# Barrier analysis of supply chain finance adoption in manufacturing companies

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## Abstract

**Purpose** – Companies all over the world have recently started to adopt supply chain finance (SCF) solutions in their supply chains to reduce the payment defaults and simplify the bill settlement process. The purpose of this paper is to identify and prioritize the barriers to adopting SCF in micro, small and medium enterprises.
**Design/methodology/approach** – It employs a three-phase methodology to identify and prioritize the essential barriers to the implementation of SCF. An extensive survey has been carried out in 101 Indian MSMEs in India which identified 37 barriers under six heads in the first phase. Experts' interview using the Delphi technique has been carried out in the second phase to finalize the barriers. The analytic hierarchy process methodology, with sensitivity analysis for validation, is used in the final stage to prioritize and rank the barriers.
**Findings** – Results show that financial and information technology barriers are prominent in SCF adoption followed by financial challenges. Among specific barriers, the disclosure of sensitive company information to competitor barrier acts as an essential barrier followed by poor technological capability of MSMEs.
**Research limitations/implications** – The study is limited to SCF adoption of MSMEs in a developing nation. Extensive research is required in order to derive a global trend.
**Practical implications** – The current research contributes to the stakeholder theory and transaction cost economics. Observations made in the current research can encourage organizations to incorporate stakeholders' concerns into the adoption of SCF solutions. The study provides a more in-depth view of such challenges and a benchmark, which will help companies to adopt SCF solutions more effortlessly. Moreover, policy makers across the world can explore these serious issues and amend or introduce new policies to facilitate companies' implementation of supply chain financial solutions.
**Originality/value** – To the best of the authors' knowledge, this is the first study which identified and prioritized SCF adoption barriers of MSMEs in a developing nation. This study is also novel in adopting a hybrid analytical hierarchy process-sensitivity analysis for ranking the SCF barriers in an MSME context. SCF studies often emphasize only on the reverse factoring aspect of SCF. The current study considers many innovative aspects of SCF, such as pre-shipment financing, dynamic discounting, inventory financing, collaborative logistics, etc.
**Keywords** Benchmarking, AHP, Supply chain management, Barrier analysis, Micro, small and medium enterprises, Supply chain finance
**Paper type** Research paper

## Introduction

Globalization, coupled with competitive pressure, has resulted in complex and dynamic supply chains across the world (Jüttner *et al.*, 2003; Xu *et al.*, 2003; Manuj and Mentzer, 2008; Creazza *et al.*, 2010). This has caused companies to be more concerned about the coordination and collaboration of their stakeholders for optimizing supply chain operations (Mentzer *et al.*, 2001). Though companies and academics have focused on the flow of goods and information, the financial aspect of supply chains has often been neglected (Pfohl and Gomm, 2009; More and Basu, 2013). Inconsistent financial flows and irregularities in working capital have paved the way for a new area of research, namely, "supply chain finance (SCF)."

SCF is an approach for two or more organizations in a supply chain, including external service providers, to jointly create value through the means of planning, steering and controlling the flow of financial resources on an inter-organizational level (Hofmann, 2005). It is an automated solution through which the buyer firm provides immediate settlement to the suppliers through an intermediary such as a bank with interest (Demica, 2007;

Shang *et al.*, 2009; Jongejans *et al.*, 2014). SCF considers the credibility of the buyer and not the seller (Aberdeen Group, 2007; Jongejans *et al.*, 2014). The factor in this system only needs to calculate the credit risk for the buyer. This helps creditors in developing nations to make use of non-recourse-based factoring, which reduces the risks involved in financing suppliers with a high-risk profile. This provides immense benefits to small suppliers, such as MSMEs, because there is no requirement for comprehensive credit information on all the seller's customers, which is usually costly and difficult for small suppliers to calculate. The scope of SCF is wider than reverse factoring, and it includes pre-shipment financing, such as raw material financing and vendor-managed inventory financing as well as post-shipment financing, such as bills receivable financing. SCF solutions can be classified broadly into two categories: finance-based solutions and supply chain-based solutions. However, there is a dearth of studies on the financial aspect of SCF solutions (Caniato *et al.*, 2016). Many academics believe that SCF will reduce the requirement for working capital, even though there is a lack of evidence to support this in the literature (Pfohl and Gomm, 2009; Seifert and Seifert, 2009; More and Basu, 2013; Wuttke *et al.*, 2013). Countries like the Netherlands have launched an SCF community program with the aim of making the country the logistic center of the world by 2020 (Jongejans *et al.*, 2014). By following the international trend, India has also introduced the country's first "Trade Receivables Discounting System" (TReDS), which is named the "Receivables Exchange of India" (RXIL), in January 2017. TReDS in India is an online electronic institutional mechanism which facilitates the financing of MSME sellers' bills against large corporates and public sector undertakings through an auction mechanism. The banks or non-banking financial companies acting as the intermediaries in the program can make bids against the bills getting registered in the platform. If the MSME units accept the bid, the intermediary will allocate the funds. Factoring is done without recourse to sellers. This helps MSMEs to realize their trade bills at a competitive market rate in a short span of time and thereby funding working capital requirements. TReDS also ensures that MSME bills are settled within 45 days of acceptance of goods or services rendered as stated in the Indian MSME Act (2006).

Identifying the challenges that implementing SCF schemes entails will help managers and governments to facilitate their implementation in a hassle-free manner. Studies such as Liebl *et al.* (2016) and More and Basu (2013) have given great emphasis on analyzing various challenges involved in SCF adoption. Liebl *et al.* (2016) found that taxes and regulations as the greatest challenges in SCF adoption. The study also sheds light on the challenges posed by country specific characteristics since SCF can involve international parties. The paper primarily analyzed challenges on international buyers and sellers based in the USA or Germany.

To the best of our knowledge, this is the first study to identify and prioritize SCF adoption barriers of MSMEs in an emerging country. The current study addresses the first research question by carrying out an extensive sample survey on Indian MSMEs. A hybrid methodology consists of analytical hierarchy process (AHP) and sensitivity analysis has been done to rank the identified SCF adoption challenges to investigate the second research question. The current study makes additional novel contributions on the work of More and Basu (2013), in which the authors explored 37 challenges faced by Indian companies in SCF adoption and developed a hierarchical model to analyze the relationship among them using the ISM-MIMBI methodology. A lack of common vision among partners found to be the most critical barrier confronting SCF adoption. However, the study has emphasized on the reverse factoring aspect of SCF. SCF offers many innovative aspects such as pre-shipment financing, dynamic discounting, inventory financing, collaborative logistics, etc. (Berger Allen and Udell, 2006; Wuttke *et al.*, 2013), which the current study takes into account. Moreover studies on SCF seldom considered the challenges faced by MSMEs in SCF adoption (Sahoo and Behera, 2018; Song *et al.*, 2018. The study by More and Basu (2013) is only based on 80 responses, which could pose a serious problem in generalizing the findings.

MSMEs contribute around 6.11 percent of the manufacturing GDP and 24.63 percent of the GDP from service activities as well as 33.4 percent of India's manufacturing output with a network of 36.1m units across the country. MSMEs provide employment to around 120m persons and contribute around 45 percent of the overall exports from India (CII, 2018). Moreover, it is evident from the literature that studies on SCF are often confined to developed countries such as the USA, Italy, Switzerland and Germany (e.g. Wuttke *et al.*, 2013; Caniato *et al.*, 2016) and less on developing countries such as India and China (e.g. More and Basu, 2013; Song *et al.*, 2018). Therefore, the current study is also novel in considering a developing economy. To the best of our knowledge, this is the first study which analyzes the SCF adoption challenges faced by Indian MSMEs after Reserve Bank of India has launched TReDS platform in January 2017 which was expected to pave the way for faster settlements of MSME bills. Therefore, other countries could also implement such schemes by focusing more on specific challenges which still requires more attention as per this study outcomes.

The current study is guided by the following two important research questions:

*RQ1.* Do MSMEs face challenges in SCF adoption?

*RQ2.* What are the major challenges faced by MSMEs in SCF adoption?

## Literature review

Financial challenges are one of the critical concerns of supply chains (Croom *et al.*, 2000; Mentzer *et al.*, 2001). Despite these challenges, the research community has only just begun to analyze empirically the significance of the financial flows in firms' profitability (Raghavan and Mishra, 2011; Liu and Cruz, 2012). A recent literature review paper by Gelsomino *et al.* (2016) analyzed 119 research papers on SCF domain and found two major SCF approaches, namely, the finance oriented and supply chain oriented, which are the short-term services offered by financial institutions, and an internal affair focused on working capital optimization, respectively. Song *et al.* (2018) compared SCF solutions provided by financial service providers and commercial banks to MSMEs using in-depth case studies. They found that SCF solutions offered by financial service providers are better in minimizing information asymmetry. Lekkakos and Serrano (2016) investigated the impact of reverse factoring on MSMEs through a multi-stage dynamic problem. The study found that reverse factoring helps to unlock more than 10 percent of the supplier's working capital, which leads to high operational performance. Liebl *et al.* (2016) has also found that reverse factoring provides win-win situation to supply chain partners. Wuttke *et al.* (2013) laid the theoretical foundation for financial supply chain management (FSCM) through 8 case studies and 40 interviews. The research categorized FSCM into pre-shipment FSCM (before invoice release) and post-shipment FSCM (after invoice release). The study concluded that pre-shipment FSCM helps to improve the upstream working capital, whereas post-shipment FSCM strengthens the working capital position of the buyer. Bank credit is one of the major sources of SCF for companies across the world. Jing and Seidmann (2014) examined the merits of bank and trade credit in supply chains. The study found that trade credit is better in mitigating double marginalization when the production costs are relatively low compared to bank credit. There are many financial consequences of taking bank credit; hence, SCF could be the future of supply chain financing. Sahay and Mohan (2003) carried out an extensive study on the supply chain practices followed by Indian industries. The study was based on a joint survey covering 156 organizations. The findings of the study proposed that the supply chain strategies and business strategies in Indian firms should be aligned and form partnerships to reduce inventory levels and enhance infrastructure. Tripathy *et al.* (2016) identified and established a causal relationship among the success factors of supply chains in Indian MSMEs using structural equation modeling (SEM) based on the responses of 105 managers. The authors found that information technology holds the

key position in achieving a competitive advantage in Indian MSMEs, followed by customer information. The study completely neglected the financial aspects of supply chains. Berger Allen and Udell (2006) developed a conceptual framework for analyzing the issues related to SME credit availability in the USA. The study concluded by stating that the financial institution structure and the lending infrastructure in a country is affected by government policies. At the bottom of the chain is the technological aspect of finance. The study further indicated that the presence of foreign financial institutions compared with state-owned financial institutions is likely to cause higher SME credit availability in developing nations. State-owned institutions were criticized, the study pointing out that they appear to be unsupportive of SMEs in developing nations. Caniato *et al.* (2016) provided a reference framework for the motivations to implement SCF solutions by analyzing 14 cases of Italian companies and concluded that SCF application has to consider other non-financial variables, such as partner relationships, digitalization collaboration, during its implementation. The study suggested that future research needs to focus on IT-enabled SCF platforms, which have not been addressed so far.

Based on a further extensive literature review of SCF aspects, various barriers to its adoption have been explored and are discussed below under six headings.

*Finance-related barriers*
The ultimate goal of SCF is to consider financial flows along with information and goods flows in the chain to improve cash flows (Wuttke *et al.*, 2013). Thus, the challenges that confront the smooth flow of funds in the supply chain can be classified as finance-related barriers affecting SCF implementation. Along with these issues, the difficulty in sourcing funds from financial institutions (Yang and Li, 2010; Qianlei, 2012; Mangla *et al.*, 2015), volatile inflation and currency exchange rates (Peck, 2005; Yang and Li, 2010) and unbalanced working capital positions of the parties (Wuttke *et al.*, 2013) are other financial challenges.

*Human resource-related barriers*
Human resource management is critical for organizational growth and prosperity as well as for retaining a competitive advantage in the market (Schuler and MacMillan, 1984). The SCF approach helps to improve trust, profitability and commitment in the supply chain (Randall and Theodore Farris, 2009). The trust and commitment of SC partners are purely human behavior-related elements of the organization. The other major HR issues that challenge SCF adoption are the scarcity of skilled labor (Yang and Li, 2010), poor common vision of partners (More and Basu, 2013), employee chaos (Barton, 1993; Kovoor-Misra, 1995; Caponigro, 1998), perception of the management (Jongejans *et al.*, 2014) and quality of external relationships (Christopher and Ryals, 1999; Christopher and Lee, 2004).

*Firm coordination-related barriers*
The benefits of SCF implementation depend on cooperation and coordination among SC partners, which open doors to credit opportunities at lower costs (Gelsomino *et al.*, 2016). They also help to improve visibility in the chain (Hofmann and Belin, 2011; Lamoureux and Evans, 2011), which assists firms in improving their financial performance (Cao and Zhang, 2011). The other main coordination-related challenges are a lack of shared objectives and poor communication between partners (More and Basu, 2013).

*Organizational policy-related barriers*
A policy is a course of action or guidelines that an organization must follow to achieve its goals. Organizational policies with respect to supply chain activities can have various effects on the organization, because the SCM activities must align with the overall business strategy

for better performance (Presutti and Mawhinney, 2007). The other organizational policy-related challenges are unnecessary interventions by managers in policy implementation (Jüttner *et al.*, 2003) and complexity in policy implementation (experts' opinion).

### Information technology-related barriers

According to the transaction cost economics (TCE) theory, IT in supply chain management is used for improving collaboration and visibility by reducing coordination costs. According to the resource-based view theory, an increase in IT investments does not guarantee improvements in performance. The crucial IT-related barriers to SCF implementation are computer breakdowns (Barton, 1993), inadequate technological systems offered by third parties for automation (Aberdeen Group, 2007), the poor technological capability of MSMEs, a lack of skilled labor to operate technology and the cost of implementation (experts).

### Macro institutional barriers

Factors that are normally beyond the control of business organizations are the cultural setting, regulatory changes, geographical location of partners (Peck, 2005) and overall complexity involved in SCF adoption due to the regulatory framework (Wuttke *et al.*, 2013). The policies and regulatory framework of different countries can also pose challenges to the adoption of SCF in an internationally operating supply chain (More and Basu, 2013). Along with these factors, inadequate government support coupled with poor regulations could create challenges for SCF adoption (experts' opinion).

### Theoretical underpinnings

We perform this research on SCF based on the theoretical pillars of finance and supply chain management. Our observations about SCF are dependent on two widely recognized theories: stakeholder theory (ST) (Mitchell *et al.*, 1997; Sarkis, 2001) and TCE theory. ST emphasizes the rationale behind organizations' actions, which are normally above and beyond the maximization of their shareholders' wealth. SCF requires the coordination and cooperation of many SC partners, which help to simplify the financial settlements and reduce the defaults in the payments (Demica, 2007; Shang *et al.*, 2009; Jongejans *et al.*, 2014). This relationship can encourage organizations to incorporate the concerns of the stakeholders into the adoption of SCF solutions. However, TCE defines it as "all costs necessary to run a relationship" (Carr and Pearson, 1999). Concepts such as opportunism and bounded rationality provide insights into the understanding of SCF adoption. Moreover, financial innovations in supply chain operations could reduce transaction costs (Wuttke *et al.*, 2013).

### Research gaps and highlights

Past studies on SCF adoption have employed traditional methodologies, such as the ISM methodology, a theoretical approach or case study analysis (Sahay and Mohan, 2003; Berger Allen and Udell (2006); Klapper, 2005; Saad and Patel, 2006; Lamoureux and Evans, 2011; Thakkar *et al.*, 2012; More and Basu, 2013; Wuttke *et al.*, 2013). However, the increase in problems makes tools like ISM more complex, limiting the number of variables used in ISM model development (Govindan *et al.*, 2014). Further, ISM does not quantify the influence of each factor on the main barrier. This is clearly evident from the study of More and Basu (2013) since the study could only consider nine variables in developing the interrelationships. But in the current study, we consider a total of 37 SCF adoption barriers for the prioritization.

Studies such as Liebl *et al.* (2016) and More and Basu (2013) have given great emphasis on analyzing various challenges involved in SCF adoption. However, both these studies did not focus on MSME sector which is prominent in emerging nations. Moreover, it is evident

from the literature that studies on SCF are often confined to developed countries such as the USA, Italy, Switzerland and Germany (e.g. Wuttke *et al.*, 2013; Liebl *et al.*, 2016; Caniato *et al.*, 2016) and less on developing countries such as India and China (e.g. More and Basu, 2013; Song *et al.*, 2018). We also feel that the challenges identified by More and Basu (2013) might change since Reserve Bank of India has launched TReDS platform to pave the way for faster settlements of MSME bills in January 2017 and the consideration of MSME units in the current study.

A literature gap has been found in the identification of important barriers to SCF adoption with respect to MSME sector. Moreover, to the best of our knowledge none of the studies has prioritized SCF adoption challenges which would have been helpful for supply chain managers in planning and avoiding them during SCF adoption. This research paper bridges these research gaps with a three-phased research approach:

(1) identification of common SCF adoption barriers in MSME sector through a literature review and the survey method; and

(2) prioritization and ranking of the essential barriers using the AHP method with validation through sensitivity analysis.

To achieve the above-stated objectives, the AHP methodology was employed, followed by a sensitivity analysis to validate the results.

**Solution methodology**
A detailed questionnaire was framed after preparing the literature review and consulting experts. This questionnaire was circulated among various companies in the manufacturing industry. From the scrutiny of the collected questionnaires, common barriers to SCF implementation were finalized. The AHP technique was employed for understanding the essential key barriers.

*Overview of the AHP*
The AHP is a multiple-criteria decision-making technique, which is widely used in business industries. The AHP employs a well-defined mathematical structure with consistent matrices that associate the right eigenvector's capability of producing true or approximate weights (Saaty, 1980). The AHP delineates the scope for the problem environment with a set of axioms and compares the criteria or alternatives with respect to the criteria in a natural and pairwise mode (Saaty, 1980). The AHP framework is depicted in Figure 1.

*Application of the proposed model*
*Questionnaire development and data collection.* A questionnaire was developed for the two-phase data collection. Phase 1 of the data collection was intended to explore the common SCF adoption barriers in MSMEs, and Phase 2 aimed to identify the key barriers with the help of experts. A nine-point scale was employed to collect the response of the experts, as shown in Table I. The questionnaire was sent to 348 MSME units in India. A total of 178 participants responded to it. The pairwise comparisons were conducted for specific barriers in Phase 1 followed by the category-level barriers in Phase 2.

Phase 1: Identification of the main barriers. The respondents were requested to mark (yes/no) the important SCF adoption barriers from a list of 43 common barriers finalized with the help of subject experts. The mailed questionnaire and interview methods were used to collect the data. Of 178 respondents, 52 questionnaires were incomplete and 25 were returned empty, which resulted in an overall response rate of 29 percent (101 responses). A response rate of 20 percent is the minimum requirement for the positive assessment of the data (Malhotra and Grover, 1998). For details of the respondents, see Tables II–IV.
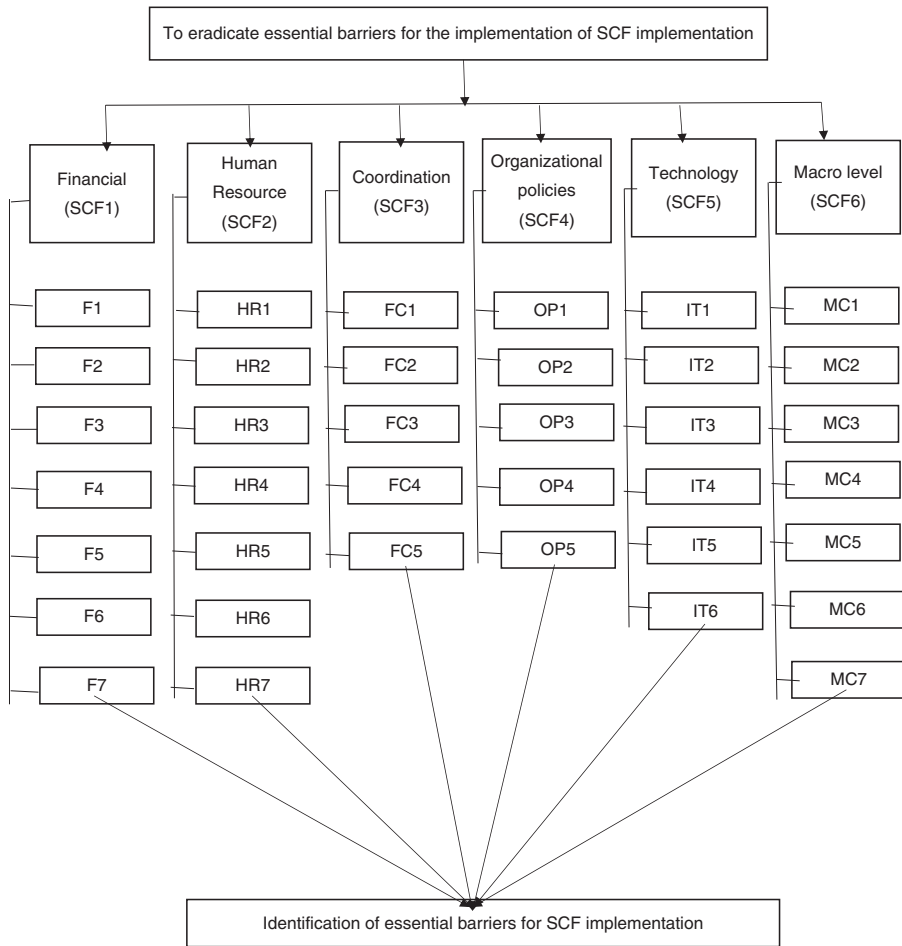
**Figure 1.**
AHP framework for
the identification and
ranking of the barriers
to SCF
implementation

| Preference weights/level of importance | Definition | Explanation |
|---|---|---|
| 1 | Equally preferred | Equal contribution by two activities to the objective |
| 3 | Moderately | Judgment slightly favor one activity over other |
| 5 | Strongly | Judgment strongly or essentially favor one activity over other |
| 7 | Very strongly | An activity is strongly forced over another |
| 9 | Extremely | One activity favor over another at its highest degree possible for affirmation |
| 2,4,6,8 | Intermediate values | Represents a compromise between preferences |
| Reciprocals | Reciprocals for inverse comparison | |

**Source:** Saaty (1980)

**Table I.**
Scale of preference
between two elements

www.

Phase 2: Identification of the sub-barriers. The AHP was applied to prioritize the key barriers to SCF implementation in Phase 2 of the research. Phase 1 identified 37 (Table V) common barriers out of 43 initial barriers to SCF implementation. The hierarchy decision process levels in the AHP are shown in Figure 2. The four levels of the hierarchy process are as follows:

- Level 1: the objective/goal;
- Level 2: the main barrier category;
- Level 3: the specific barrier category; and
- Level 4: prioritization of essential barriers.

Expert consensus was derived to frame the initial reachability matrix for the AHP. We sought the assistance of eight experts for finalizing the barriers in SCF adoption and to frame the pairwise comparison matrix. Two experts are supply chain managers in an Indian MSME unit, three academicians specialised in the area of operations and supply chain management, three chartered accountants. Experts had an average experience of 5.3 years

| Relevant dimension | Profile |
|---|---|
| Job positions of the respondents | 16% senior-level |
| | 63% middle-level |
| | 21% lower level |
| Qualification of respondents | 32% postgraduate |
| | 42% undergraduate |
| | 26% diploma |
| Experience of respondents (years) | 16% > 11 |
| | 31% > between 5 and 10 |
| | 53% < 5 |

**Table II.**
Summary of
respondents

| Industry | Total | Percentage |
|---|---|---|
| Textiles | 16 | 16 |
| Auto component | 17 | 17 |
| Electrical/electronics | 18 | 18 |
| Paper | 10 | 10 |
| Food | 12 | 11 |
| Plastic | 8 | 8 |
| Iron and steel | 5 | 5 |
| Industrial and commercial machinery | 8 | 8 |
| Cement | 7 | 7 |
| Total | 101 | 100 |

**Table III.**
Profile of the
responding companies

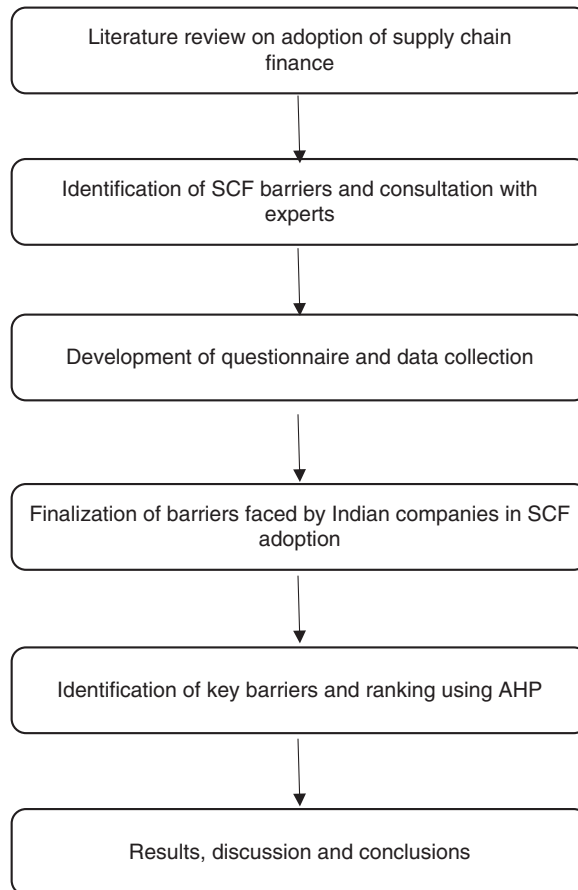| Size | Total | Percentage |
|---|---|---|
| > 3,000 (Enterprises) | 7 | 7 |
| 2,001–3,000 (Large) | 14 | 14 |
| 701–2,000 (Medium) | 32 | 32 |
| 501–700 (Small) | 48 | 47 |
| Total | 101 | 100 |

**Table IV.**
Size (employees)

Figure 2.
Flow chart of
the research

in their respective area. The pairwise comparison matrix developed for the category of main barriers is depicted in Tables VI and VII, and the detailed AHP weights for the barrier categories are shown in Table VIII.

## Results and discussion
### Barrier category
Table VIII shows that the financial barrier category occupies the first rank, followed by the technology barrier category. This is a contradiction to the findings of More and Basu (2013), because their study found lack of common vision among supply chain partners as the most important SCF adoption challenge which is a human resource-related challenge. This could be possibly due to the critical financial challenges faced by MSMEs around the world as evident from the literature (Sahoo and Behera, 2018). Maiti (2018) also stated that there exists a gap between demand and access to the MSME finance in India. In developing countries, 200m businesses go without much needed credit (International Finance Corporation, 2018). The barriers related to the organizational policy rank third. Gaudenzi and Borghesi (2006) stated that, irrespective of the internal philosophy of the organization, partners should share a common vision with respect to the final market. The human

| Barriers | Description | Sources |
|---|---|---|
| *Financial (SCF1)* | | |
| Higher discounting rates (F1) | Exorbitant reverse factoring rates quoted by financial institutions | Our contribution |
| Increase in payment terms (F2) | Transparency in SCF makes payment terms stringent. This leads the inability to extend days payable outstanding with suppliers | Coulibaly *et al.* (2013), Garcia-Appendini and Montoriol-Garriga (2013), Conroy (2009) |
| Inflation and currency exchange rates (F3) | Inflation and currency exchange rates: inflation and variations in currency exchange rates would affect the financial concerns, and thus, supply chain effectiveness might be affected | Yang and Li (2010) |
| Higher credit rating requirements by 3rd parties (F4) | The role of credit rating in bill discounting by 3rd parties | Jongejans *et al.* (2014), Klapper (2005) |
| Lack of financing from financial institutions (F5) | Financial institutions are often carrying the burden of settlement. Low credit rating of firms, defaults, other associated risks makes financial institutions to be vigilant with SCF | Palia and Sopranzetti (2004), Tanrisever *et al.* (2012) |
| Disclosure of sensitive company information to competitors (F6) | Disclosure of sensitive company information such as suppliers' details and financial bills while dealing on a platform like TReDS leads to competitors getting access to sensitive company data. Companies worry that this could impact on their financial performance | Our contribution |
| Unbalanced working capital positions of the buyer (F7) | Excess or over working capital position indicates poorly managed inventories, payment terms and delays | Hofmann and Kotzab (2010) |
| *HR challenges (SCF2)* | | |
| Lack of trust among SC partners (HR1) | Lack of trust among SC partners can hinder policy implementation in organizations | Kwon and Suh (2004), Handfield and Bechtel (2002) |
| Lack of commitment of the team (HR2) | Poor commitment of the team can delay new reforms in the organizations | Fawcett *et al.* (2006), Mentzer *et al.* (2001) |
| Scarcity of skilled labor (HR3) | To operate and manage IT based solutions and programs, skillful employees are required | Yang and Li (2010) |
| Poor relationships with upstream and downstream partners (HR4) | Poor relationships can lead to difference of opinion and chaos | Christopher and Ryals (1999) |
| Lack of common vision among SC partners (HR5) | Lack of common vision toward the implementation of SCF among SC partners | More and Basu (2013) |
| Employees' chaos (HR6) | Violence, strikes, politics, etc. in the organization might lead to delayed payments and defaults. Due to this management of such organizations might fear the implementation of a transparent and time bound system like SCF | Caponigro (1998), Kovoor-Misra (1995), Barton (1993) |
| Perception of the management (HR7) | Management perceives that SCF implementation is a hassle to incorporate it in company | Jongejans *et al.* (2014) |
| *Firm Coordination (SCF 3)* | | |
| Lack of cooperation among partners (FC1) | Lack of cooperation in calibrating networks for SCF implantation | Kelle and Akbulut (2005) |
| Lack of collaboration from other parties (FC2) | SCF requires the participation of 3rd parties such as banks, non-banking financial | Hofmann and Belin (2011), Lamoureux and Evans (2011), Cao and Zhang (2011) |

**Table V.**
Description of SCF adoption barriers

(*continued*)

| Barriers | Description | Sources |
|---|---|---|
| Lack of shared objective among partners (FC3) | institutions, governmental agencies, etc. Lack of such collaborations can pose a challenge Objectives of SCF implementation such as easy and high speed settlements, transparency etc. should be common among partners, else they might be reluctant in its implementation | More and Basu (2013) |
| Poor communication between partners (FC4) | Poor communication system between partners can lead to complexity misunderstanding in adoption | More and Basu (2013) |
| Lack of common interest (FC5) | Lack of common interest of SC partners in SCF implementation | Viswanathan and Piplani (2001), Power (2005) |
| *Organizational policies (SCF4)* | | |
| Mismatch between supply chain strategies and business strategies (OP1) | Supply chain strategies should be strategically aligned with overall business strategy to achieve desirable financial performance | Presutti and Mawhinney (2007) |
| Poor inter-organizational networks (OP2) | SCF makes payments and bill transactions through e-platforms. Poor inter-organizational networks can pose a serious challenge in its adoption | Hall and Braithwaite (2008), Gulati and Gargiulo (1999) |
| Unnecessary interventions by managers in the SCF activities (OP3) | Poorly assigned roles of managers in SCF activities can lead to over interventions, then to conflicts | Jüttner *et al.* (2003) |
| Complexity in the management of SCF activities (OP4) | SCF implantation requires plenty of work to be done in calibrating partner systems and collaborating with financial institutions. This complexity leads to reluctance in SCF adoption | Jüttner *et al.* (2003) |
| Management decision to not adopt Trade Receivable e-Discounting System (TReDS) (OP5) | TReDS platform is the only convenient and government regulated exchange for MSME Bill discounting in India by companies and public sector undertakings. Management decision to abstain from it can make SCF adoption hectic | Our contribution |
| *Information Technology (SCF5)* | | |
| Lack of automation in the payment process (IT1) | Lack of automation in payment process by SC partners | Aberdeen Group (2007) |
| Computer breakdowns (IT2) | Continuous computer and system breakdowns can disrupt payment system | Barton, L. (1993) |
| Unavailability of E-platforms from 3rd parties (IT3) | Unavailability of e-platforms from 3rd parties such as Banks, NBFCs, etc. | Wuttke *et al.* (2013), Aberdeen Group (2007) |
| Cost associated with implementing new technology (IT4) | Implementation of SCF requires IT capability which leads to huge implantation costs | Barton (1993), Mitra and Chaya (1996) |
| Lack of skilled labor to operate technology (IT5) | MSMEs often lack skilled labor to operate technology | Kiley (1999), Haskel and Heden (1999) |
| Poor technological capability of MSMEs (IT6) | One of the fundamental obstacles MSMEs face in innovation is the poor technological capability | Gupta and Barua (2016) |
| *Macro institutional challenges (SCF6)* | | |
| Geographical location of the partners (MC1) | SC partners are often scattered across the country. Availability of financial institutions and technological capability of companies in rural areas can be a serious challenge in SCF adoption | Peck (2005) |

**Table V.**

(*continued*)

| Barriers | Description | Sources |
|---|---|---|
| Cultural settings (MC2) | Cultural settings of companies operate in different parts of the world may not favor innovations such as SCF | Peck (2005) |
| Regulatory changes (MC3) | Continuous regulatory changes by the governmental departments can make SCF activities unfavorable | Peck (2005) |
| Complexity in adoption (MC4) | Complexity due to regulatory policies, stringent rules and other external factors | Wuttke *et al.* (2013) |
| Internationally operating supply chain (MC5) | Legal and political differences might effect SCF adoption in international supply chains | Wagner and Neshat (2012), Christopher and Lee (2004) |
| Poor government policies (MC6) | Poor governmental policies on bill discounting activities | Our contribution |
| Lack of government support (MC7) | Lack of government support in regulating and controlling SCF related activities at nation level | Our contribution |

Table V.

| | SCF 1 | SCF 2 | SCF 3 | SCF 4 | SCF 5 | SCF 6 |
|---|---|---|---|---|---|---|
| SCF 1 | 1 | 8 | 8 | 2 | 2 | 9 |
| SCF 2 | 0.125 | 1 | 2 | 0.333333 | 0.111111 | 3 |
| SCF 3 | 0.125 | 0.5 | 1 | 0.25 | 0.111111 | 2 |
| SCF 4 | 0.5 | 3 | 4 | 1 | 0.5 | 7 |
| SCF 5 | 0.5 | 9 | 9 | 2 | 1 | 8 |
| SCF 6 | 0.111111 | 0.333333 | 0.5 | 0.142857 | 0.125 | 1 |

**Notes:** Vector: 0.386777, 0.05855, 0.040525, 0.169829, 0.316227, 0.028092; Principal eigenvalue = 6.216; Consistency ratio (CR) = 3.5%

Table VI.
Pairwise comparison matrix for barrier category

| Category | Code | Priority (%) | Rank |
|---|---|---|---|
| 1 | SCF 1 | 38.70 | 1 |
| 2 | SCF 2 | 5.90 | 4 |
| 3 | SCF 3 | 4.10 | 5 |
| 4 | SCF 4 | 17.00 | 3 |
| 5 | SCF 5 | 31.60 | 2 |
| 6 | SCF 6 | 2.80 | 6 |

Table VII.
AHP weights for main category

resource management barrier and firm coordination barrier categories rank fifth and sixth, respectively. The human-related aspects and coordination aspects follow the implementation of a new policy; hence, the findings confirm that financial and technological barriers are the primary SCF adoption barriers.

*Ranking of the SCF implementation barriers*
Specific barriers were also ranked using the global weights from the AHP analysis, as shown in Table VIII. The global weights were calculated by multiplying the relative weight of the barrier category values with the relative weights of each specific barrier. The results of the barrier categories can be explained as follows.

*Financial.* Financial aspects in supply chains are of critical importance (Wagner *et al.*, 2009; Boissay and Gropp, 2007; Mentzer *et al.*, 2001; Hofmann, 2005; Basu and Nair, 2008; Steeman, 2014). The results of the current study demonstrated the first and foremost role of

| Barrier category | Relative weights using AHP | Barriers | Relative weights using AHP | Global weights using AHP | Rank |
|---|---|---|---|---|---|
| SCF1 | 0.386777 | F1 | 0.04713 | 0.018229 | 13 |
| | | F2 | 0.256391 | 0.099166 | 3 |
| | | F3 | 0.029955 | 0.011586 | 20 |
| | | F4 | 0.133856 | 0.051772 | 6 |
| | | F5 | 0.088237 | 0.034128 | 10 |
| | | F6 | 0.424698 | 0.164263 | 1 |
| | | F7 | 0.019732 | 0.007632 | 24 |
| SCF2 | 0.05855 | HR1 | 0.236798 | 0.013865 | 17 |
| | | HR2 | 0.06401 | 0.003748 | 30 |
| | | HR3 | 0.074536 | 0.004364 | 28 |
| | | HR4 | 0.106268 | 0.006222 | 26 |
| | | HR5 | 0.179982 | 0.010538 | 22 |
| | | HR6 | 0.027792 | 0.001627 | 36 |
| | | HR7 | 0.310614 | 0.018186 | 14 |
| SCF 3 | 0.040525 | FC1 | 0.170025 | 0.00689 | 25 |
| | | FC2 | 0.260503 | 0.010557 | 21 |
| | | FC3 | 0.442081 | 0.017915 | 15 |
| | | FC4 | 0.070916 | 0.002874 | 31 |
| | | FC5 | 0.056475 | 0.002289 | 32 |
| SCF4 | 0.169829 | OP1 | 0.311198 | 0.05285 | 5 |
| | | OP2 | 0.146034 | 0.024801 | 11 |
| | | OP3 | 0.203107 | 0.034493 | 9 |
| | | OP4 | 0.048969 | 0.008316 | 23 |
| | | OP5 | 0.290693 | 0.049368 | 8 |
| SCF5 | 0.316227 | IT1 | 0.192977 | 0.061025 | 4 |
| | | IT2 | 0.157352 | 0.049759 | 7 |
| | | IT3 | 0.05507 | 0.017415 | 16 |
| | | IT4 | 0.06906 | 0.021839 | 12 |
| | | IT5 | 0.041167 | 0.013018 | 18 |
| | | IT6 | 0.484373 | 0.153172 | 2 |
| SCF6 | 0.028092 | MC1 | 0.173105 | 0.004863 | 27 |
| | | MC2 | 0.143662 | 0.004036 | 29 |
| | | MC3 | 0.072059 | 0.002024 | 34 |
| | | MC4 | 0.080381 | 0.002258 | 33 |
| | | MC5 | 0.420771 | 0.01182 | 19 |
| | | MC6 | 0.045638 | 0.001282 | 37 |
| | | MC7 | 0.064385 | 0.001809 | 35 |

Table VIII.
Global and local
weights of all barriers

addressing financial-related challenges for the SCF implementation. In the financial barrier category as well as in the global ranking, the disclosure of sensitive company information to competitors (F6) ranks first. In India's TReDS, named "Receivables Exchange of India" (RXIL), companies are supposed to disclose the details of their suppliers and details of the necessary documents to register for bill discounting. Without availing the facility of TReDS, companies need to expose their strategic suppliers' details with third parties, i.e. banking and non-banking financial companies. Companies fear that competitors may take advantage of it by accessing the details of their strategic suppliers and purchase bills. Increase in Payment Terms (F2) is next to the F6 barrier. Companies normally want to enjoy suppliers' credit for a longer period, but SCF solutions through a transparent electronic platform such as TReDS increase the payment terms with the suppliers. Micro, Small and Medium Enterprises Development Act (MSME, 2006) makes it mandatory to settle the dues of MSME suppliers before 45 days from the day of procurement of materials. Higher credit rating requirements by third parties (F2) holds the third rank. The significance of companies'

credit rating in availing the factoring and reverse factoring services from third parties has been well documented in the literature (Michalski, 2008; Summers and Wilson, 2000; Ayadi, 2008). Further, in TReDS platform, credit rating of the companies determines the probability of accepting the bills at a reasonable rate by the financial institutions. This makes companies reluctant to accept all the formalities and fees involved in supply chain financial solutions. The lack of financing from financial institutions (F5) holds fourth rank in the category. This can be considered as the extension of the credit rating requirement. Owing to higher default risks and poor credit rating of companies, financial institutions often abstain from offering reverse factoring services. Higher discounting rates (F1) offered by the financial institutions while accepting the bills holds fifth rank in the category, which is another reason for companies to opt for direct settlement in the future. Inflation and currency exchange rates issues (F3) hold sixth rank, which confirms the findings of Yang and Li (2010) about the importance of changes in country's inflation and exchange rates on supply chain financial operations. Low priority is assigned to unbalanced working capital positions of the buyer (F7) compared to other barriers in the financial category.

*Technology*. MSMEs usually lack technological capability (Das and Das, 2012; Setyawati *et al.*, 2014; Govindan *et al.*, 2014), which makes the SCF adoption a hectic task for them. As evident from the literature, technological capability of MSMEs in India was a questionable one (Subrahmanya, 2011; Gupta and Barua, 2016). This is justified with technological challenges of MSMEs receiving the second rank in the category. According to TCE theory, the main purpose of information technology in supply chain management is to improve SC collaboration and to reduce coordination costs by increasing SC visibility and transparency. Therefore, the findings of the current study state that technological upgradation is an important enabler in SCF adoption in MSMEs which might reduce the transaction costs (TCE) and improve corporate performance (Subrahmanya, 2011). Poor technological capability of MSMEs (IT6) received the first rank in the global category. This is very relevant in the present context since India's rank (44) in the logistics performance index of the World Bank, especially on the infrastructure parameter (2.91), is lower than that of countries such as China (3.75) and South Africa (3.19) (LPI Index, 2018). The Deloitte (2014) had also revealed the poor infrastructure facility in the country. These insights might motivate policy makers to provide an adequate boost to MSMEs in terms of technological infrastructure, which will help them in easy SCF adoption. Lack of automation in the payment process (IT1) received second rank in the category. The findings are line with the findings of Jamak *et al.* (2014), Sobanke *et al.* (2014) and Gupta and Barua (2016) which validates the poor technological capability of MSMEs. Subrahmanya (2011) has also found that technological innovation of Indian MSMEs leads to better economic and firm performance in the form of high growth of sales turnover.

*Organizational policies*. Organizational policies received third rank in the category. Organizational policies with respect to supply chain activities can have various impacts on the organization, because SCM processes should be strategically aligned with the overall business strategy to achieve good financial performance (Presutti and Mawhinney, 2007). Since there are no mandatory rules regarding the implementation of SCF strategies in Indian companies, the choice of the management is to stay out of SCF. Mismatch between supply chain strategies and business strategies (OP1) got the first priority in this category. This is in line with the findings of Sahay and Mohan (2003) which stated that one-third of companies in developing nations such as India have no supply chain strategies (Sahay and Mohan, 2003). We prove that this is true in the case of MSMEs also. Management decision to not adopt Trade Receivable e-Discounting System (OP5) is the second major challenge in this category. This finding is in line with the Rank 1 in this study, which is "disclosure of sensitive company information to competitors" (barrier F6).

*Human resource.* The importance of human resource-related aspects in the organizational performance and success has been well documented in academia (Becker and Gerhart, 1996; Wright and McMahan, 1992; Valentine and Fleischman, 2018). Human resource management is critical for organizational growth, prosperity and retaining a competitive advantage in the market (Schuler and MacMillan, 1984). Human resource challenges received fourth rank in the category. Perception of the management (HR6) received first rank under this category. This is in line with the observation of Jongejans *et al.* (2014) on the importance of the perception of management in adopting new policy changes. Lack of trust among supply chain partners (HR1) is the second most important barrier in this category. It was evident from the literature that SCF approach improves trust, commitment and profitability along the entire chain (Randall and Theodore Farris, 2009). But our findings prove that trust among supply chain partners poses a challenge in its implementation face, which was missing in the existing literature.

*Firm coordination.* Rank 5 was received by the firm coordination challenges. Firm coordination and collaboration enhance the performance and supply chain links of a firm (Hofmann and Belin, 2011; Lamoureux and Evans, 2011; Cao and Zhang, 2011). SCF adoption requires cooperation and collaboration among the SC partners (Gelsomino *et al.*, 2016). Lack of shared objective among partners (FC3) holds the first rank in this category. This is in line with the findings of More and Basu (2013). But contrary to their findings, it is of least priority in the global ranking of the barriers. Financial and technological challenges dominate in the context of MSMEs rather than human resource and other organizational barrier categories. Lack of collaboration from other parties (FC2) in the supply chain occupies the second rank, which is followed by lack of cooperation among partners (FC1). Poor communication between partners (FC4) and lack of common interest (FC5) gets the least ranking in the analysis.

*Macro institutional.* The factors that are normally beyond the control of the companies such as political, economic, social, natural elements can affect the supply chains; and therefore, these factors have been analyzed under this category (Peck, 2005). Though factors under this category seem to have least influence on the SCF adoption compared to other categories, internationally operating supply chains (MC5) are found to be critical, and so, it holds the first rank in the category. This can be due to change in rules, regulations and tax frameworks from one country to another. geographical location of the partners (MC1) comes next to MC5 in the category (Peck, 2005), which is applicable to domestically operating supply chains because of the varying local rules and regulations. Cultural settings (MC2) occupy the third rank, and it was found to be capable of making supply chains vulnerable in the literature (Peck, 2005). Overall, the complexity in adoption (MC4) owing to the overall business settings prevailing in the nation occupies the fourth rank. Regulatory changes (MC3), government support (MC7), and poor government policies (MC6) are given least importance in the category as well as in global ranking. These factors are given the least rankings because of the continuous initiatives of the Government of India toward business sector and Reserve Bank of India's dream project TReDS.

### Sensitivity analysis

The financial barrier receives high priority in the AHP analysis (Table VII); thus, it can influence other barrier categories. Govindan *et al.* (2014) and Gupta and Barua (2017) pointed out that minor variations in weights would lead to major changes in the final ranking. This is owing to the influence of the individual judgments of the experts; therefore, there is a need to test the stability of the ranking under varying barrier category weights. Sensitivity analysis was conducted to validate this argument. Here, the financial barrier category values were considered to be changing the values from 0.1 to 0.9, with 0.1 as the increase.

This leads to variations in all the other barriers, with the technology barrier (SCF5) receiving the greatest variation. This calculation is shown in Table IX.

Along with the change in the categorization of barriers, specific barriers also underwent change. With the financial category barrier change of 0.1, poor technological capability of MSME (IT6) holds the first rank, and poor government policies (MC6) hold the lowest rank. IT6 retains the first rank until reaching the value of 0.3, which is near the normalized value. From the normal value of 0.3867 onwards, the disclosure of sensitive company information to competitors (F6) retains the first rank. This is illustrated in Figure 3. The changes in specific barriers are shown in Table X. It is evident from the analysis that the financial barrier category has a critical impact on SCF adoption; hence, this category seeks special attention from companies and regulatory authorities. If the financial barrier category is eliminated along with the advancement in technological aspects, the remaining barriers could be managed easily. Companies and governments can focus on these aspects thoroughly to make SCF implementation a straightforward task.

## Conclusions and scope for future research

A benchmarking framework to ease SCF adoption in manufacturing companies has been shown in this paper by trimming down the difficulties of identifying the barriers for the concerned stakeholders. This paper has employed a three-phase methodology to identify and prioritize the essential barriers to the implementation of SCF. An extensive survey has been carried out in 101 Indian MSME units which identified 37 barriers under six headings in the first phase. Experts' interview using the Delphi technique has been carried out in the second phase to finalize the barriers. The analytic hierarchy process methodology, with sensitivity analysis for validation, is used in the final stage to prioritize and rank the barriers.

| Barriers | Barrier category values | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCF1 | 0.386777 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| SCF2 | 0.05855 | 0.085931 | 0.076383 | 0.066835 | 0.057287 | 0.04774 | 0.038192 | 0.028644 | 0.019096 | 0.009548 |
| SCF3 | 0.040525 | 0.059477 | 0.052868 | 0.04626 | 0.039651 | 0.033043 | 0.026434 | 0.019826 | 0.013217 | 0.006609 |
| SCF4 | 0.169829 | 0.24925 | 0.221556 | 0.193861 | 0.166167 | 0.138472 | 0.110778 | 0.083083 | 0.055389 | 0.027694 |
| SCF5 | 0.316227 | 0.464112 | 0.412544 | 0.360976 | 0.309408 | 0.25784 | 0.206272 | 0.154704 | 0.103136 | 0.051568 |
| SCF6 | 0.028092 | 0.041229 | 0.036648 | 0.032067 | 0.027486 | 0.022905 | 0.018324 | 0.013743 | 0.009162 | 0.004581 |

Table IX.
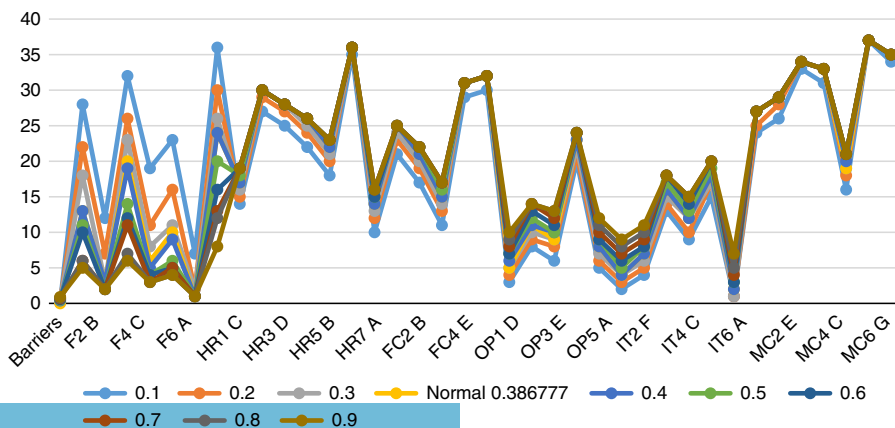Barrier category values after increasing financial category barrier



Figure 3.
Ranking of the barriers when increasing the financial barrier category value in the sensitivity analysis

| | Financial barrier category values in sensitivity analysis | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Barriers | 0.1 | 0.2 | 0.3 | Normal | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| F1 | 28 | 22 | 18 | 13 | 13 | 11 | 10 | 6 | 6 | 5 |
| F2 | 12 | 7 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| F3 | 32 | 26 | 23 | 20 | 19 | 14 | 12 | 11 | 7 | 6 |
| F4 | 19 | 11 | 8 | 6 | 5 | 4 | 4 | 3 | 3 | 3 |
| F5 | 23 | 16 | 11 | 10 | 9 | 6 | 5 | 5 | 4 | 4 |
| F6 | 7 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| F7 | 36 | 30 | 26 | 24 | 24 | 20 | 16 | 13 | 12 | 8 |
| HR1 | 14 | 15 | 16 | 17 | 17 | 18 | 19 | 19 | 19 | 19 |
| HR2 | 27 | 29 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| HR3 | 25 | 27 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| HR4 | 22 | 24 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| HR5 | 18 | 20 | 21 | 22 | 22 | 23 | 23 | 23 | 23 | 23 |
| HR6 | 35 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| HR7 | 10 | 12 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 16 |
| FC1 | 21 | 23 | 24 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| FC2 | 17 | 19 | 20 | 21 | 21 | 22 | 22 | 22 | 22 | 22 |
| FC3 | 11 | 13 | 14 | 15 | 15 | 16 | 17 | 17 | 17 | 17 |
| FC4 | 29 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| FC5 | 30 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| OP1 | 3 | 4 | 5 | 5 | 6 | 7 | 7 | 8 | 9 | 10 |
| OP2 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 14 | 14 |
| OP3 | 6 | 8 | 9 | 9 | 10 | 10 | 11 | 12 | 13 | 13 |
| OP4 | 20 | 21 | 22 | 23 | 23 | 24 | 24 | 24 | 24 | 24 |
| OP5 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 12 |
| IT1 | 2 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 9 |
| IT2 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 11 |
| IT3 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 18 | 18 | 18 |
| IT4 | 9 | 10 | 12 | 12 | 12 | 13 | 14 | 15 | 15 | 15 |
| IT5 | 15 | 17 | 17 | 18 | 18 | 19 | 20 | 20 | 20 | 20 |
| IT6 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 7 |
| MC1 | 24 | 25 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| MC2 | 26 | 28 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| MC3 | 33 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| MC4 | 31 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| MC5 | 16 | 18 | 19 | 19 | 20 | 21 | 21 | 21 | 21 | 21 |
| MC6 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| MC7 | 34 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |

Table X.
Ranking for barriers when increasing financial barrier category value from 0.1 to 0.9 by sensitivity analysis

The AHP analysis indicates that the financial barrier category is the crucial barrier category, followed by the technological barrier category. The organizational policy barrier, human resource-related barrier, firm coordination and macro institutional challenges are the next priorities. In this study, it can be observed that macro institutional barriers are given the lowest priority, which reveals that these barriers have less importance than the financial and technology-related barriers. Among the specific barriers, the disclosure of sensitive company information to competitors (F6) barrier acts as an essential barrier in comparison with the other 37 barriers. Poor technological capability of MSMEs received second rank in the global ranking. As evident from the literature, MSMEs usually lack technological capability (Das and Das, 2012; Setyawati et al., 2014; Govindan et al., 2014). The results emphasize the significance of finance-related and technological issues of MSMEs in SCF adoption (Camerinelli, 2009; Yang and Li, 2010; Tanrisever et al., 2012; Wuttke et al., 2013; Mangla et al., 2015). These insights might motivate policy makers to provide an adequate boost to MSMEs in terms of technological infrastructure, which will help them in easy SCF adoption.

It is not practical to eliminate or eradicate all the barriers in the nascent stage of a company's SCF adoption. The current study has provided insights and benchmarks related to the essential barriers, which can be used by industrialists and governments to implement SCF solutions and strategies efficiently. Other advanced MCDM or statistical techniques, such as SEM or DEMATEL (Kumar and Dixit, 2018a, b), could be used to analyze and verify the findings of the current study. The supply chains in a developed nation can vary from those of a developing nation (Sahay and Mohan, 2003; Sahay *et al.*, 2006; Zhao *et al.*, 2007); hence, the generalization and validation of the findings need more extensive research in different countries.

## Managerial and practical implications
Identifying the challenges related to SCF adoption in companies ensures easy and systematic implementation of SCF solutions. The current study contributes to theory, policy and practice with respect to supply chain management and SCF. The results of the study have been discussed with the experts to examine the relevance and managerial implications as discussed below.

### Theoretical implications
The current research contributes to the ST (Mitchell *et al.*, 1997; Sarkis, 2001) and TCE theory. ST emphasizes on the rationale of organizations to take actions that are normally above and beyond the shareholders wealth maximization. The stakeholders are the parties who can affect or get affected by the performance of the organization. They can include owners, suppliers, employees, lenders, borrowers, customers, government, society, natural environment, etc. Our study confirms that SCF requires coordination and cooperation of many SC partners because it will help to simplify the financial settlements and reduce defaults in the payments (Jongejans *et al.*, 2014; Shang *et al.*, 2009; Demica, 2007; Jongejans *et al.*, 2014). This observation can encourage the organizations to incorporate stakeholders' concerns in the adoption of SCF solutions. Moreover, TCE defines SCF as "all costs necessary to run a relationship" (Carr and Pearson, 1999). The concepts such as opportunism and bounded rationality provide insights into the understandings of SCF adoption. Moreover, financial upliftments in supply chain operations could also reduce the transaction costs (Wuttke *et al.*, 2013).

### Implications to practice
Literature on SCF is in the nascent stage and research is focused on the theoretical aspects (Gomm, 2010; Wuttke *et al.*, 2013) and case studies. Since there is a dearth of empirical studies in SCF, this study can help MSME managers to look into the challenges they might face while implementing SCF. Since it is not practical to eradicate all the challenges in SCF adoption, managers can prioritize the challenges with the help of the findings of the current study. The significance of barriers under financial and technological categories will encourage managers to cope with those aspects extensively. Our study provides a more in-depth view of such challenges and provided a benchmark, which will help companies to adopt SCF solutions more effortlessly.

### Implications to policy
The results shed light on the issues such as the fear of companies in leaking sensitive suppliers' details, bills and contract agreements to competitors. Poor technological capability of MSME suppliers is also one of the challenges faced by Indian companies while adopting SCF solutions. Central banks and industrial related departments of various governments across the world can look into these serious issues and amend or introduce new policies to facilitate companies for implementing the supply chain financial solutions.

## References

Aberdeen Group (2007), "Technology platforms for supply chain finance. How to drive competitive business advantage by increasing payment and financing automation with business partners", available at: https://bit.ly/2Vb4C7a (accessed January 10, 2018).

Ayadi, R. (2008), "SME financing in Europe: measures to improve the rating culture under the new banking rules", *Prace Naukowe/Akademia Ekonomiczna w Katowicach*, pp. 97-135.

Barton, L. (1993), *Crisis in Organizations: Managing and Communicating in the Heat of Chaos*, South-Western Publishing Company, Nashville.

Basu, P. and Nair, S. (2008), "Dynamic payables discounting: a supply chain finance perspective", *Proceedings: POMS (Production and Operations Management Society) 2008 Annual Meeting*, *May*, pp. 1-11.

Becker, B. and Gerhart, B. (1996), "The impact of human resource management on organizational performance: progress and prospects", *Academy of Management Journal*, Vol. 39 No. 4, pp. 779-801.

Berger Allen, N. and Udell, G.F. (2006), "A more complete conceptual framework for SME finance", *Journal of Banking & Finance*, Vol. 30 No. 11, pp. 2945-2966.

Boissay, F. and Gropp, R. (2007), "Trade credit defaults and liquidity provision by firms", *SSRN Electronic Journal*, doi: 10.2139/ssrn.966281.

Camerinelli, E. (2009), "Supply chain finance", *Journal of Payments Strategy & Systems*, Vol. 3 No. 2, pp. 114-128.

Caniato, F., Gelsomino, L.M., Perego, A. and Ronchi, S. (2016), "Does finance solve the supply chain financing problem?", *Supply Chain Management: An International Journal*, Vol. 21 No. 5, pp. 534-549.

Cao, M. and Zhang, Q. (2011), "Supply chain collaboration: impact on collaborative advantage and firm performance", *Journal of Operations Management*, Vol. 29 No. 3, pp. 163-180.

Caponigro, J.R. (1998), *The Crisis Counselor: The Executive's Guide to Avoiding, Managing, and Thriving on Crises that Occur in All Businesses*, Barker Business Books Incorporated, Chicago, IL.

Carr, A.S. and Pearson, J.N. (1999), "Strategically managed buyer–supplier relationships and performance outcomes", *Journal of Operations Management*, Vol. 17 No. 5, pp. 497-519.

Christopher, M. and Lee, H. (2004), "Mitigating supply chain risk through improved confidence", *International Journal of Physical Distribution & Logistics Management*, Vol. 34 No. 5, pp. 388-396.

Christopher, M. and Ryals, L. (1999), "Supply chain strategy: its impact on shareholder value", *The International Journal of Logistics Management*, Vol. 10 No. 1, pp. 1-10.

CII (2018), "The confederation of Indian industry", available at: www.cii.in/Sectors.aspx?enc=prvePUj2bdMtgTmvPwvisYH+5EnGjyGXO9hLECvTuNuXK6QP3tp4gPGuPr/xpT2f (accessed January 20, 2018).

Conroy, M. (2009), *Branded!: How The'certification Revolution'is Transforming Global Corporations*, New Society Publishers.

Coulibaly, B., Sapriza, H. and Zlate, A. (2013), "Financial frictions, trade credit, and the 2008–09 global financial crisis", *International Review of Economics & Finance*, Vol. 26, pp. 25-38.

Creazza, A., Dallari, F. and Melacini, M. (2010), "Evaluating logistics network configurations for a global supply chain", *Supply Chain Management: An International Journal*, Vol. 15 No. 2, pp. 154-164.

Croom, S., Romano, P. and Giannakis, M. (2000), "Supply chain management: an analytical framework for critical literature review", *European Journal of Purchasing & Supply Management*, Vol. 6 No. 1, pp. 67-83.

Das, S. and Das, K. (2012), "Factors influencing the information technology adoption of micro, small and medium enterprises (MSME): an empirical study", *International Journal of Engineering Research and Applications*, Vol. 2 No. 3, pp. 2493-2498.

Deloitte (2014), "Deloitte report", available at: https://bit.ly/2V9f5zP (accessed January 1, 2018).

Demica, S.S. (2007), "The growing role of supply chain finance in a changing world", Demica Report Series, available at: http://www.demica.com/

Fawcett, S.E., Ogden, J.A., Magnan, G.M. and Bixby Cooper, M. (2006), "Organizational commitment and governance for supply chain success", *International Journal of Physical Distribution & Logistics Management*, Vol. 36 No. 1, pp. 22-35.

Garcia-Appendini, E. and Montoriol-Garriga, J. (2013), "Firms as liquidity providers: evidence from the 2007–2008 financial crisis", *Journal of Financial Economics*, Vol. 109 No. 1, pp. 272-291.

Gaudenzi, B. and Borghesi, A. (2006), "Managing risks in the supply chain using the AHP method", *The International Journal of Logistics Management*, Vol. 17 No. 1, pp. 114-136.

Gelsomino, L.M., Mangiaracina, R., Perego, A. and Tumino, A. (2016), "Supply chain finance: a literature review", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 4, pp. 348-366.

Gomm, M.L. (2010), "Supply chain finance: applying finance theory to supply chain management to enhance finance in supply chains", *International Journal of Logistics: Research and Applications*, Vol. 13 No. 2, pp. 133-142.

Govindan, K., Kaliyan, M., Kannan, D. and Haq, A.N. (2014), "Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process", *International Journal of Production Economics*, Vol. 147, pp. 555-568.

Gulati, R. and Gargiulo, M. (1999), "Where do interorganizational networks come from?", *American Journal of Sociology*, Vol. 104 No. 5, pp. 1439-1493.

Gupta, H. and Barua, M.K. (2016), "Identifying enablers of technological innovation for Indian MSMEs using best–worst multi criteria decision making method", *Technological Forecasting and Social Change*, Vol. 107, pp. 69-79.

Gupta, H. and Barua, M.K. (2017), "Supplier selection among SMEs on the basis of their green innovation ability using BWM and fuzzy TOPSIS", *Journal of Cleaner Production*, Vol. 152, pp. 242-258.

Hall, D. and Braithwaite, A. (2008), "The development of thinking in supply chain and logistics management", in Brewer, A.M., Button, K.J. and Hensher, D.A. (Eds), *Handbook of Logistics and Supply-chain Management*, Handbooks in Transport, Vol. 2, ISBN: 978-0-0804-3593-0, Emerald Group Publishing Limited, pp. 81-98.

Handfield, R.B. and Bechtel, C. (2002), "The role of trust and relationship structure in improving supply chain responsiveness", *Industrial Marketing Management*, Vol. 31 No. 4, pp. 367-382.

Haskel, J. and Heden, Y. (1999), "Computers and the demand for skilled labour: industry-and establishment-level panel evidence for the UK", *The Economic Journal*, Vol. 109 No. 454, pp. 68-79.

Hofmann, E. (2005), "Supply chain finance: some conceptual insights", *Beiträge Zu Beschaffung Und Logistik*, Springer Gabler, Wiesbaden, pp. 203-214.

Hofmann, E. and Belin, O. (2011), *Supply Chain Finance Solutions*, Springer-Verlag, Berlin and Heidelberg, pp. 644-645.

Hofmann, E. and Kotzab, H. (2010), "A supply chain-oriented approach of working capital management", *Journal of Business Logistics*, Vol. 31 No. 2, pp. 305-330.

International Finance Corporation (2018), "International Finance Corporation Annual report", available at: www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/annual+report/download (accessed January 20, 2018).

Jamak, A.B.S.A., Ali, R.M.M. and Ghazali, Z. (2014), "A breakout strategy model of Malay (Malaysian indigenous) micro-entrepreneurs", *Procedia – Social and Behavioral Sciences*, Vol. 109, pp. 572-583.

Jing, B. and Seidmann, A. (2014), "Finance sourcing in a supply chain", *Decision Support Systems*, Vol. 58, pp. 15-20.

Jongejans, H.P., Keizer, J.A., Mahieu, R.J. and Rooijakkers, J. (2014), "Supply chain finance: fostering financial innovation for SMEs and throughout the supply chain", doctoral dissertation, master thesis, Eindhoven University of Technology, Eindhoven.

Jüttner, U., Peck, H. and Christopher, M. (2003), "Supply chain risk management: outlining an agenda for future research", *International Journal of Logistics: Research and Applications*, Vol. 6 No. 4, pp. 197-210.

Kelle, P. and Akbulut, A. (2005), "The role of ERP tools in supply chain information sharing, cooperation, and cost optimization", *International Journal of Production Economics*, Vol. 93, pp. 41-52.

Kiley, M.T. (1999), "The supply of skilled labour and skill-biased technological progress", *The Economic Journal*, Vol. 109 No. 458, pp. 708-724.

Klapper, L. (2005), *The Role of Factoring for Financing Small and Medium Enterprises*, The World Bank, available at: http://documents.worldbank.org/curated/en/844291468321884034/The-role-of-factoring-for-financing-small-and-medium-enterprises

Kovoor-Misra, S. (1995), "A multidimensional approach to crisis preparation for technical organizations: some critical factors", *Technological Forecasting and Social Change*, Vol. 48 No. 2, pp. 143-160.

Kumar, A. and Dixit, G. (2018a), "An analysis of barriers affecting the implementation of e-waste management practices in India: a novel ISM-DEMATEL approach", *Sustainable Production and Consumption*, Vol. 14, pp. 36-52.

Kumar, A. and Dixit, G. (2018b), "Evaluating critical barriers to implementation of WEEE management using DEMATEL approach", *Resources, Conservation and Recycling*, Vol. 131, pp. 101-121.

Kwon, I.W.G. and Suh, T. (2004), "Factors affecting the level of trust and commitment in supply chain relationships", *Journal of Supply Chain Management*, Vol. 40 No. 1, pp. 4-14.

Lamoureux, J.F. and Evans, T.A. (2011), "Supply chain finance: a new means to support the competitiveness and resilience of global value chains", *SSRN Electronic Journal*, doi: 10.2139/ssrn.2179944.

Lekkakos, S.D. and Serrano, A. (2016), "Supply chain finance for small and medium sized enterprises: the case of reverse factoring", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 4, pp. 367-392.

Liebl, J., Hartmann, E. and Feisel, E. (2016), "Reverse factoring in the supply chain: objectives, antecedents and implementation barriers", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 4, pp. 393-413.

Liu, Z. and Cruz, J.M. (2012), "Supply chain networks with corporate financial risks and trade credits under economic uncertainty", *International Journal of Production Economics*, Vol. 137 No. 1, pp. 55-67.

LPI Index (2018), "Logistics Performance Index report", World Bank, available at: https://lpi.worldbank.org/report (accessed December 20, 2018).

Maiti, M. (2018), "Scope for alternative avenues to promote financial access to MSMEs in developing nation evidence from India", *International Journal of Law and Management*, Vol. 60 No. 5, pp. 1210-1222.

Malhotra, M.K. and Grover, V. (1998), "An assessment of survey research in POM: from constructs to theory", *Journal of Operations Management*, Vol. 16 No. 4, pp. 407-425.

Mangla, S.K., Kumar, P. and Barua, M.K. (2015), "Risk analysis in green supply chain using fuzzy AHP approach: a case study", *Resources, Conservation and Recycling*, Vol. 104, pp. 375-390.

Manuj, I. and Mentzer, J.T. (2008), "Global supply chain risk management strategies", *International Journal of Physical Distribution & Logistics Management*, Vol. 38 No. 3, pp. 192-223.

Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001), "Defining supply chain management", *Journal of Business Logistics*, Vol. 22 No. 2, pp. 1-25.

Michalski, G. (2008), "Factoring and the firm value", *FACTA UNIVERSITATIS Series: Economics and Organization*, Vol. 5 No. 1, pp. 31-38.

Mitchell, R.K., Agle, B.R. and Wood, D.J. (1997), "Toward a theory of stakeholder identification and salience: defining the principle of who and what really counts", *Academy of Management Review*, Vol. 22 No. 4, pp. 853-886.

Mitra, S. and Chaya, A.K. (1996), "Analyzing cost-effectiveness of organizations: the impact of information technology spending", *Journal of Management Information Systems*, Vol. 13 No. 2, pp. 29-57.

More, D. and Basu, P. (2013), "Challenges of supply chain finance: a detailed study and a hierarchical model based on the experiences of an Indian firm", *Business Process Management Journal*, Vol. 19 No. 4, pp. 624-647.

MSME Act (2006), available at: https://msme.gov.in/ (accessed December 10, 2017).

Palia, D. and Sopranzetti, B.J. (2004), "Securitizing accounts receivable", *Review of Quantitative Finance and Accounting*, Vol. 22 No. 1, pp. 29-38.

Peck, H. (2005), "Drivers of supply chain vulnerability: an integrated framework", *International Journal of Physical Distribution & Logistics Management*, Vol. 35 No. 4, pp. 210-232.

Pfohl, H.C. and Gomm, M. (2009), "Supply chain finance: optimizing financial flows in supply chains", *Logistics Research*, Vol. 1 Nos 3–4, pp. 149-161.

Power, D. (2005), "Supply chain management integration and implementation: a literature review", *Supply Chain Management: An International Journal*, Vol. 10 No. 4, pp. 252-263.

Presutti, W.D. and Mawhinney, J.R. (2007), "The supply chain-finance link", *Supply Chain Management Review*, Vol. 11 No. 6, pp. 32-38.

Qianlei, L. (2012), "The study on the risk management of agricultural products green supply chain based on systematic analysis", *2012 Second International Conference on Business Computing and Global Informatization. IEEE, October*, pp. 250-253.

Raghavan, N.S. and Mishra, V.K. (2011), "Short-term financing in a cash-constrained supply chain", *International Journal of Production Economics*, Vol. 134 No. 2, pp. 407-412.

Randall, W.S. and Theodore Farris, M. (2009), "Supply chain financing: using cash-to-cash variables to strengthen the supply chain", *International Journal of Physical Distribution & Logistics Management*, Vol. 39 No. 8, pp. 669-689.

Saad, M. and Patel, B. (2006), "An investigation of supply chain performance measurement in the Indian automotive sector", *Benchmarking: An International Journal*, Vol. 13 Nos 1/2, pp. 36-53.

Saaty, T.L. (1980), *The Analytic Process: Planning, Priority Setting, Resources Allocation*, McGraw, New York, NY.

Sahay, B.S. and Mohan, R. (2003), "Supply chain management practices in Indian industry", *International Journal of Physical Distribution & Logistics Management*, Vol. 33 No. 7, pp. 582-606.

Sahay, B.S., Gupta, J.N. and Mohan, R. (2006), "Managing supply chains for competitiveness: the Indian scenario", *Supply Chain Management: An International Journal*, Vol. 11 No. 1, pp. 15-24.

Sahoo, C. and Behera, A.R. (2018), "Financing MSMEs rife with problems – a demand side analysis", *International Conference on Economics and Finance, Springer, Cham, February*, pp. 171-186.

Sarkis, J. (2001), "Manufacturing's role in corporate environmental sustainability-concerns for the new millennium", *International Journal of Operations & Production Management*, Vol. 21 Nos 5/6, pp. 666-686.

Schuler, R.S. and MacMillan, I.C. (1984), "Gaining competitive advantage through human resource management practices", *Human Resource Management*, Vol. 23 No. 3, pp. 241-255.

Seifert, R.W. and Seifert, D. (2009), "Supply chain finance-what's it worth?", *Perspectives for Managers*, No. 178, pp. 1-4.

Setyawati, A., Nimran, U., Zulkhirom, M. and Kumadji, S.K. (2014), "Effect of strategic decision, innovation, and information technology adoption on competitive advantages and MSME performance. Studies at MSME food and beverage industry sector in Bandung Raya", *European Journal of Business and Management*, Vol. 6 No. 35, pp. 24-33.

Shang, K.H., Song, J.S. and Zipkin, P.H. (2009), "Coordination mechanisms in decentralized serial inventory systems with batch ordering", *Management Science*, Vol. 55 No. 4, pp. 685-695.

Sobanke, V., Adegbite, S., Ilori, M. and Egbetokun, A. (2014), "Determinants of technological capability of firms in a developing country", *Procedia Engineering*, Vol. 69, pp. 991-1000.

Song, H., Yu, K. and Lu, Q. (2018), "Financial service providers and banks' role in helping SMEs to access finance", *International Journal of Physical Distribution & Logistics Management*, Vol. 48 No. 1, pp. 69-92.

Steeman, M. (2014), *The Power of Supply Chain Finance*, Windesheimreeks kennis en on derzoek, Windesheim, 50.

Subrahmanya, M.H. (2011), "Technological innovations and firm performance of manufacturing SMEs: determinants and outcomes", *ASCI Journal of Management*, Vol. 41 No. 1, pp. 109-122.

Summers, B. and Wilson, N. (2000), "Trade credit management and the decision to use factoring: an empirical study", *Journal of Business Finance & Accounting*, Vol. 27 Nos 1–2, pp. 37-68.

Tanrisever, F., Cetinay, H., Reindorp, M. and Fransoo, J. (2012), "Value of reverse factoring in multi-stage supply chains", p. 28.

Thakkar, J., Kanda, A. and Deshmukh, S.G. (2012), "Supply chain issues in Indian manufacturing SMEs: insights from six case studies", *Journal of Manufacturing Technology Management*, Vol. 23 No. 5, pp. 634-664.

Tripathy, S., Aich, S., Chakraborty, A. and Lee, G.M. (2016), "Information technology is an enabling factor affecting supply chain performance in Indian SMEs: a structural equation modelling approach", *Journal of Modelling in Management*, Vol. 11 No. 1, pp. 269-287.

Valentine, S. and Fleischman, G. (2018), "From schoolyard to workplace: the impact of bullying on sales and business employees' machiavellianism, job satisfaction, and perceived importance of an ethical issue", *Human Resource Management*, Vol. 57 No. 1, pp. 293-305.

Viswanathan, S. and Piplani, R. (2001), "Coordinating supply chain inventories through common replenishment epochs", *European Journal of Operational Research*, Vol. 129 No. 2, pp. 277-286.

Wagner, S.M. and Neshat, N. (2012), "A comparison of supply chain vulnerability indices for different categories of firms", *International Journal of Production Research*, Vol. 50 No. 11, pp. 2877-2891.

Wagner, S.M., Bode, C. and Koziol, P. (2009), "Supplier default dependencies: empirical evidence from the automotive industry", *European Journal of Operational Research*, Vol. 199 No. 1, pp. 150-161.

Wright, P.M. and McMahan, G.C. (1992), "Theoretical perspectives for strategic human resource management", *Journal of Management*, Vol. 18 No. 2, pp. 295-320.

Wuttke, D.A., Blome, C. and Henke, M. (2013), "Focusing the financial flow of supply chains: an empirical investigation of financial supply chain management", *International Journal of Production Economics*, Vol. 145 No. 2, pp. 773-789.

Xu, M., Qi, X., Yu, G., Zhang, H. and Gao, C. (2003), "The demand disruption management problem for a supply chain system with nonlinear demand functions", *Journal of Systems Science and Systems Engineering*, Vol. 12 No. 1, pp. 82-97.

Yang, Z.K. and Li, J. (2010), "Assessment of green supply chain risk based on circular economy", *2010 IEEE 17Th International Conference on Industrial Engineering and Engineering Management, IEEE*, October, pp. 1276-1280.

Zhao, X., Flynn, B.B. and Roth, A.V. (2007), "Decision sciences research in China: current status, opportunities, and propositions for research in supply chain management, logistics, and quality management", *Decision Sciences*, Vol. 38 No. 1, pp. 39-80.

**Further reading**

Niti, N. (2018), "Receivables management and supply chain finance for MSMES: analysis of TREDS", *Academy of Strategic Management Journal*, Vol. 17 No. 3.

## Appendix

### Identification of essential barriers (AHP)
The following questionnaire is based on the barriers that your company might have faced in the implementation of its supply chain finance strategy. Kindly mark your responses on a nine-point scale as shown in the following tables.

| Preference weights/level of importance | Definition | Explanation |
|---|---|---|
| 1 | Equally preferred | Equal contribution by two activities to the objective |
| 3 | Moderately | Judgment slightly favor one activity over other |
| 5 | Strongly | Judgment strongly or essentially favor one activity over other |
| 7 | Very strongly | An activity is strongly forced over another |
| 9 | Extremely | One activity favor over another at its highest degree possible for affirmation |
| 2,4,6,8 | Intermediate values | Represents a compromise between preferences |
| Reciprocals | Reciprocals for inverse comparison | |

**Table AI.**
Identification of
essential barriers

| | SCF 1 | SCF 2 | SCF 3 | SCF 4 | SCF 5 | SCF 6 |
|---|---|---|---|---|---|---|
| SCF 1 | 1 | | | | | |
| SCF 2 | | 1 | | | | |
| SCF 3 | | | 1 | | | |
| SCF 4 | | | | 1 | | |
| SCF 5 | | | | | 1 | |
| SCF 6 | | | | | | 1 |

**Table AII.**
Barrier category

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