

An exploratory study into Supply Chain Finance: the relevance of supplier segmentation

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INTRODUCTION

In a globalizing economy, industrial supply chains are becoming more complex, spanning more countries and suppliers than ever before (Hieminga, 2012). Such chains involve an equally complex string of (financing) arrangements and interdependencies between suppliers, buyers, banks and logistics service providers (Hurtrez & Gesua'sive salvadori, 2010). This large network of agreements creates a clear challenge, where data is fragmented and lacks common sharing and interface (Hofmann, 2013). While the flow of goods and associated information are increasingly integrated and optimized, the interdependency of financial flows and operational flows is rarely recognized (Protopappa-Sieke & Seifert, 2010). Inefficiencies in inter-company processing mean that significant amounts of working capital is locked up in delivered products and services not yet paid for by the client. (Roubert, 2013) claims in his study an excess of working capital of more than €200 billion due to poorly managed inventories and payment terms and delays in France alone.

Many companies need to obtain credit to overcome this cash flow problem. Whereas large corporates often are 'investment grade' with related credit terms, their direct and indirect suppliers face relatively high financing costs with credit rates rising hugely as the distance from their large, credit-worthy end buyers increases (NG, 2013). Such financial inefficiencies are increasingly becoming a strategic risk factor in supply chain management, for example, due to bankruptcies of suppliers. Preliminary research by (Muriel, 2006) indicates that late payments contributed to about 25% of bankruptcies in Europe.

More often, lack of cash could prevent a supplier from achieving desired production capacity. This can be illustrated by the widely published case of Caterpillar, the world's leading manufacturer of construction equipment. When it wanted to ramp up production in 2010, some of its top 500 suppliers could not deliver due to insufficient working capital. This had a ripple effect throughout its supply chain and limited growth. Such risks, therefore, force companies to maintain expensive stock or to support supplying companies with working capital (Timothy, 2010).

The credit crisis has revealed the structural weaknesses of this system. During the recent credit crisis liquidity dried up (Ellingsen & Jonas, 2009) and many companies adopted aggressive cash management strategies to safeguard their cash levels in the face of declining credit from financial institutions. One aspect of these new cash management strategies included extending payment terms with their suppliers. Companies have continued to push payment term extensions with suppliers as a means of freeing up cash for purposes such as investment, dividends and share buybacks (NG, 2013). Another reason for the continued pursuit of aggressive cash management strategies is that companies feel that they do not have sufficient working capital to take advantage of an economic upturn. Suppliers to these companies are now feeling the effects of extended payment terms by having to obtain more and more financing to continue operations.

Among large buyers there is a growing focus on how cooperation at a financial level with suppliers can contribute to reducing working capital, reducing costs and decreasing instability in supply chains. A typical example would be for a large manufacturer to use its own credit rating and financial strength to unlock low-interest credit to its small suppliers. For its suppliers, such new models could significantly improve access to finance and reduce the overall need for external financing. These collaborative models are generally referred to as supply chain finance models (Templar, Cosse, Camerinelli, & Findlay, 2012). The most common form discussed in the vast majority of publications whether popular or academic is reversed factoring. Large companies have turned to reversed factoring solutions over the past 5 years as evidenced in publications about its application at Philips, Inditex, Volvo, Walmart, Unilever and Motorola (Blackman, Holland, & Westcott, 2013b; Bozdogan, 2010; Seifert & Seifert, 2011; Steeman, 2012; van Woelderren & Witteveen, 2008).

The theoretical concept of moving from suboptimal working capital management on a company level towards managing the financial supply chain with an integrated view on the most beneficial financial arrangements triggered several researchers to estimate the monetary potential of supply chain finance. Such as Hieminga (2012), who believes that SCF can free up € 22 billion additional free cash flow, just for Dutch buyers. (Hofmann & Belin, 2011) came to a figure of €368 billion in Western Europe. A recent French report states that SCF is expected to be able to contribute to a 25-30% and even up to 50% reduction of working capital and overall improvement of 3-5% return on investment (Hillion, 2013).

In this paper we explore the relationship between supplier segmentation and the application of supply chain finance. The main research question is how supplier segmentation affects the application of supply chain finance solutions.

Empirical data is collected from a questionnaire completed by 418 procurement professionals. Semi-structured interviews with procurement professionals at two large Dutch companies have been used to clarify the findings.

We establish that supplier segmentation affects the type of SCF solutions that companies choose to use with their suppliers. SCF solutions can be categorized into two groups. Operational SCF arrangements include reversed factoring and dynamic discounting. These are applied across all supplier groups with the main aim to lower working capital and costs. Strategic SCF arrangements include loans and inventory finance employed for strategic suppliers with the main aim to mitigate risk.

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The remainder of the paper will be organized into 4 sections. The next section discusses the academic literature on supply chain finance; it provides the theoretical framework leading to a definition of supply chain finance, grounded in supply chain management and corporate finance theories and specifying the characteristics that sets supply chain finance apart. It then briefly discusses the various supplier segmentation models. Both the formulation of a definition for SCF and the choice of a segmentation model were seen as a prerequisite to be able to structure the empirical data gathering via the survey. Section 3 describes the research design, methods and data collection. Section 4 is the analysis and presentation of the differentiated approach in supply chain finance. The final section concludes the paper by proposing directions for future research, based on the findings and limitations of the study.

1. Literature Review

Even though numerous articles can be found on supply chain finance in non-academic literature, it is still limited in academic literature. Hofmann (2013) in his literature review only listed 21 academic articles that dealt with SCF in its broadest sense and were truly scholarly. He determines several common SCF themes across the papers of which supply chain orientation, international, collaboration and network financing stand out. More recently a series of more case study based articles from the perspective of the buying firm, such as in the articles on Innovation adoption strategy for SCF (Wuttke, Blome, Foerstl, & Henke, 2013), the Motorola case on SCF strategy (Blackman et al., 2013b) and SCF at an Indian firm (More & Basu, 2013).

The current literature on SCF touches on various SCF themes but provides very little guidance on the definition of supply chain finance. Work recently done by (Templar et al., 2012) provides some guidance on the various SCF concepts as they are being used in a wide variety of publications but fails to come up with a definition for SCF. Several definitions can be found in non-academic publications but they fail to be firmly grounded in both supply chain management and corporate finance, the two research domains from which the theories are borrowed to research and explain supply chain finance.

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None of the existing academic literature examines the actual usage of various SCF solutions by companies. The majority take the case study approach, either single case (Blackman et al., 2013b; More & Basu, 2013), or multiple case (Fellenz & Dublin, 2009; Templar et al., 2012; Wuttke et al., 2013) and others are more theoretical by nature using conceptual model building (Gomm, 2010; Hofmann & Kotzab, 2010; Pfohl & Gomm, 2009; Randall & Farris, 2009; Vliet, Reindorp, & Fransoo, 2013a). This is the first paper of its kind to combine quantitative techniques, the survey, with qualitative techniques, semi-structured interviews to analyze the usage of SCF solutions.

As the term suggests, supply chain finance is generally positioned in academic literature at the interface between finance and supply chain management (Blackman et al., 2013b; Hofmann, 2009; Pfohl & Gomm, 2009; Randall & Farris, 2009).

We have to realize that the supply chain management framework itself only developed over the past 3 decades, introduced by consultants in the 1980's (Lambert, 2006). Supply chain management in its early days was viewed as an intra-company research field focused on logistics. An important mark in time is 1998. (Lambert, Cooper, & Pagh, 1998) published their paper that year with the statement that the Council of Logistics Management formally stated that logistics itself is a subset of supply chain management and the terms are not synonymous. More recently, also APICS, the association active in the operations area, is using the term supply chain management. Also procurement is often named supply management

and seeks the link with supply chain management (Kraljic, 1983). Supply chain management then really became firmly rooted in the systems theory of the firm which propagates that decisions taken in isolation would be suboptimal as trade-offs exist, for example, between the functions logistics and purchasing. Coordination, alignment and firm level management are necessary to optimize outcomes (Drucker, 1954). This is also reflected in the organization of some universities that bring together purchasing, operations and logistics under the umbrella of supply chain management.

Over time supply chain managers have taken these firm based, cross-functional activities and extended them to the supply chain as a whole (Ballou, 2007). Extending the firm-based systems approach to the network of firms is now considered the basis for modern supply chain management (Randall & Farris, 2009). It is generally accepted that this includes the flow of material or goods and information. It is only in the last few years that researchers from the supply chain management research domain have now also turned to the financial flow looking for further optimization at the supply chain level. Whereas supply chain management within the firm is primarily about optimization and integration of business processes across functional areas, financial management within the firm, or corporate finance, is about two broad questions:

What investment should the firm make and how should it pay for those investments?
(Brealey & Myers, 2003)

SCF researchers borrow freely from the corporate finance theory and marry the concepts with supply chain and systems theories. An example is (Vliet et al., 2013a), who brings in the finance concepts such as the Capital Asset Pricing Model and the Modern Portfolio Theory when developing a risk-return approach to SCF. (Hofmann, 2011) brings in Net Present Value and Option Theory in his discussion on natural hedging as a source of supplier financing. Agency Theory and Information Asymmetry are especially popular concepts found in a wide range of master theses and are also touched upon by (Blackman, Holland, & Westcott, 2013a; Ellingsen & Jonas, 2009; Hofmann & Kotzab, 2010). The attempt made in these papers is to take these corporate finance concepts from a corporate to a supply chain or network level. This could be compared to the evolution of logistics management from an intra-firm activity to an interfirm across networks. Corporate finance then follows a natural progression of a firm-specific function that is taken to the supply chain (Randall & Farris, 2009). In this paper we take the view that taking corporate finance to the supply chain level basically means that both investment and financing decisions will be taken to the supply chain level. Following this reasoning supply chain finance is then about both investment and financing decisions that are not taken in the isolation of one firm but rather in collaboration with supply chain partners.

Supply chain finance can be defined as financial arrangements used in collaboration by at least two supply chain partners with the aim of improving the overall financial performance and mitigating the overall risks of the supply chain.

On the basis of this working definition we try to establish what financial arrangements should be included. Analyzing existing academic literature on supply chain finance we came up with the following non-exhaustive list for the purpose of guiding our respondents in the survey questions:

- Equity/Joint Venture/Minority Stake (Das & Teng, 1996; Petersen & Raghuram G. Rajan, 1997)
- Reversed Factoring (Vliet, Reindorp, & Fransoo, 2013b; Wuttke et al., 2013) and others
- Long-term loans (Gupta & Dutta, 2011) – long-term cash decisions and investment
- Vendor-Managed Inventory (More & Basu, 2013; Pfohl & Gomm, 2009)
- Buyer-Managed Inventory (Hofmann, 2011) – also referred to as Tolling or Natural Hedging
- Dynamic Discounting (Lycklama, Cortet, & Nienhuis, 2013; More & Basu, 2013)
- Contractual Risk/Profit Sharing (Blackman et al., 2013b; Hofmann, 2011)

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We recommend further research to establish a more comprehensive list of financial products that could be included under our definition of supply chain finance. This is not within the scope of this paper.

In this study we try to establish whether supplier segmentation models are relevant in the context of supply chain finance. In this light it is important to stress that we do not intend to discuss the choice or the application of supplier segmentation models within organizations. In order to operationalize supplier segmentation into the survey we are particularly interested in using a supplier segmentation model that is widely recognized.

It is clear from the many publications on supplier segmentation models such as (Caniëls & Gelderman, 2005; Gelderman & Weele, 2002; Olsen & Ellram, 1997) that the model introduced by (Kraljic, 1983) is still, after 25 years, the dominant approach among purchasing practitioners for segmenting suppliers.

2. Research Design

The nature of this research is to understand the actual usage of SCF by companies in the context of supplier segmentation. To answer this question we need a wide variety of companies. We have chosen to collect empirical data through an online questionnaire and

clarify the findings with semi- structured interviews with procurement professionals at two large Dutch companies.

Given the multidisciplinary nature of SCF it was not immediately clear for the survey which function to approach within a company: finance, logistics, supply chain, operations, procurement, or others. From the existing literature, both academic and non-academic, there were indications that procurement and finance (treasury) were most regularly involved with SCF (Blackman et al., 2013b; Wuttke et al., 2013). Based on further interviews with managers responsible for SCF within several large Dutch companies it seemed that the procurement function was the leading function in the roll out of SCF programs.

Mid 2012 we approached the NEVI institute, in which procurement professionals in the Netherlands are organized. NEVI was founded in 1956 and since then has grown to become one of the world's largest purchasing management organizations. With over 6.000 members and approximately 5.000 students working in the private and public field, NEVI is the principal authority for matters concerning purchasing and the supply chain in the Netherlands. In the summer of 2012 we were granted access to this contact database of procurement professionals.

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The first step was to scope the contact database to have survey respondents being actual purchasing practitioners in the private sector of the economy. We made a first selection in the NEVI database excluding functions like advisors and students and excluding respondents working in the following sectors: financial services, healthcare, education, and the government and public sector. The scoping resulted in 4.956 eligible subjects.

The online self-completion questionnaire was chosen as the research tool. (M. P. Couper, Kapteyn, Schonlau, & Winter, 2007; Fleming & Bowden, 2009) support the choice for the online tool in light of the size of the population, the speed of data collection and its cost effectiveness. (Zhang, 2000) highlights that the online tool will allow for a flexible design strategy, which may improve response rates. Another advantage regularly cited in relation to the online self-completion questionnaire is anonymity. (Harris, 1997), for example, suggests that interviewer bias is reduced or eliminated in online surveys. This can also lead to some measurement error as the identity of the respondent could not be ascertained (Hewson et al., 2003).

The exploratory nature of our research led to a survey design that included more than 50 questions. This included specific questions to respondents that would indicate the use of reversed factoring. These questions were not included in this analysis. The survey was conducted in Dutch and is available upon request.

This makes a reasonable response rate in online surveys even more challenging. Online surveys have lower overall response rates than onsite surveys (Epstein, Klinkenberg, Wiley, & McKinley, 2001). Response rates drop off significantly after 10-15 questions and are directly and negatively correlated with questionnaire length (Harris, 1997).

To limit the possibility of any technical, trust or delivery issues affecting the response rate we worked together with a reputable online survey company based in The Netherlands that specializes in delivering online surveys. To further improve the response rate we offered to raffle a master class on supply chain finance amongst the respondents. Even though the use of lottery incentives to improve response rates is not conclusive, especially amongst professionals, we followed the suggestion of (Bennet, 2000) that the incentive, in this case the master class, must be relevant to the audience to have a positive effect. To further improve response rates we used a single reminder as suggested by (M. Couper, 2000). All of these efforts led to 255 completed surveys after the first mailing and another 163 completed surveys after the second. This resulted in a response rate of more than 8% (418 completed questionnaires out of a population of 4956). A total of 387 respondents indicated they would not participate bringing the total number of non-respondents to 4151 respondents.

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Sample bias is probably limited as we targeted and surveyed a specific group in its entirety which reduces or eliminates the effects of sampling error (Umbach, 2004). It is however not possible to completely rule out non-response bias among the respondents because not enough characteristics of the population are known. We mention two possible non-response biases that could have an effect on the results. A frequently cited non-response bias can be present due to the different levels of technical ability among the respondents (Bosnjak, Tuten, & Bandilla, 2001). It could also be the case that respondents already familiar with supply chain finance would be more likely to complete the survey, thus exaggerating the percentage of SCF users. Non-response bias was tested by dividing the sample into early response ($n = 247, 60,5\%$) and late response ($n = 161, 39,5\%$) groups (Armstrong, 1977). Non-response bias has been tested using the t-test to compare the similarities between mean, standard deviation, and standard error mean of the demographic data of the second wave of respondents to the data of the first wave of respondents. All our tests indicate no significant differences between each group. Tests are available on request from the authors. It can be assumed that non-response bias has no significant impact in this study.

Following (Field, 2013) we recoded and transformed two non-binary questions in order to be able to interpret positive or negative correlations consistently. After eliminating the "don't know" and "different" answers, we had scores and records with comparable metrics. Our tests on kurtosis and skewness showed that none of the variables used in correlation analyses need to be corrected to better fit the normal distribution. Measurement errors can arise as a result of respondents actually working for the same company.

Further face validity of the survey was ensured by subjecting our initial survey to a review by a procurement professional, in this case a representative of the NEVI with significant experience in procurement and surveying. This led to the further refinement of the type and order of questions. Usability testing was conducted to check that the website performed the function for which it was designed (Palmer, 2002).

On November 19th, 2012 the survey was sent out to 4.956 members of the NEVI that remained after the first scoping and on December 6th the reminder was sent. This resulted in 418 completed questionnaires which were downloaded from the online tool and further processed in SPSS. In a first analysis of the respondents we excluded 10 survey results as the job title entered by the respondent was too vague to be considered as active in actual procurement, thus resulting in 408 qualified records.

3. Analysis

The respondents' firms were diverse in size and measured in number of employees in the organization (4 categories) and the estimated annual purchasing volume (7 categories). Of the total of 408 eligible respondents 70 (17%) worked for a very large company (>5000 employees), 75 (19%) for a large company (1000-5000 employees), 99 (24%) for a midsized company (250-1000 employees) and 164 (40%) for companies with less than 250 employees.

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The respondents were quite evenly spread over the purchasing volume categories that ranged from 0-10 mln euro to more than 500 mln euro. The smallest category of 101-200 counted 46 respondents, whereas the largest categories of 11-25 mln and more than 500 mln both counted 70 respondents.

Our dataset spans various industry sectors with 216 (52%) in production, 69 (17%) in services, 48 (12%) in construction and energy, 38 (9%) in retail, 27 (7%) in logistics and the remaining spread across leisure, agriculture and mining.

To answer our main research question we first determined whether segmentation models like Kraljic are used by the respondents when collaborating with suppliers as our literature review suggests. First we used a 4-point Likert scale to ask the respondents whether they were using Kraljic or a similar segmentation model to differentiate between suppliers. The results showed that 145 (36%) of the respondents used Kraljic consistently, 103 (25%) used it frequently, 101 (25%) used it but not actively and 14% did not use it at all. We found a strong positive correlation between the use of Kraljic and the size of the firm (Spearman, Sig. 00, Coeff. .184). This suggests that the larger firms are more active in differentiating their suppliers.

It was tested whether the respondents who are more active in using Kraljic would also be more active in collaborative activities with their suppliers.

(McLaren, Head, & Yuan, 2002) mention three mechanisms for collaboration: (1) information integration; (2) process and resource coordination; (3) reporting of performance measures to ensure accountability.

To survey the usage of these mechanisms, they were operationalized into several specific collaboration questions on: data exchange, dispute management, logistic cooperation, and performance measurement. The association between these variables, the size of the company and the usage of supplier segmentation was tested using the Spearman Correlation. In all four cases we found a positive correlation between the intensity of the collaboration and the intensity of using supplier segmentation.

To be able to understand the extent to which respondents use supply chain finance in their company, it was necessary first to present them with the definition as devised in the theoretical framework before proceeding with the various questions.

132 Of the respondents 78 (19%) indicated that they are familiar with supply chain finance. A total of 56 (14%) said they are using SCF actively in their organization and reported using one or more SCF models. We used a multi-response question to determine what SCF models were most commonly used.

The constructed multi-response variable poses extra complications when performing correlations analyses. From (Lavassavi, Movahedi, & Kumar, n.d.) we learn that variables can receive multiple responses for any row and/or column but then the marginal values of that row or column (there may be more than one of either) would be greater than the total observations of the variables. The second reason is that since one observation in this circumstance may yield multiple responses, the "standard assumption" of independence of rows and columns in the table is violated. Standard correlation analysis would therefore not be a valid option.

To overcome this issue we devised a new variable that counts the number of SCF models used by each respondent and classified no models as missing. Correlation analysis can also be performed for multi-response variables following Rao-Scott (1981), but this is not supported by SPSS. The higher the result of this new variable called SCF models, the more number of SCF models that are used. On average almost 3 models are being used by each respondent with a minimum of 1 and a maximum of 6. The new variable SCF models can now be read as an approximation of the intensity of the SCF usage by respondents. This new variable was then used to test the correlation with size, use of segmentation and the other

collaboration models. The analysis shows that there is a significance correlation between size, as well as the usage of segmentation models and the intensity of SCF usage (sign. of .035 and .023 respectively).

We have established that the usage of SCF is correlated to the usage of Kraljic. In this last part of our analysis we try to get an insight into whether segmentation also affects the choice of the SCF models to be used. We make an effort to link the four quadrants of the Kraljic matrix to the different SCF models. Using the structure of multi-response questions we asked the respondents what SCF models they would use for suppliers in each of the four quadrants. On an aggregated level the respondents linked SCF models most often to strategic suppliers (44%), followed by bottleneck (28%), leverage (16%) and routine (12%).

To further understand the selected SCF model per quadrant we reorganized the 11 multi-response questions into one variable called SCF choice. Firstly, each combination of the Kraljic quadrants was recoded into a new value. Based on the weighing of each combination the new values were divided into three categories: risk, neutral, and profit. If, for example, the SCF model would be linked to strategic, bottleneck and leverage suppliers we would classify this combination as more weighted towards risk (code 1) rather than profit when looking at the two dimensions of the Kraljic matrix. If the SCF model would be linked to bottleneck and leverage only we would classify the combination as neutral (code 2). And if the SCF model is linked to routine and leverage it would be classified as profit (code 3).

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We established that only three variables have a mean close to 2, a skewness below 1, and a stronger negative kurtosis: dynamic discounting, VMI and reversed factoring. This can be interpreted that these three models are more frequently used across all quadrants of Kraljic. The other SCF models all show means closer to 1, high skewness and high kurtosis indicating that these models tend to be used in those categories where the risk impact is higher, which corresponds to the strategic and bottleneck quadrants in the Kraljic matrix.

This suggests grouping SCF models into two categories. One category we will call strategic and includes equity, long-term loans, contractual profit/risk sharing and advance payments. These models are used more with suppliers that have a high risk impact on the buying firm. The second category we will call operational and includes dynamic discounting, VMI and reversed factoring which are used across all suppliers.

We would expect significant differences between these two groups in terms of characteristics, applications, transaction costs, employability, capital providers, geographic use and so on. This will be interesting for further research but could not be taken up within the scope of this exploratory research paper.

4. Conclusion

Supply chain finance is clearly on the agenda of companies. A growing group of researchers are becoming inspired to study this new field on the interface of supply chain management and corporate finance.

From the literature we learn that supplier segmentation is important for buyers in collaboration models across the supply chain. We also show that many companies use supplier segmentation models in dealing with their suppliers.

Positioning supply chain finance as a collaboration model, we find that companies use segmentation models to select SCF solutions for their suppliers. SCF solutions are offered in the first place to suppliers where the supply risk is perceived as high.

We have built a case for further categorizing SCF solutions in what we call operational and strategic SCF solutions. Operational SCF solutions include reversed factoring and dynamic discounting. These are applied across all supplier groups with the main aim to lower working capital and costs. Strategic SCF arrangements include loans and inventory finance employed for strategic suppliers with the main aim to mitigate risk.

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With this exploratory paper we provide insights for academia on the categorization of supply chain finance that can further guide more comprehensive studies on the application of SCF solutions.

The practitioner gets a better understanding of supply chain finance as a collaboration model with its suppliers as part of its range of supply chain management collaboration models. The categorization of SCF solutions can assist the practitioner in selecting and adopting the appropriate SCF solution with its suppliers.

The most important limitation of this study is the limited number of companies actually using SCF solutions compared to the total number of respondents (56 out of 418). The survey was specifically designed for this research and the collected data served well the purpose of an exploratory study, but future research should follow up these initial findings, employing a more rigorous approach, including a focused development of the dependent, independent and control variables. This will allow for an improved operationalization of the constructs and could lead to more explanatory power.

Future research could look into creating a more exhaustive list of SCF solutions under the provided definition. This could further strengthen the definition of supply chain finance which is important for the growth of this field of research.

As the usage grows it will then be interesting to learn more about the reasons companies have for choosing certain SCF solutions in certain situations. Why would a company, for example, choose to use dynamic discounting instead of reversed factoring, or long-term loans instead of an equity stake?

Lastly, it would be interesting to also look at the prioritization of suppliers or supplier segmentation when buyers implement SCF solutions.

We firmly believe in the growing usage of SCF models by companies worldwide that will open up many more research topics in the years to come.

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