

# System Review: A Text Analysis on Supply Chain Finance

Chao-Chen Hsieh<sup>1,\*</sup>, Jun-Zhi Chiu<sup>2</sup>

<sup>1</sup>Department of Marketing Management, Central Taiwan University of Science and Technology, Taiwan

<sup>2</sup>Department of Senior Citizen Service Management, Yuh-Ing Junior College of Health Care and Management, Taiwan

*Received October 14, 2019; Revised December 27, 2019; Accepted December 30, 2019*

Copyright©2020 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

**Abstract** Supply chain finance (SCF) is dynamic approach in banks' proprietary platform and is becoming more flexible and transparent through ingenious technological solutions of effectively integrating the flows of logistics and capital into the financial service provider industry. The paper aims to utilize the TF-IDF technique in order to make greater contributions to future SCF researches and discusses different scopes of SCF and their relation to roll out SCF solutions. In efforts to demonstrate the importance role that frequency-inverse document frequency (TF-IDF) plays in retrieving information using various keywords within various document (otherwise known as text mining), this study will attempt to showcase the research findings from more than 250 academic database which focuses on supply chain finance between seller and buyer. In presenting the two leading components that impact the analysis of text mining, namely the mechanism and technological innovation of SCF. Through systematic review of the SCF is concerned with financial liquidity and the viability of SCF, this research will analyze the keyword frequencies and assess the significance of terms (or words) within this document collection separately. Finally, this report explores possible solutions for future research based on the current framework and data analysis in order to achieve capital gain, sustainability and viable replenishments.

**Keywords** Text Mining, Text Analysis, Supply Chain Finance, TF-IDF

## 1. Introduction

Text mining is an emerging field of study based on the statistical and the "natural language processing" (NLP) analytical systems where one would extract and analyze

keywords in various articles (Dias et al., 2011). In this study, we utilized the text mining field of study to handle the raw data in various articles. The applications of Supply Chain Finance (SCF) has added to the gradually growing database of systematic literature reviews which allow for the opportunities for various perspectives to address most, if not all the technical and social science challenges associated with using text mining and SCP.

SCF plays an essential part in optimizing and managing the working capital and liquidity investment within the supply chain "process and transactions" (Kwon and Kim, 2018). SCF also puts heavy emphasis on the process of generating liquidity between vendors and consumers through specific facilitating technologies (Babich & Kouvelis, 2018) such as the FnConn.com.

The purpose of the study is using TF-IDF to evaluate why these terms (or words) are so critical and valuable in document collection. Through word mining analysis, this paper aims to utilize the TF-IDF technique in order to make greater contributions to future SCF researches. Additionally, through different scopes of SCF and their relation to roll out SCF solutions, providing an integral scope, with clear requirement for supply chain collaboration and a comprehensive purpose.

## 2. Literature Review

There are two main components that will be discussed in great detail within this paper: the SCF mechanism and the implementation of innovative technologies such as blockchain in tech-driven platforms.

OECD report indicated that "small and medium enterprises (SMEs) play a significant role in the development of the economy." (OECD, 2012) Financing is one of the major obstacles for SME given the increasing number of firms using their own version of SCF platforms. Lots of researchers such as Song, et al., (2018), Randall &

Farris (2009) indicated that credit crunch, credit shortages and the high borrowing costs have created obstacles for SMEs finance to obtain risk-free credit in order to manage their net working capital.

The studies that Emery and Nayar (1998) and Long et al. (1993) created primarily concentrate on the trade credit where Fu et al. (2018) examines the robust relationship between the customers and merchant Lee et al. (2018) in effort to enhance the inter firm collaborative experiences. While both papers provide detailed explanation of the inner workings of financial flows and supply chains, they were unable to fully explore the topic of the mutual benefits that can be generated from supply chain partnership. Further research on creative financial supply chain solutions that will benefit all parties involved, such as working capital solution will be presented in this paper to review the share benefits that could stem from certain forms of supply chain partnerships.

SCF has transformed itself from a service that is being mainly delivered by banks to a more open, dynamic approach driven by banks' proprietary platform. In addition, SCF is becoming more flexible and transparent through ingenious technological solutions such as Innopay. According to Song, et al. (2018), SCF concentrates on the financial transaction process and purchase information for the purpose of effectively integrating the flows of logistics and capital into the financial service provider industry. The partnership built between financial service provider and the end users are based on a trust-based, limited-constrained relationship (Song, et al. 2018). SCF technology makes the process of dynamic discounting or reverses factoring more fluid, which in term, allows the suppliers the opportunity to optimize their working capital and leverage strong banking relationships with their end users.

### 3. Materials and Methods

#### 3.1. Collection of Raw Data

The ISI Web of Science was chosen as the data source for its large variety of versatile applications in this area of study. Once the data source has been determined, this paper will attempt to define the appropriate search terms using the "initial set of keywords and search". The following steps were used to define an initial set of keywords and search in effort to analyze the raw data.

#### 3.2. Selection of the Type of Item for the Analysis

In order to efficiently identify the "exclusion keywords", the study began by analyzing papers and research areas relevant to the current field of study so that the keyword filtering can be correctly executed as a part of the TF-IDF algorithm.

#### 3.3. Use TF-IDF Based Framework for Text Categorization

To calculate the frequency of keywords, the algorithm must begin by extracting the keywords as highlighted in the abstract then search through the entire paper using the highlighted keywords. The process of keyword filtration was implemented to ensure that key word duplications (i.e. Words with exact meanings and words that are connected by hyphens) will not occur.

TF can be described as a technique based on the frequency of word occurrences in a document- in which the TF of the term "i" in document "j" and IDF (the inverse document frequency)- of the term "i". This method of research algorithm produced successful results in the overall framework and testing process. With this successful TF-IDF can be calculated as Uguz (2011). We calculate TF-IDF weights for these queries according to following equation.

$$a_{ij}=tf_{ij}idf_{ij} = t_{ij}\log_2\left(\frac{N}{df_i}\right)$$

$a_{ij}$  is the weight of the term "i" in document "j", "N" is the number of the documents in the collection, " $tf_{ij}$ " is the term frequency of the term "i" in the document "j" and " $df_i$ " is the document frequency of the term "i" in the collection. This formula was implemented in the overall framework. During the testing process, excellent test results were produced when we used the documents with equal length.

### 4. Results and Discussion

#### 4.1. Text Analysis Based on TF-IDF of Keywords

The initial statistical reports show that more than 250 journals have made the contributions of 618 published academic research papers. During our research process, the research findings indicated that 10 journals have published 143 academic papers in correlation with the desired topic of discussion. This research finding illustrated that the articles represented approximately 23.14% of all academically published papers in related field. Table 1 shows the "Top 10 journals or sources as well as their corresponding number of academic articles. It should be evident that optimizing and further research needs to be completed in regards to using TF-IDF in efforts to optimize the SCF process with academic journals such as "INTERNATIONAL JOURNAL OF PRODUCTION ECONOMICS" taking the lead in this area of study.

The Text analysis showcased in Table 2 aims to characterize the themes of the articles in efforts to examine the relationship between internal and external factors and its impact on the keywords usage over time. In order to identify the changes in topics over time of the SCF publications, this section analyzes keywords

frequency and assesses the significance of terms or words in the document collection separately.

**Table 1.** Top 10 Journals or sources

Journals or sources	No. of papers
INTERNATIONAL JOURNAL OF PRODUCTION ECONOMICS	32
SUSTAINABILITY	19
COMPUTERS INDUSTRIAL ENGINEERING	15
EUROPEAN JOURNAL OF OPERATIONAL RESEARCH	15
INTERNATIONAL JOURNAL OF PHYSICAL DISTRIBUTION LOGISTICS MANAGEMENT	13
INTERNATIONAL JOURNAL OF PRODUCTION RESEARCH	11
M SOM MANUFACTURING SERVICE OPERATIONS MANAGEMENT	10
PRODUCTION AND OPERATIONS MANAGEMENT	10
MANAGEMENT SCIENCE	9
VACCINE	9

As shown in table 2, the most frequently used keywords utilized in SCP research thus far are “Sustainability”, “Capital-constrained”, and “Replenishment”.

**Table 2.** Frequency and TF-IDF weight of top 5 keywords

Keywords	Frequency	TF-IDF weight
Capital	210	0.0459
Sustainability	97	0.0087
Replenishment	41	0.0036
Deteriorating	35	0.0032
Collaboration	29	0.0025

#### 4.2. How Finance Technology Improve SC Ecosystem

Firstly, inter-company optimization of the financing experiences has become an essential research subject in the SCF field of study recently. SCF is also deemed to enhance the management of the invested working capital and the invested liquidity within the supply chain processes. This move towards improving the “management of working capital and liquidity” aims to improve the accessibility of funds, especially for smaller supply chain partners. The idea behind “Working capital” is built on the notion of financial liquidity and viability for all supply chain participants. In other words, SCF encourages mutual trust and cooperation between all parties involved rather than rivalry. It is also concerned with the value creation form as well as how it impacts the capital flow of the funding (Hofmann, 2005). The progress of technology has not only improved working capital flow, but it has also empowered the bank, buyer and supplier ecosystem by making sure that all parties can profit.

Secondly, one of the crucial aspects with the idea of

“sustainability” is related to the economic factors and sustainable financial development. Closs et al. (2011) builds on the framework related to economic dimensions- the internal management system and the external management system. The former puts its main focal point on the strategic transportation sourcing and the consistent improvement and transportation optimization. The latter is concerned with process of outsourcing goods and services in efforts to reduce overhead costs. As such, the mixed results generated from the correlation between the investments made sustainably and steady economical performances. SCF can also be deemed as a type of mixed strategy which focuses on the integration of the financial processes with upstream and downstream production elements in efforts to boost the financial worth of all the companies that are part of this system. (Pflhi and Gomm, 2009).

Thirdly, our paper discovered that the literature linking a retailer’s trade credit contracts and inventory financing portfolios concurs that bank replenishment (bank loan) is a viable option when the retailer’s cash level is low with the current SCF system process (Yang and Birge, 2018).

### 5. Conclusions

The systematic review of the SCF is concerned with financial liquidity and the viability of SCF to all of the supply chain participants. Then, this research will analyze the keyword frequencies and assess the significance of terms (or words) within this document collection separately.

The paper aims to demonstrate that working capital, sustainability, and replenishment gradually establish the gravity of its importance within the whole supply chain system. In order to coordinate their production line and to optimize the transportation costs, suppliers make replenishment decisions based on the data that replenishments can be granted according to the visibility of the buyers’ inventory levels or the products can be ordered by the consumers (Yao & Dresner, 2008). The most crucial aspect is the driving force that encourages buyers and sellers to augment and roll out SCF solutions as the optimal solutions of net working capital.

The findings of the current study may provide suggestions for future SCF operations in building sustainable financial growth. Text analysis that assesses enables SCF to execute the integration of financial processes, to maintain the sustainability between the buyers and sellers, and to reduce the cash conversion cycle without introducing undesirable supply risks.

### Acknowledgements

This work was supported by the National Science Council, Taipei, Taiwan, R.O.C., Project No. Grant

MOST: 107-2622-E-514-001 -CC3

---

## REFERENCES

- [1] D. J. Closs, C. Speier, N. Meacham. Sustainability to support end-to-end value chains: the role of supply chain management, *Journal of the Academy of Marketing Science*, Vol. 39, No. 1, 101-116, 2011.
- [2] E. Hofmann. Supply chain finance: some conceptual insights, *Logistic Management*, 203-214, 2005.
- [3] G. Emery, N. Nayar. Product quality and payment policy, *Review of Finance and Accounting*, Vol. 10, No. 3, 269-284, 1998.
- [4] H. H. Lee, J. Zhou, J. Wang. Trade credit financing under competition and its impact on firm performance in supply chains, *Manufacturing & Service Operations Management*, Vol. 20, No. 1, 36-52, 2018.
- [5] H. Pflhi, M. Gomm. Supply chain finance: optimizing financial flows in supply chains, *Logistics Research*, Vol. 1, No. 3-4, 149-161, 2009.
- [6] H. Song, K. Yu, Q. Lu. Financial service providers and banks' role in helping SMEs to access finance, *International Journal of Physical Distribution & Logistics Management*, Vol. 48, No. 1, 69-92, 2018.
- [7] H. Uguz. A two-stage feature selection method for text categorization by using information gain, principal component analysis and genetic algorithm, *Knowledge Based Systems*, Vol. 24, 1024-1032, 2011.
- [8] I.-W. Kwon, S.H. Kim. Humanitarian supply chain/logistics: roadmap to effective relief effort, Vol. 5, 95-109, 2018.
- [9] Innopay. B2B Fintech: Payments, supply chain finance & e-invoicing guide, 2017.
- [10] J. Fu, P. Matous, T. Yasuyuki. Trade credit in global supply chains, *RIETI Discussion Paper Series*, 18-E-049, 2018.
- [11] J. Zhan, S. Li, X. Chen. The impact of financing mechanism on supply chain sustainability and efficiency, *Journal of Cleaner Production*, Vol. 205, No. 20, 407-418, 2018.
- [12] M. Dias, C. G. Mansur, M. Myczkowski, M. Marcolin. Whole field tendencies in transracial magnetic stimulation: A systematic review with data and text mining, *Asian Journal of Psychiatry*, Vol. 4, 107-112, 2011.
- [13] M. Long, I. Malitz, A. Ravid. Trade credit, quality guarantees, and product marketability. *Financial Management*, Vol. 22, No. 4, 117-127, 1993.
- [14] OECD. Financing SMEs and Entrepreneurs: An OECD Scoreboard, OECD, Paris, 2012.
- [15] S.A. Yang, J.R. Birge. Trade Credit, Risk Sharing, and Inventory Financing Portfolios, *Management Science*, Vol. 64, No. 8, 3667-3689, 2018.
- [16] V. Babich, P. Kouvelis. Introduction to the special issue on research at the interface of finance, operations, and risk management (iFORM): Recent contributions and future directions". *Manufacturing & Service Operations Management*, Vol. 20, No. 1, 1-160, 2018
- [17] W. Randall, M. Farris. Supply chain financing: Using cash-to-cash variables to strengthen the supply chain, *International Journal of Physical Distribution & Logistics Management*, Vol. 39, No. 8, 669-689, 2009.
- [18] Y. Yao, M. Dresner. The inventory value of information sharing, continuous replenishment, and vendor-managed inventory, *Transportation Research Part E*, Vol. 44, No.3, 361-378, 2008.