellers to buyers, trade credit allows goods or services to be purchased from the former without making immedi-

ate payment and, as such, is an important source of short-term finance available to businesses. More and Basu (2013) classifies the forms of trade credit according to the different stages of a supply chain operation: pre-transportation financing (e.g., for raw materials or orders), in-transit (inventory) financing, and post-transportation financing (such as advanced payment financing, or accounts receivable).

SCF has been extensively researched in recent years. It focuses on creating liquidity between seller and buyer via a facilitating technology (Babich and Kouvelis, 2018). SCF is also a dynamic solution that leverages the buyer's payable accounts without adding any financial debt to either the buyer's or supplier's balance sheet. Song *et al.* (2018) indicate that SCF enables SMEs (small and medium-sized enterprises) to receive guarantees from suppliers. With SCF, loans can be secured from banks or financial institutions based on previous transactions and purchasing information. Additionally, some research has considered the prepayment finance, financial institutions will provide to supplier of advanced, enabling them to guarantee that a commodity will reach a buyer in the future. This is supported by contractual arrangements and cash-flows between buyers and sellers (He and Tang, 2012).

The financial perspective on SCF focuses on the liquidity invested in supply chain processes and transactions (Babich and Kouvelis, 2018) and the effectiveness of working capital flow. In sum, SCF mechanisms reduce the need for working capital while optimizing its flow, thereby benefiting buyers and sellers in the supply chain. However, previous studies have rarely investigated working capital, the role of financial institutions, and the mechanisms of coordination in SCF.

The study contributes to SCF research in the following ways. First, the approach we deployed to textual analysis makes a useful methodological contribution to systematic reviews of literature. Second, our analysis of research papers identifies contemporary SCF topics by evaluating the relative importance of key terms related to the field. Third, the identification of credit term changes points towards a framework for analyzing working capital and actionable ideas for future research into supply chain financing.

The remainder of the paper is structured as follows: Section 2 contains the literature review, data, methodology used, and descriptive analysis, while Section 3 presents the results of the term frequency-inverse document frequency (TF-IDF) analysis and Section 4 summarizes the results. Finally, Section 5 discusses the findings and limitations of this study.

## LITERATURE REVIEW

### The Role of SCF

Small and medium enterprises (SMEs) play a significant role in the development of economies (Navas–Alemán *et al.*, 2012). However, such businesses face a major barrier to their growth: financing. Credit crunches, shortages, and high borrowing costs all create obstacles to SMEs, which require access to risk-free credit to manage their net working capital (Randall and Farris, 2009; Song *et al.*, 2018). Without liquidity to support investment and innovation, economic growth suffers. If liquidity can be released into the working capital of supply chains, these will grow more robust and competitive, boosting economies more generally. It is therefore worth considering how to establish credit information sharing mechanisms that promote bank lending to SMEs.

The role of SCF is to optimize both the availability and cost of capital within a given supply chain. The recent increase in scientific articles focusing on SCF has defined the concept more clearly, enabling the SCF solutions landscape to be described with greater precision.

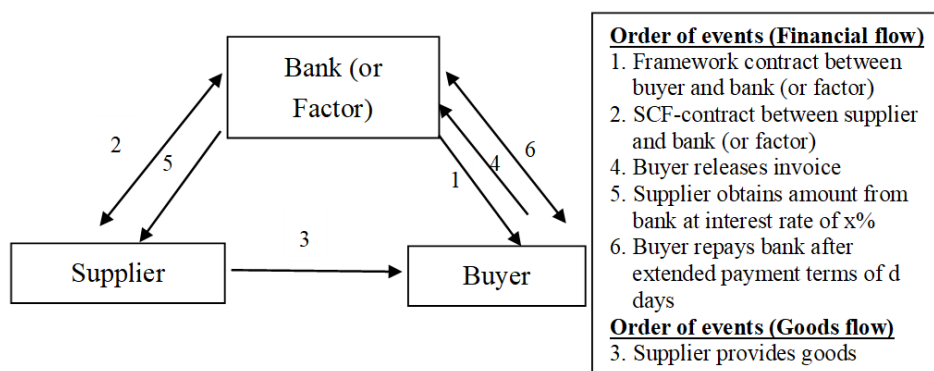
### **SCF Mechanisms**

The literature has defined SCF in a strategically ambiguous and somewhat impractical fashion. However, this broad definition has attracted wide attention and endorsement for its potential for optimizing financial flow and creating value (Hofmann, 2005). By 2000, different understandings of the term SCF had begun to appear (Hofmann, 2005), with some accounts suggesting that varying forms of SCF could be designed in line with transaction relations within the supply chain, generating several financing models (Klapper, 2006) and adding value. SCF has been widely touted to offer solutions to the problems faced by SMEs in availing finance; the literature on SCF confirmed that SCF improves accessibility to funds, particularly for smaller partners in supply chains.

Many different enterprises demand alternative forms of financing—particularly trade credit from suppliers. The availability of trade credit can be viewed as a sign of quality assurance by supplier when creating opportunities for high-tech or newly developed products (Emery and Nayar, 1998; Long *et al.*, 1993). This also applies to supply chains, where competition among suppliers can provide trade credit for downstream retailers, allowing them to postpone payments and making the relationship between customers more robust (Fu *et al.*, 2018). Meanwhile, trade credit can coordinate and enhance supply chain efficiency. A number of studies have emphasized the relationship between trade credit and supply chain performance. Research has also confirmed that suppliers and buyers can mutually benefit from enhancing inter-firm collaboration (Lee *et al.*, 2018; Tang *et al.*, 2018).

Reverse Factoring (RF), the most popular of all supply chain finance schemes, is used by large firms with high-quality credit ratings as a mechanism for ensuring their supply chains function smoothly (Caniato *et al.*, 2016). RF involves a three-party arrangement between a buyer, a factor (usually a bank), and a supplier. In this arrangement, the buyer promises to pay the invoices from its

trade transactions with the supplier to the factor, who undertakes to provide an approved invoice-based financing solution to the supplier. Tanrisever *et al.* (2015) demonstrate that the value of RF is greater when the credit spread is large, the payment extension period is short, the demand volatility is high, and the SME's working capital requirements are also relatively high. Transactions in the SCF mechanism are presented in Figure 1.



Source: Wuttke *et al.* (2013) and Caniato *et al.* (2016)

**Figure 1. Transactions in the SCF mechanism**

### Working Capital in SCF

There is a need for better management and optimization of working capital in the supply chain which SCF provides. Working capital refers to financial liquidity and viability for participants in a supply chain and it is important to understand how firms can maximize their working capital when trade credit is part of their business transactions. While working capital has always been critical to every business, supply chain professionals' active engagement in coordinating financing in their area of expertise took off only in the last decade. SCF is now seen as a unique financial product of critical importance to all supply chain members since it can ensure they can access a ready supply of working capital if managed carefully. The ultimate objective is to flexibly adjust financial flows in the supply chain as well as improve cash flow management (Wuttke *et al.*, 2013). The U.S. Federal Reserve System (2016) reported that accounts payable, i.e., the amount of trade credit owed by buyers to suppliers, were 3.3 times as large as bank loans on the aggregated balance sheet of non-financial US businesses. Therefore, it requires a disciplined approach to optimize cash flow management of business processes.

Randall and Farris (2009) indicated that inventories, receivables, and payables should be considered while making cash-to-cash cycle calculations in order to optimize capital in the supply chain. The cash-to-cash cycle approach also improves trust, commitment, and profitability througho-

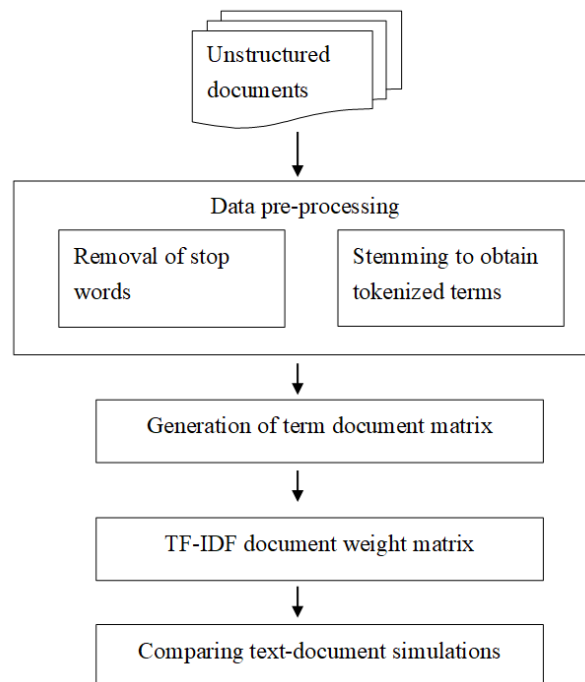
ut the chain. From this working capital management perspective, SCF offers a set of innovative financial solutions to short-term financing and particularly to managing receivables and payables.

Table 1 (see Appendix-I) shows the typical approaches taken to SCF. While the list of approaches to SCF provided is comprehensive and, in our opinion, involves many diverse practices fundamental to SCF, this paper focuses on those aspects that are closely related to short-term credit and links to finance. This goes beyond a purely financial perspective to consider the supply chain, its technologies, and the perspective of production economics more broadly.

## METHODOLOGY

### -Sample and Procedure

Our search centered on data from the Web of Science due to its wide selection of congeneric articles. To pre-process the text documents, all data were collected and organized based on indexing. After the appropriate search terms were defined and algorithms applied to remove stop words, the remaining words were stemmed to obtain tokenized terms. The weights of these terms were calculated using TF-IDF. The detailed steps taken to define an initial set of keywords and search structure are provided in Figure 2.



Source: Lydia *et al.* (2018)

**Figure 2. The Literature Search Process**

### **–Selection of Items for Analysis**

After source texts had been selected to ensure sufficient and appropriate topic coverage, the keywords within them were chosen. An initial set of keywords and search structure was established following the procedure described by Lydia *et al.* (2018). By searching irrelevant papers and research areas, the exclusion keywords could be identified, and the keyword structure was updated accordingly. The initial sample consisted of 618 articles published in 250 journals, whereas final sample comprised of 161 articles.

### **–TF-IDF Framework for Text Categorization**

The frequency of keywords was extracted from the article abstracts. Prior to counting, the keywords were filtered to avoid duplicating keywords with identical meanings and to combine hyphenated words describing a single keyword. The TF-IDF algorithm produced successful results in the overall framework and testing process (Hsieh and Chiu, 2020).

### **–Comparative Text Analysis**

Comparative text analysis showcased associations (e.g., between SCF, working capital, and trade credit) among the keywords and characterized the themes of the articles in a scientific field. These were described as keyword-based usage over time.

## **RESULTS**

A deductive approach was taken to the initial literature classification of this study. When this was completed, we switched to an inductive, bottom-up approach to perform the citation analysis.

### **Text Analysis based on TF-IDF of Keywords**

Our initial analysis identified 618 papers that had been published in more than 250 journals. Table 2 details our strategic search for the four roles of loan offer flow and the number of articles that contributed to each one. SCF, factoring, and working capital were the primary focus for many of the key journals identified. However, the linkages between supply chain finance, trade credit, and working capital may demonstrate the significance of this research area within the general context of SCF and its optimization.

The text analysis characterized each of the themes in terms of their internal and external cohesion. The frequency of keywords was calculated to identify how SCF-related topics had changed over time in the publications of documents separately. Calculating the frequency of keywords allowed us to judge their relative importance in articles focused on SCF, trade credit, and working capital. Table 3 shows that the TF-IDF “1” weighting for the “capital-constrained” keyword was higher than the “0” wei-

ghting for “replenishment”. In other words, the “capital-constrained” keyword lending high discriminatory power to those documents.

<b>Role (Loan offer flow)</b>	<b>Search of Keywords</b>	<b>Frequency in the Sample</b>
<b>Supplier → Buyer</b>	Supply chain finance and trade credit	161
<b>Buyer → Supplier</b>	Supply chain finance and purchase order financing	40
<b>Buyer → Supplier or Supplier → Buyer</b>	Trade credit and working capital	40
	Trade credit and accounts payable	4
	Trade credit and accounts receivable	5
<b>Factor → Supplier</b>	Trade credit and reverse factoring	12

Source: Authors' Presentation

*Table 2. Strategic Search for the Four Roles of SCF*

As shown in Table 3, “capital-constrained” and “replenishment” were the most-used keywords in both SCF and working capital research. In recent years, inter-corporate optimization of financing has become an important research topic in SCF-related fields. Moreover, SCF is also viewed as optimizing the management of the working capital and liquidity that has been invested, particularly for smaller SC partners.

<b>SCF</b>		<b>Trade Credit</b>		<b>Working capital</b>	
Keywords	Frequency	Keywords	Frequency	Keywords	Frequency
Sustainability	69	Capital-Constrained	48	Relationships	14
Capital-Constrained	49	Deteriorating	38	Revenue-Sharing	14
Replenishment	40	Replenishment	35	Capital-Constrained	9
Deteriorating	34	Sustainability	6	Replenishment	8
Collaboration	28	Credit-Market	4	Organizations	6

Source: Authors' Presentation

TF-IDF weighting for “capital-constrained” = 1; TF-IDF weighting for “replenishment” = 0

*Table 3. Top 5 Keywords used in SCF, Trade Credit, and Working Capital Publications*

## DISCUSSION

The results afforded several interesting insights into the evolution of SCF over recent years. Our discussion will concentrate on two specific aspects: first, the dynamics of the strategic search for the four roles of SCF, and second, the frequency of keywords in terms of what they tell us about SCF research topics and their links to the transformation of credit terms. Our discussion of the dynamics of



the strategic diagrams is based on three characteristics of the text: (a) type of central keyword defining the text, (b) major motor text, and (c) emerging text.

Particularly in Taiwan, SCF is perceived differently in credit terms. Working capital structure, capital constraints, and the financial performance of SMEs are of predominant importance as shown in Table 4. This finding corroborates with Vu Thi and Phung (2021) who attribute concerns with these aspects to the serious financial constraints faced by SMEs.

Differences	SCF	Working Capital	Major reason for working capital in SCF
Primary driver	Optimize working capital when trade credit is present in business transactions	SMEs are unable to access liquidity through conventional banking loans. Robust relationships should be built among SC participants.	Revenue-sharing. Contracts can coordinate the supply chain with enough working capital.
Role of Bank (or Financing mechanisms)	Bank loan Working capital	Factoring Reverse factoring	Reverse factoring

Source: Authors' Presentation

**Table 4. A Comparison of SCF in Credit Terms**

A proper capital structure and working capital will lead to success and maximize benefits for SME owners. However, revenue-sharing contracts can coordinate the supply chain only when enough total working capital is available. Moreover, suppliers cannot allocate profit flexibly unless their working capital is sufficiently large. At an advanced level, this issue originates from economic systems and financial institutions (Song *et al.*, 2018; Vu Thi and Phung, 2021).

## CONCLUSION

This paper has investigated the roles and mechanisms affecting supply chains covered by the SCF literature. Our systematic review found that financial liquidity and viability for supply chain participants were major concerns of this literature. After analyzing the frequency of keywords and evaluating their relative importance within our corpus of articles, we detected an increasing emphasis on the importance of working capital to the entire supply chain. Another point of emphasis was building robust relationships among supplier, customer, and service provider rather than optimizing their work in their business transactions.

One contribution of this study has been to show that revenue-sharing contracts can coordinate the supply chain with sufficient working capital to cover real-time response to demands, facilitating transparency and traceability in the flow of material, information and financial liquidity through the

supply chain. This enables SMEs to obtain essential knowledge and share information in real-time with all supply chain partners. Another contribution has been to enhance awareness and create knowledge of prepayment finance, which financial institutions will pay to producers in advance and which allows sellers to guarantee the delivery of commodities (He and Tang, 2012).

## **IMPLICATIONS**

The current study underlines the importance of the mechanisms and structure of working capital, capital constraints, and the financial performance of SMEs (Song *et al.*, 2018; Vu Thi and Phung, 2021). In addition, our systematic review of the SCF literature revealed that the financial liquidity and viability of supply chain participants was a major theme. The review indicated that managers should ensure working capital is available across the whole supply chain and optimizing capital that encourage participants to see SCF as mutually beneficial.

## **LIMITATIONS AND FUTURE DIRECTIONS**

The corpus of papers was taken only from the ISI Web of Science due to its comprehensive database of relevant articles, but other open-source databases may return additional articles and should be investigated by researchers in subsequent studies. Although its external validity may be limited by time, this study can be used as a baseline for comparison by researchers who investigate supply chain roles and mechanisms in the future.

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Role (Loan offer flow)	Financing Mechanisms	Category	References
Bank → Supplier	* Receivables Purchase (RP)	Payables financing is provided through a buyer-led program within which sellers in the buyer's supply chain are able to access finance via RP.	Babich and Kouvelis (2018); Reindorp <i>et al.</i> (2018); Klapper (2006)
		Purchase order financing (or RP) allows banks to offer loans to suppliers by considering the value of purchase orders issued by reputable buyers and assessing the risk of the supplier delivering the order successfully. Factoring is a form of RP, in which firms sell their creditworthy accounts receivable at a discount and receive immediate cash.	
Factor → Supplier	Reverse Factoring	Reverse factoring (RF), the most popular instrument among the various supply chain financing schemes, initiated by large firms with good credit ratings as a mechanism to address their suppliers' financing problems.	Caniato (2016); Tanrisever <i>et al.</i> (2015); Devalkar and Krishnan (2018)
		Tanrisever <i>et al.</i> (2015) find that reverse factoring arrangements can create mutual value for both the buyer and supplier. Devalkar and Krishnan (2018) find that reverse factoring arrangements along with delayed payment terms can restore supply chain efficiency by providing the supplier with access to inexpensive credit.	
Supplier → Buyer	Trade Credit	Trade credit payment terms typically specify that the retailer pays for the product within a certain number of days. Research focuses on understanding how the costly financing of working capital requirements affects the ability of trade credit to coordinate the supply chain. Two mechanisms are highlighted:	Lee <i>et al.</i> , 2018; Tang <i>et al.</i> , 2018; Zhan <i>et al.</i> , 2018; Kouvelis and Zhao (2012)
		The advanced payment (AP) model: the downstream retailer makes an early payment to the supplier within a certain payment term. The reverse factoring (RF) model: the retailer cooperates with and encourages a bank to offer a loan to the supplier.	
Buyer → Supplier Supplier → Buyer	** Working Capital	Working capital aims to provide financial liquidity and viability for supply chain participants when trade credit is involved in their business transactions	HSBC UK Luo and Shang (2019);

<b>Role</b> <b>(Loan offer flow)</b>	<b>Financing</b> <b>Mechanisms</b>	<b>Category</b>	<b>References</b>
			Marak and Pillai (2019); Devalkar and Krishnan (2018)

Source: Authors' Presentation

Note: \*denotes The SCF mechanisms were developed from the Global SCF Forum classification, which includes receivables purchase, a range of loans, and others defined by the author; \*\*With trade credit, inventory decisions directly affect working capital levels as the deferred inventory payment and the delayed sales collection are recorded as accounts payable (A/P) and accounts receivable (A/R), respectively. Working capital supports the liquidity and financial viability of firms.

***Table 1. SCF Practices***