

Supply chain finance (SCF): The development, trends, and challenges

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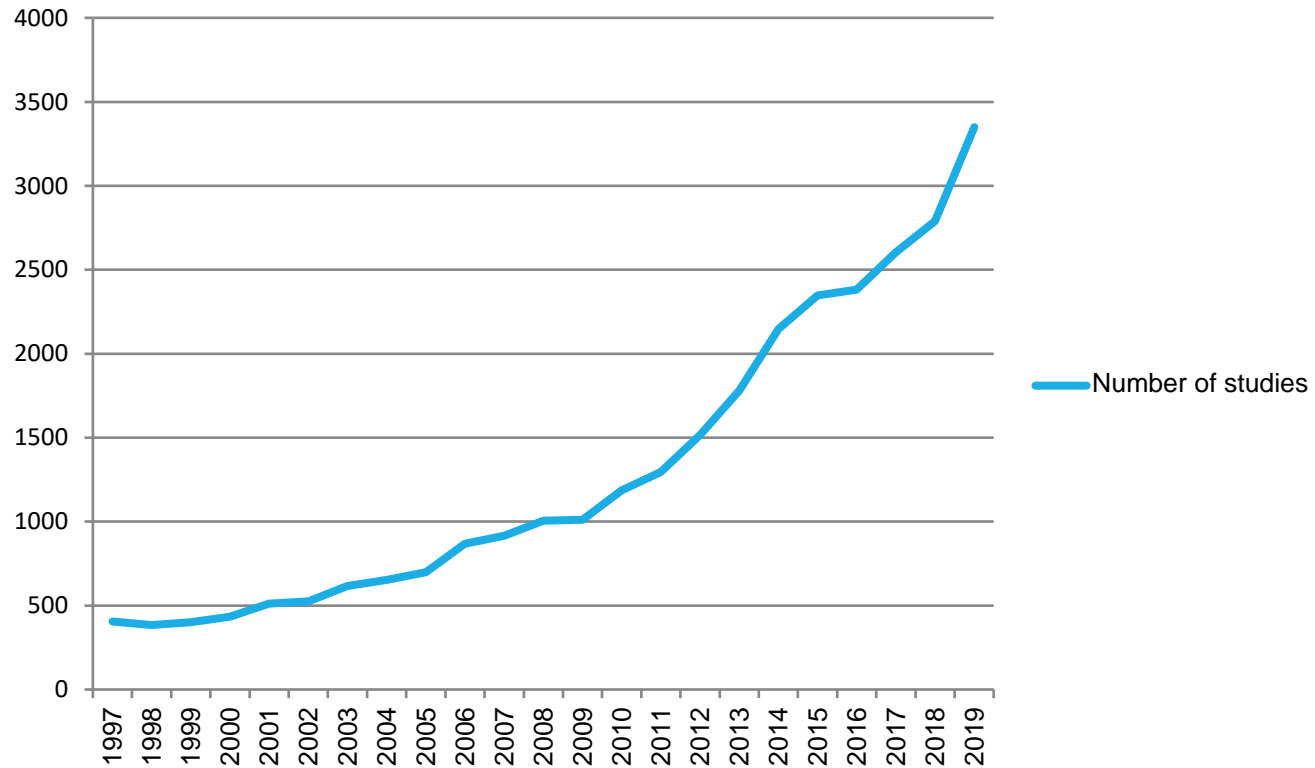
Contents

1. Development in SCF researches
2. Keys Trends
3. Challenges

The development

The development of supply chain finance researches

Number of studies



- First paper related to Supply chain finance was in 1973.
 - No definition of supply chain finance
 - Focus on inventory policy and trade credit
- Increasing number of studies especially after 2010

Definition development in SCF

Years	Authors	Contents
2002	Baimain & Rajan	Financial collaboration with the most important suppliers to enhance procurement process
2005	Hofmann	Operating and financing activities are independent and closely connected
2007	Robinson	Managing working capital, or simply the flow of cash between corporations along the supply chain
2011	Hofmann	The management of financial flow and information flow simultaneously with physical flow of supply chain
2018	Global Supply Chain Finance Forum, International Chamber of Commerce	The use of financing and risk mitigation practices and techniques to optimize the management of the working capital and liquidity invested in supply chain processes and transactions

Previous SCF definitions and applications

Definitions

- SCF is about managing working capital, or simply the flow of cash between corporations along the supply chain either in the form of a payment between a vendor and a buyer or in the form of finance. (Robinson,2007)

Applications

Letter of Credit

- a letter from a bank guaranteeing a supplier for a buyer's payment.

Open Account

- Supplier ships the goods and expects the buyer to remit payment according to the agreed terms

Disadvantage of previous SCF adoptions

Letter of Credit

- Costly
- Inconsistent documents in processes

Open Account

- Credit risks
- Absence of legal enforcement
- Struggle in financing processes due to information asymmetry
- Need more working capital

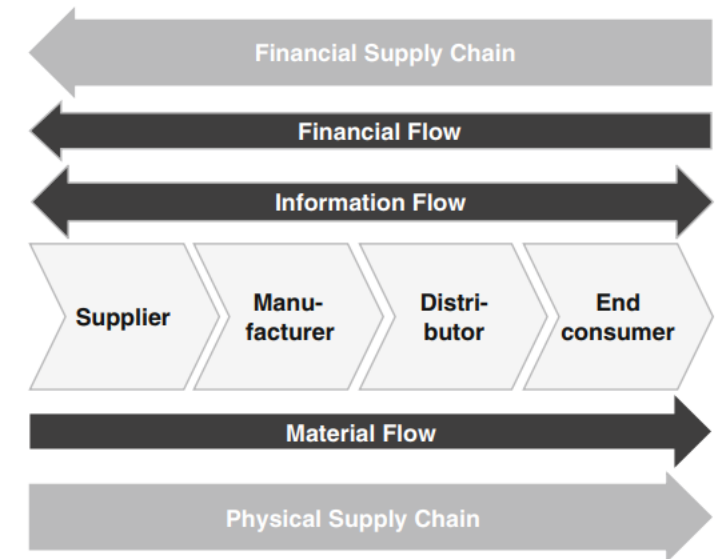
Current Definition of SCF

- “At the center of SCF is the management of working capital and financial flows, but equally important is **the management of the respective information across the supply chain** and the documents and data involved that support these flows, such as POs, invoices and payment approval processes. Enhanced transparency and visibility across both these chains has become a key ambition across the incrementally more intertwined subject of SCF.”

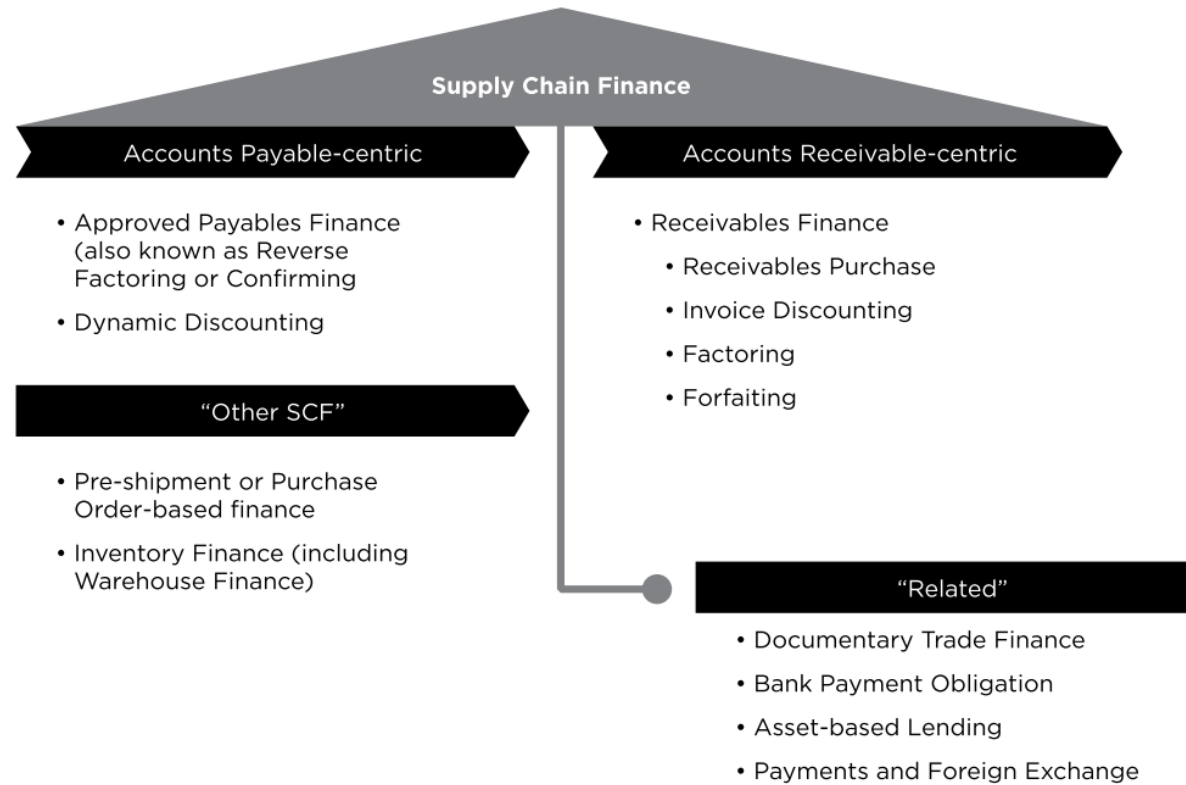
Hofmann, 2011

- “Supply Chain Finance is defined as **the use of financing and risk mitigation practices and techniques** to optimize the management of the working capital and liquidity invested in supply chain processes and transactions. SCF is typically **applied to open account trade** and is **triggered by supply chain events**. Visibility of underlying trade flows by the finance provider(s) is a necessary component of such financing arrangements which can be **enabled by a technology platform**”

Global Supply Chain Finance Forum, International Chamber of Commerce, 2018



Current SCF applications



The development of contents in supply chain finance researches

There are 4 main clusters of researches

1. Deteriorating inventory model under trade credit policy based on EOQ/EPQ model
2. Inventory decision with trade credit policy under more complex situation
3. Interaction between replenishment decisions and delay payment strategies in supply chain
4. Roles of financing service in supply chains

Cluster 1: Deteriorating inventory model under trade credit policy based on EOQ/EPQ model

- Focus on the impact of specific forms of financing mechanisms on decisions of the classical inventory model
- Research objectives of these papers are perishable products or deteriorating inventory systems.
- The financing mechanisms are all trade credit policies in the forms of permissible delays in payment, discounted cash flows (DCF) and date terms
- Inventory decisions are focused on the optimal price, ordering quantity or replenishment frequency. These models are all based on traditional EOQ or EPQ mode

Cluster 2: Inventory decision with trade credit policy under more complex situation

- Study of the impact of trade credit policy on inventory decisions.
- Considers inventory decisions within the EOQ or EPQ framework, but extends the traditional model and assumptions compared with Cluster one as followings dimensions:
 - extends the traditional model and assumptions is to extend the classical EOQ or EPQ models by introducing new methods such as fuzzy sense into the modeling and considering the demand rate, holding cost, ordering cost and purchasing cost as fuzzy numbers.
 - extend the model in terms of trade credit by considering two-level trade credit instead of one-level trade credit
 - extends the traditional model and assumptions is to extend the assumptions and consider extreme cases.

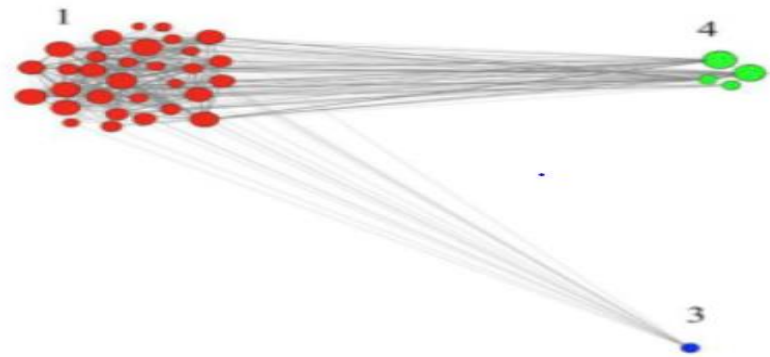
Cluster 3: Interaction between replenishment decisions and delay payment strategies in supply chain

- Focus on the interaction between replenishment decisions and delayed payment strategies in the supply chain
- Three main features:
 - extends the traditional replenishment models, which are focal company focused, by considering supply chain players and trade credit stages and constructing a Stackelberg game
 - relaxes some strict assumptions , add more assumptions, and consider imperfect situation
 - consider new research ideas such as cost and credit risks and the coordination of the supply chain in the form of supply chain contracts

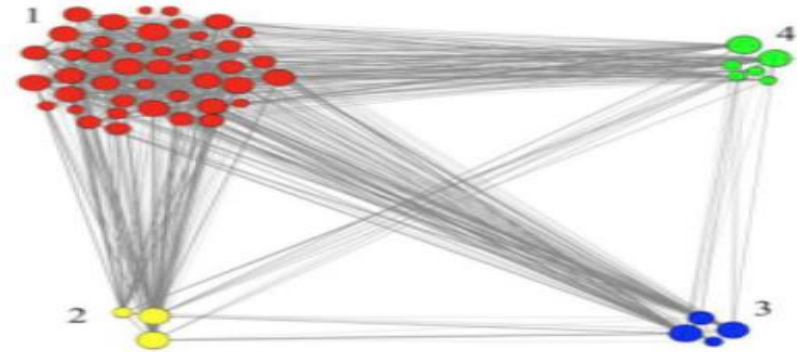
Cluster 4: Roles of financing service in supply chains

- Focus on the impact of integrated operations and financing decisions on supply chain performance.
- Study the roles of financing service providers in the supply chain
- Investigate how formal or informal financing services, e.g., bank credit and trade credit, affect joint operational and financial decisions in a supply chain
- Consider not only trade credit but also other forms of supply chain financing mechanisms, e.g., reverse factoring and different supply chain contracts
- Pays more attention to supply chain coordination and examines how supply chain financing service providers coordinate the supply chain or creates value for both individual companies and the entire supply chain.
- The models in this cluster can be applied to more complicated situations
- Stress on the budget-constrained conditions of supply chain players and introduces new conditions of tariff or fluctuated demand information or
- More diverse methods were adopted including surveys, experiments and a combination of empirical and modeling methods

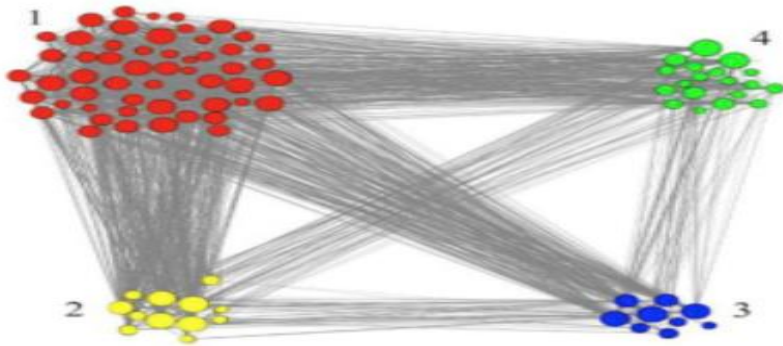
The development in contents of SCF researches



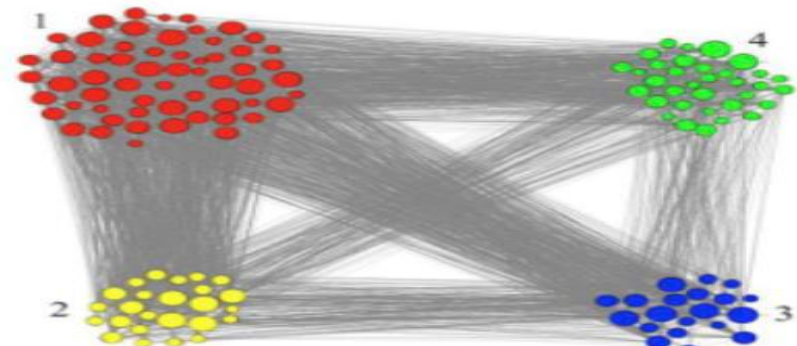
(i) 1973–2006



(ii) 1973–2008

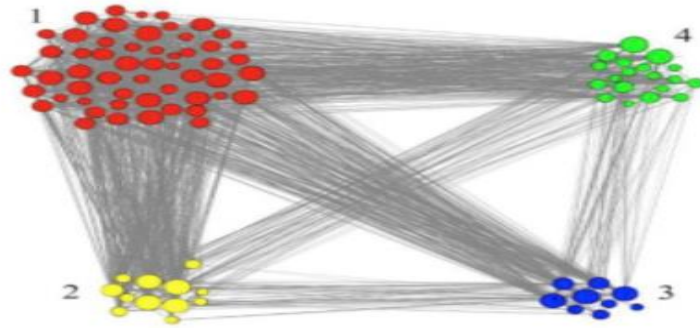


(iii) 1973–2010

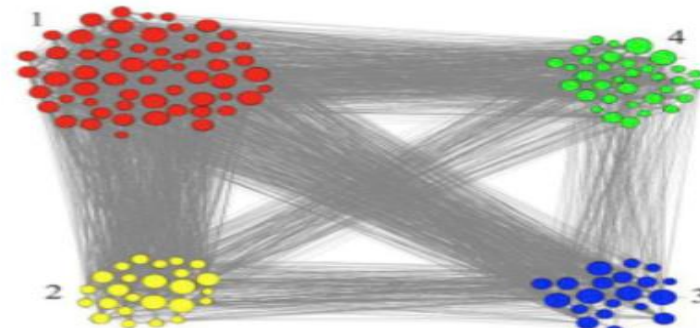


(iv) 1973–2012

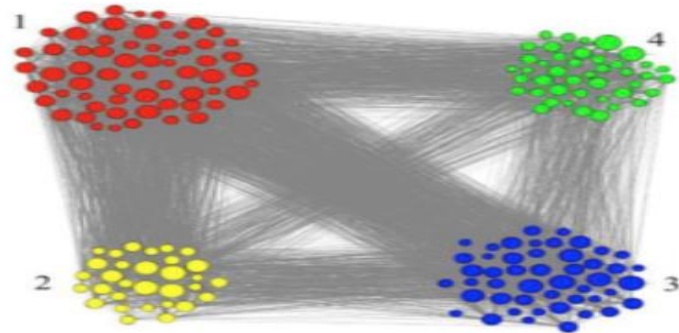
The development in contents of SCF researches



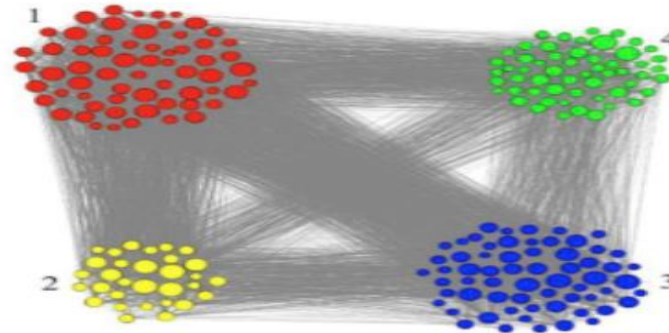
(iii)1973–2010



(iv)1973–2012



(v)1973–2014



(vi)1973–2016

The development in contents of SCF researches

The number of published papers in each cluster (1973–2016).

Year	Number of published articles			
	Cluster 1	Cluster 2	Cluster 3	Cluster 4
1973	1			
1981				1
1985	1			
1986	1			
1987	1			
1994	1			
1995	1			
1999	1			
2000	1			
2001	2			
2002	2			
2003	3			
2004	5			2
2005	8		1	
2006	3			1
2007	8	2		
2008	5	1	3	2
2009	5	6		9
2010	5	3	5	4
2011	2	6	2	8
2012	3	7	9	7
2013	3	5	14	4
2014		1	14	5
2015			9	8
2016	1		6	6
Total	63	31	63	57

Key trends in SCF researches

1. Investigate either one-level or two-level trade credit.

- Cluster one focuses on the one-level trade credit
- Cluster two develops the model based on Cluster one and considers the two-level trade credit so that the retailer can obtain the full trade credit offered by the supplier and the retailer just offers the partial trade credit to customers
- Cluster three, Pal et al. (2014) investigate the optimal replenishment lot size of the supplier and optimal production rate of the manufacturer under three levels of trade credit policy
- In the future, scholars may focus on the multi-level trade credit or even SCF in a supply network.

2. Relaxing current assumptions and introducing new assumptions

All the existing SCF research papers across Clusters one to three have the assumption of

- symmetric information
- Risk-neutral

In Cluster four, more papers consider

- the asymmetric information assumption,
- Different risk attitudes

3. Adjust and extend the research models to adapt to a more turbulent environment for SCF.

- In cluster 1, and cluster 2:
 - The assumptions of certain demand considered in EOQ or EPQ models do not match reality
 - Optimal decision made based on the cost
- Cluster 3 show that SCF could increase not only the overall chain profit but also each member's profit under some conditions
- Cluster four, consider a two-stage Stackelberg game between the assembler and the two suppliers
 - In the future, more flexible forms of demand or fluctuated demand information should be considered for a broader scope of application.
 - more research focusing on both cost reduction and profit generation by the supply chain players should be conducted.
 - more game theory models and their variations can be used to analyse the SCF problems in further research

4. Consider complicated situations

- Papers in Cluster four have examined complicated situations, e.g., considering budget-constrained conditions, and introduce new conditions of tariffs or bankruptcy
- More forms of financing mechanisms such as taxes should be introduced to SCF research.
- In the future, scholars may consider the application of SCF in global supply chains and examine the impact of exchange rate or tariff rules on the SCF decisions of supply chain players.
- Researchers could provide more ideas about how to improve the profit and efficiency of the global supply chain with SCF, helping firms make better import and export decisions and offering suggestions to policy makers

5. Attention to sustainable development and sustainable supply chain management

- Suppliers and retailers have begun to care about the environmental and social sustainability of their supply chains. Few papers examine the relationship between sustainable development and SCF.
- Future research could examine
 - The effects of the adoption of sustainability criteria in the supply chain on SCF or explore how SCF promotes supply chain sustainability

6. SCF in specific industry sectors

- Combining SCF with specific industry sectors or real problems would add value to SCF research.
- SCF in specific industry sectors, such as the manufacturing sector or the retail sector, deserves more attention from SCF researchers

7. More studies using empirical and case study methods

- Papers in Clusters one, two and three predominantly adopt a modelling method, whereas Cluster four shows some early signs of adopting an empirical method, including the mixed method, e.g., case studies and surveys in addition to the modelling method.
- More studies using empirical and case study methods are called for in the future to gain a better understanding of SCF
- In future research, different types of SCF business models could be identified.

Challenges

Challenges for the Supply Chain Finance research

Challenges in objectives

Presenting meaningful interactions both in Operation Management and in Finance considerations

Lacking of theoretical background for new assumptions, and new models

Challenges in contents

In practice, SCF has been adopted in limited markets, and in some specialize sectors

Challenges in methodologies

Blend methodologies are required but lacking of empirical data, and practical cases applying SCF



Thank you!