Exploring supply chain finance along different supply chain stages: a case-based research in the agri-food industry

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Abstract

Purpose – Since 2008's financial crisis, attention toward supply chain finance (SCF) has increased. However, most research investigates SCF considering single supply chain (SC) stages or buyer–supplier dyads and focuses on a single SCF solution. It is important to see how different solutions are adopted at different SC stages, by actors with different financing needs. This study aims to analyze SCF at different SC stages, to understand why different solutions are implemented at different SC stages and the contingency factors (regulation, SC stage, product category and size) influencing their adoption.

Design/methodology/approach – The paper is based on multiple exploratory case studies in the Italian agri-food industry, considering firms distributed at different SC stages and adopting multiple SCF solutions. The paper exploits a contingent approach (Sousa and Voss, 2008) to analyze how contingent factors influence SCF adoption at different SC stages.

Findings – Findings explain how and why different SC stages (producer, cooperative, processor and retailer) implement different SCF solutions (reverse factoring, dynamic discounting, inventory finance and Minibond), describing contingency variables' impact on their adoption.

Originality/value – To the best of the authors' knowledge, the research is original in its description of SCF at different SC stages, considering different SC actors' drivers and barriers, and questioning the importance of a coordinated approach in SCF adoption along an entire SC. Moreover, the paper adopts a contingent approach, contributing to SCF research, seldomly based on theoretical lenses.

Keywords Supply chain finance, Agri-food industry, Reverse factoring, Dynamic discounting, Inventory finance

Paper type Case study

1. Introduction

Supply chain finance (SCF) is the set of models aiming to optimize firms' financial performance and working capital within a supply chain (SC), leveraging on relationships among the parties in the network (Gelsomino *et al.*, 2016).

The SCF concept raised after the 2008 financial crisis and it kept growing, returning to prominence in 2020 due to COVID-19 (Moretto and Caniato, 2021).

Despite the attention received by SCF, few studies consider the involved stakeholders' different perspectives (Bals, 2019), the different SC stages' financial needs and which solutions might solve them (Moretto and Caniato, 2021). Most literature analyzes SCF focusing on a single firm or buyer-supplier dyad, without considering their stage along a SC, while different SC stages might have different financial needs and objectives to pursue. For example, usually, retailers are cash-rich, large manufacturers have higher working capital and more need for financing, but also good access to funding, while small upstream suppliers have high financing needs and difficulties in obtaining loans (Miller and Jones, 2010). Besides, some small- and medium-sized enterprises (SMEs) suffer because their customers pay late (Iotti and Bonazzi, 2015), while others bear high inventory levels, thus requiring different solutions (Van Bergen *et al.*, 2019).

Literature often considers a single SCF solution (mainly reverse factoring [RF], Lekkakos and Serrano, 2016; Tanrisever *et al.*, 2012) or compares SCF solutions at a single SC stage (Gelsomino *et al.*, 2019). Moreover, according to a contingency approach (Sousa and Voss, 2008) beyond the SC

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stage other contingency variables (e.g. size, regulation and products involved) can influence SCF adoption.

This paper aims to fill the gap in the literature regarding SCF implementation with a SC perspective, analyzing contingency variables' impact on SCF solutions' adoption, and their adoption drivers and barriers at different SC stages. Thus, the paper addresses the following research questions:

RQ1. Why do different supply chain stages use different SCF solutions?

RQ2. How do contingent variables influence the adoption of SCF along a supply chain?

To pursue this goal, a single sector was considered to facilitate the comparison of different stages avoiding sectorial variance; therefore, we focused on the agri-food industry. This choice is motivated by the characteristics of its diverse production processes and food products, generating different financing needs at different SC stages (Tsolakis *et al.*, 2014; Van Bergen *et al.*, 2019), which make SCF's adoption relevant at different stages. Furthermore, despite several contributions about SCF importance, its potential in the agri-food industry is not properly investigated, and SCF literature should focus on specific industries to grasp their peculiarities (Xu *et al.*, 2018).

The paper exploits an exploratory case study methodology, developing 16 case studies, considering agri-food firms at different SC stages and financial institutions.

The main contributions are related to understanding why and how different SCF solutions (namely, RF, dynamic discounting [DD], inventory finance [IF] and Minibond) are adopted along the agri-food SC, composed of four main stages (i.e. producer, cooperative, processor and retailer), together with the contingency variables' impact.

The rest of the paper is organized as follows. In Section 2, the literature review is presented. Section 3 describes the methodology; then, the results are presented (Section 4) and discussed (Section 5). Section 6 presents the contributions and future research opportunities.

2. Literature review

2.1 Supply chain finance solutions

SCF includes multiple solutions involving an ecosystem of players. Literature analyzes SCF from a finance-oriented and an SC-oriented perspective (Gelsomino *et al.*, 2016). The financial perspective considers SCF solutions that have a financial focus limited to payables and receivables (Guida *et al.*, 2021) and are offered by financial providers (Bals, 2019). Within this perspective, literature considers, for example, RF (Caniato *et al.*, 2016). The SC-oriented perspective, instead, also focuses on inventories, stresses the relevance of collaboration (Guida *et al.*, 2021) and does not mandatorily involve financial providers (Bals, 2019), therefore also including solutions such as IF and DD (Gelsomino *et al.*, 2019).

This paper assumes an SC-oriented perspective and will consider SCF solutions that are most studied (Gelsomino *et al.*, 2019; Guida *et al.*, 2021) and applicable to the agri-food industry:

- *Reverse factoring*: a form of factoring in which a high credit rating buyer activates a partnership with a financial institution that purchases suppliers' account receivables, which benefit from their buyers' credit rating (Caniato *et al.*, 2016).
- *Dynamic discounting*: solution allowing the invoices' dynamic settlement in a buyer–supplier relationship. Suppliers provide the buyer with a discount on the nominal value of the invoice proportional to the days of advance payment (Gelsomino *et al.*, 2019).
- *Inventory finance*: line of credit or short-term loan to finance a company's inventory (Hofmann, 2009; Bonzani *et al.*, 2018). There are two IF types, differing in the role of the 3PL involved in the solution. In the IF Traditional model, the 3PL provides only logistic services, while the financial provider offers the loan (Hofmann, 2009). In the IF Control model, the 3PL provides both logistic and financial services: the 3PL buys goods from a manufacturer and retains ownership during shipping and warehousing, before selling them to the manufacturers' customers, allowing for inventory derecognition from the manufacturer's balance sheet (Bonzani *et al.*, 2018).
- *Minibonds*: debt securities issued by private industrial companies, for an amount lower than €50m (Altman *et al.*, 2018). Although Minibonds do not strictly belong to the set of SCF solutions, they facilitate SMEs' access to capital, and there are numerous implementations in the agri-food industry. Indeed, the inventory of high-value products with long aging periods (such as wine, cheese and ham) is used as collateral (Osservatorio Minibond, 2020), therefore Minibonds are used as a form of IF.

Although SCF entails many solutions, practitioner reports (Extra *et al.*, 2018) and academic literature (Lekkakos and Serrano, 2016) agree that RF is the most used in the industry, and few studies considered multiple SCF solutions at different SC stages (Caniato *et al.*, 2019). For example, Van Bergen *et al.* (2019) compared different financing schemes on a three-echelon SC, and Gelsomino *et al.* (2019) considered RF, DD and IF, to understand how a buyer decides which solutions to offer to suppliers. However, the approach implemented is mainly analytical, while more empirical research is needed. Moreover, most literature describes SCF focusing on the buyers' viewpoint (Dello Iacono *et al.*, 2007; Extra *et al.*, 2018); only some preliminary attempts to consider the suppliers' viewpoint emerged (Martin and Hofmann, 2019; De Goeij *et al.*, 2021). Different SCF solutions need to be explored, analyzing why and how firms implement them and which is more appropriate for different SC stages. The agri-food industry, characterized by fragmented SCs with different financial and operational needs at different SC stages, represents a suitable setting for this analysis.

2.2 Supply chain finance in the agri-food industry

The agri-food industry is characterized by production seasonality, long production cycles and uncertainty in products' quantity and quality due to weather conditions (Tsolakis *et al.*, 2014; Van Bergen *et al.*, 2019), which also causes price fluctuations (Welch *et al.*, 2011). Cyclicity and long production cycles lead to less frequent and seasonal payments, impacting upstream SC stages (Van Bergen *et al.*, 2019). These stages also face high average delays in collecting commercial credit from distributors and retailers (Iotti and Bonazzi, 2015) while

downstream in the chain firms have stable financial conditions and exert their bargaining power above their suppliers (Cho *et al.*, 2019) also extending payment terms, despite recently new regulation was introduced to cope with this issue (Late Payment Directive 2011/7/EU, explained in Table 3). For products involving long inventory cycles, stocks are held by farmers and intermediate processing plants, causing high holding costs (Van Bergen *et al.*, 2019). Upstream SC stages are generally constituted by smaller players. Financial institutions ask for proper collateral to mitigate the risk, and although some SMEs have profitable businesses (Abbasi *et al.*, 2018), their assets are mainly represented by accounts receivables, inventory and equipment (Hanedar *et al.*, 2014) and firms are not always able to provide the amount of collateral required (Ruete, 2015). Moreover, SMEs' owners are not always highly educated in finance and might be unaware of different credit sources (Abbasi *et al.*, 2018). Finally, loans granted to SMEs have short maturity periods and cannot cover significant investments (Abbasi *et al.*, 2018; Ardic *et al.*, 2011).

Despite the potential relevance of SCF adoption in the agri-food industry (Van Bergen *et al.*, 2019), limited studies have been conducted in the industry (Xu *et al.*, 2018).

Literature mentions SCF mostly within the Value Chain Finance context, which includes financial services in the agri-food industry involving different SC players, but differs from SCF as it is implemented in developing countries and has a strong nonprofit orientation (Van Bergen *et al.*, 2019). Given the agri-food industry's nature, authors investigating SCF also started to consider sustainability. The industry is fragmented and composed of SC actors (i.e. small farmers) struggling to access financial resources (Miller and Jones, 2010), so SCF can potentially support those players (Van Bergen *et al.*, 2019) and improve their working and living conditions. For example, Zhuo *et al.* (2018) and Bal and Pawlicka (2021) investigated the impact of SCF on environmental, social and economic sustainability.

2.3 Supply chain finance drivers and barriers

Previous studies analyzed SCF adoption drivers and barriers in different ways. For example, Hofmann and Belin (2011) defined the external enablers and barriers toward SCF adoption starting from a literature review. More and Basu (2013) identified the main barriers through a literature review and conducting a survey in India, finally using a single-case study to understand the relationships among the emerged challenges. Liebl *et al.* (2016) analyzed RF barriers, from the buyer's, the supplier's and the bank's viewpoints, through a literature review and interviews.

Starting from the definition of the main "drivers and enablers of SCF" by Hofmann and Belin (2011), integrating them with previously cited relevant contributions in the SCF field (Gelsomino *et al.*, 2016; Caniato *et al.*, 2016), and with the main agri-food financial issues (Tsolakis *et al.*, 2014; Van Bergen *et al.*, 2019), drivers to SCF adoption are defined (Table 1).

Starting from the definition of the main "SCF challenges" by More and Basu (2013) and integrating them with previously cited relevant contributions in the SCF field (Wuttke *et al.*, 2013; Hofmann and Belin, 2011), SCF adoption barriers are defined (Table 2).

Table 1 SCF drivers

Group of drivers	Driver	Description	Reference
Supplier continuity	Bankruptcy risk of suppliers	Manage and reduce suppliers' risks, to avoid their bankruptcy	Hofmann and Belin (2011); Gelsomino *et al.* (2016)
	Need to assure quality	Financially help suppliers to guarantee supply quality and continuity	Caniato *et al.* (2016)
Long cash-to-cash cycle	Payment terms	High days sales outstanding (DSO) and/or low days payables outstanding (DPO)	Hofmann and Belin (2011); Caniato *et al.* (2016)
	Level of stock	High days inventory holding (DIH)	Van Bergen *et al.* (2019)
Level of liquidity	Lack of liquidity	Need for liquidity faced by firms	Hofmann and Belin (2011)
	Lack of access to financial services	Lack of adequate access to financial services at reasonable rates	Miller and Jones (2010)
	Exploit the excess of liquidity	Need to exploit and remunerate liquidity excess of a cash-rich firm	Gelsomino *et al.* (2016)
Features of the product	Long production cycle	Long lead time between the start of the production and the sales to the final customer	Tsolakis *et al.* (2014); Van Bergen (2019)
	Lack of collateral	Lack of traditional assets to be used as collateral to obtain loans	Ruete (2015); Abbasi *et al.* (2018); Hanedar *et al.* (2014)
	Short maturity period	Situation in which a loan is granted for a shorter period than the requested time	Abbasi *et al.* (2018); Ardic *et al.* (2011)
SC Sustainability	Social and economic sustainability	Increasing the sustainability of the supply chain according to an economic and social viewpoint	Zhuo *et al.* (2018); Zhan *et al.* (2018), Jia *et al.* (2020); Tseng *et al.* (2021)

Source: Authors' own creation

Table 2 SCF barriers

Barrier	Description	Reference
Knowledge about SCF	Lack of knowledge and training about SCF	Abbasi *et al.* (2018); More and Basu (2013); Hofmann and Belin (2011)
Collaboration and visibility	Lack of collaboration among different firms involved in the SCF solution	More and Basu (2013)
Technological barriers	Paper-based manual processes and poor visibility on the goods movement in the organizations	More and Basu (2013); Hofmann and Belin (2011)
Regulatory barriers	Law and regulatory barriers slowing down SCF implementation	Wuttke *et al.* (2013); More and Basu (2013)
Macro-institutional challenges	Geographical, cultural and language differences between parties involved	Wuttke *et al.* (2013); More and Basu (2013)
Lack of high volumes	Small transaction volumes and/or low transactions frequency	Guida *et al.* (2021); Gelsomino *et al.* (2019)

Source: Authors' own creation

Despite several authors dealing with SCF drivers and barriers, they mostly focused on SCF in general, without considering different SCF solutions (Hofmann and Belin, 2011). When papers analyzed in detail a specific SCF solution, they generally focused on RF only (Liebl *et al.*, 2016). Moreover, previous research generally focuses on the buyer–supplier dyad (Liebl *et al.*, 2016, who also considered the financial institution viewpoint), but there is the need to consider different SC stages. Finally, these variables are often industry-specific, but few studies analyzed SCF adoption in specific domains (Xu *et al.*, 2018).

2.4 Contingency theory in supply chain management and supply chain finance

Contingency theory suggests that organizations adapt their structure and characteristics to the changing context in which they operate, to fit with it and improve their performance (Sousa and Voss, 2008). This theory was widely adopted in management research, and recently gained relevance in the supply chain management (SCM) literature to explain under which contextual conditions managerial choices are effective (Sousa and Voss, 2008). Within SCF, for example, Ronchini *et al.* (2021) adopted a contingency approach to explore the contingent variables fostering asset-based lending solutions' adoption, and Moretto and Caniato (2021) used this theoretical lens to explore the SCF role in SC recovery from COVID-19.

The agri-food industry presents specific context-related characteristics, suggesting to adopt a contingent approach to explore the implementation of different SCF solutions along the SC. Contingent variables potentially impact SCF adoption along the SC (Section 2.2), are summarized in Table 3.

2.5 Research framework

Starting from the research questions and variables identified in the literature, a research framework (Figure 1) was built to explain the logical connection between them.

3. Methodology

3.1 The sample

Given the topic's novelty, an exploratory case study approach (Yin, 1984) was adopted. The unit of analysis is the SC stage adopting and/or offering to suppliers a SCF solution (e.g. a retailer offering RF to suppliers, a processor/producer adhering to a RF offer and a processor implementing IF).

The sample (Table 4 and Figure 2) covers all four agri-food SC stages. We included firms at different SC stages, and financial providers, asking them to describe at which SC stage their SCF solutions are adopted. Financial institutions involved in the sample have a long experience in the agri-food industry, working with actors at different SC stages. The other selected firms belong to the agri-food sector, but they are not necessarily linked by commercial transactions. Indeed, our aim is to consider firms at different SC stages, with their upstream/downstream relationships. The sampling strategy performed is useful to grasp the diversity brought by different SC stages, product categories and SCF solutions implemented, fitting the research goal. Moreover, this methodological approach was already successfully implemented by studies analyzing different SC stages in the agri-food industry (Golini *et al.*, 2017; Leòn Bravo *et al.*, 2018).

Selected interviewees cover mainly procurement, finance or administrative roles, and we selected roles that were responsible for managing the SCF solutions. We considered solutions both successfully implemented and whose implementation had not succeeded or that were just under evaluation, because they were deemed relevant to grasp information about adoption drivers and barriers and about the contingency variables.

The sample developed is heterogeneous according to SC stages, product categories and size, consistently with the research goal. On the other hand, the sample is homogeneous per industry considered and attention to the SCF domain.

3.2 Data collection

Primary data were collected through interviews, that followed a semi-structured interview protocol covering the research framework (Appendix 1) and were conducted face-to-face or via phone calls. At each interview, at least two researchers were involved, to avoid information loss and bias in the answers' perception.

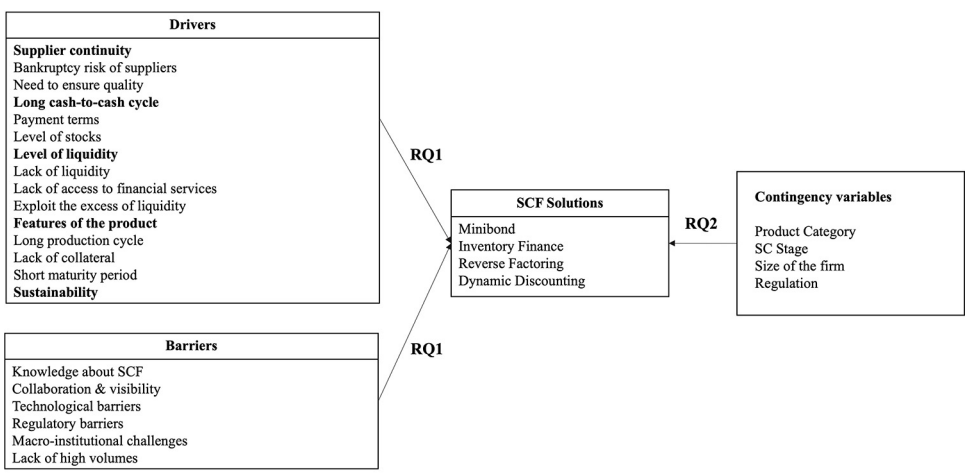
During the interviews, the company was asked to present all the SCF solutions implemented, illustrating their goals and the goals of the counterpart involved (either supplier or customer). For each interview, the questions composing the semi-structured protocol were repeated for each of the SCF

Table 3 Contingent variables

Contingency variable	Description	Sub-variables	Reference
SC stage	The main agri-food SC stages	Producer: farmers and growers Cooperative: aggregations of producers providing members with shared services and fair economic conditions Processor: actors performing food processing to transform raw materials into finished products Retailer: actors belonging to the distribution sector	Tsolakis *et al.* (2014); Cagliano *et al.* (2016); Bonazzi and Iotti (2014)
Size of the firm	Size of the firms, considering as SMEs all firms with an annual turnover lower than €50m and employing less than 250 people, or whose annual balance sheet total does not exceed 43 million	Large firms SMEs	EU recommendation 2003/361/CE
Product category	Food product categories	Aged: products characterized by long production cycles due to long ageing periods, during which their value increases Fresh: highly perishable products with short shelf-life Packaged: processed and packaged food products, with long shelf-life Frozen: packaged products that require to be kept at low temperature (cold chain), with long shelf-life Commodity: agricultural raw materials used by processors	Bonazzi and Iotti (2014); Smith (2007), Cagliano *et al.* (2016)
Regulation	Laws regulating payment terms in the agri-food industry	Late Payment Directive 2011/7/EU: imposes a maximum of 60 days of payment terms for enterprises. In Italy, in the agri-food industry, a derivative of this directive imposes a maximum of 30 days of payment terms for perishable products	European Commission

Source: Authors' own creation

Figure 1 Research framework



Source: Author's own creation

Table 4 Interviewed firms

		Interviewee role	Size	SC stage implementing SCF (UoA)	SCF sol. state	Category
Firm	A	Treasury Manager	Big firm	1. Producer/Cooperative – Processor (RF) 2. Processor (IFC)	1. Implemented 2. Under evaluation	Commodity
	B	CFO, Finance and Treasury Manager	Big firm	1. Processor (IFC) 2. Producer/Cooperative – Processor (RF)	1. Implemented and stopped 2. Implemented	Fresh, aged
	C	CFO	Big firm	1. Producer/Cooperative – Processor (RF) 2. Processor – Retailer (RF)	1. Evaluated and not implemented 2. Implemented	Fresh
	D	CFO, Credit Manager	Big firm	1. Producer/Cooperative – Processor (RF) 2. Processor – Retailer (RF)	1. Under evaluation 2. Implemented	Frozen
	E	Treasury Manager, Supplier Accounting Specialist	Big firm	1. Processor – Retailer (RF) 2. Producer/Cooperative – Processor (DD)	1. Implemented 2. Under evaluation	Packaged
	F	Administrative, Financial and Control Responsible	Big firm	Producer/Cooperative – Processor (DD)	Proposed but not implemented	Commodity
	G	Treasury and Finance Director	Big firm	Cooperative/Processor – Retailer (DD)	Implemented	Various
	H	CFO	Big firm	Producer/Cooperative – Processor (DD)	Implemented	Commodity
	I	Administrative Director	Big firm	Cooperative/Processor – Retailer (RF)	Implemented	Various
	J	CFO	SME	Producer (1.M, 2.IFT)	1.Implemented 2.Under evaluation	Aged
	K	Director	SME	Cooperative (M)	Implemented	Aged
	L	Product Manager	Big firm	Cooperative/Processor – Retailer (RF)	Implemented	Various
Fin. Inst.	M	Product Manager	–	1. Producer/Cooperative – Processor (RF) 2. Processor (IFT)	1. Implemented 2. Under evaluation	Fresh
	N	Trade Finance Specialist, Product Manager	–	Producer/Cooperative – Processor (RF)	Under evaluation	Not specified
	O	Marketing Manager	–	Producer/Processor (IFT)	Implemented	Aged, frozen
	P	Head of Structured Trade Solutions	–	Processor (IFC)	Under development	Commodity

Source: Authors' own creation

solutions presented by the interviewee. Overall, 16 interviews were performed. After the interviews, if necessary, additional calls were organized to complement the information, or e-mails were shared with the companies.

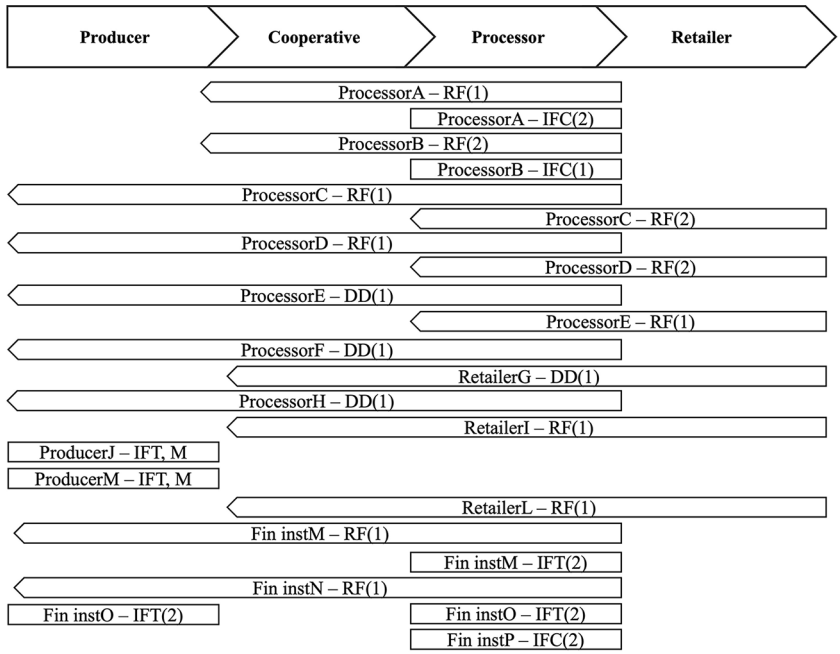
In addition to data collected through direct interviews, information was triangulated with additional sources, including companies' balance sheets, documents about the SCF solution's use and the companies' websites. In addition, some interviewees presented their SCF initiatives at practitioner-oriented events, and these insights were also used to triangulate the information.

3.3 Data analysis

Interviews were recorded, transcribed and coded: for the within-case analysis, a mixed approach was used. First, informants' words were organized and coded following the variables emerging from the literature review composing the research framework. Then, an inductive approach was used: given the semi-structured protocol implemented, during the interviews new variables emerged (Table 5), and they were coded *in vivo*.

After the coding, all the interviews regarding the same SC stage and the same SCF solution were compared through a cross-case analysis; variables were compared to highlight patterns, similarities and differences (see Tables A2–A5 in Appendix 2). Following the selected unit of analysis, when SCF solutions considered involved a buyer–supplier dyad (i.e. RF and DD), we jointly considered both the buyer's and the supplier's perspectives. Comparing cases considering the same SC stage and SCF solution was useful to manage the sample heterogeneity in terms of size and SCF solution adopted.

Figure 2 Sample representation



Source: Author's own creation

Table 5 New variables emerged

Macro variable	Variable	Description
Drivers	Need to collaborate with a relevant customer	Collaborating with a relevant customer offering the solution, which is generally strategic and/or relevant from a turnover viewpoint
	Balance sheet composition	Improving balance sheet's composition
Barriers	Uncertain marketability	Uncertain marketability of products used as collateral in IF solutions
	Finding a financial institution willing to take the risk	For the implementation of innovative SCF solutions, difficulties in finding a financial institution willing to take the risk and collaborate on the solution
	Complexity and time efforts	Implementing some SCF solutions might be complex and require time efforts and investments
	Cultural change	Cultural change required to implement a SCF solution (i.e. fear of change, distrust toward new financial instruments and new financial institutions)
Contingency variables	Regulation about the nonpossessory pledge	Nonpossessory pledge defines that the pledged asset in a SCF solution (e.g. IFT) can be used by the company in its operations after the financing was received.

Source: Authors' own creation

The cross-case analysis was performed by two researchers independently; results were compared, and in case of differences, they were shared with a third researcher until reaching agreement.

The results were shared with companies interviewed for validation, then presented in a conference with around 60 SCF experts, to get feedback and comments about their validity.

3.4 Qualitative research rigor

During the case studies development, first, to provide construct validity, we used different sources of evidence triangulating information coming from interviews with secondary sources, such as companies' websites, balance sheets and available reports and news. Second, the within-case report for the case studies was reviewed by interviewees and by peers for integrations or corrections. Third, we kept track of and thoroughly explained each step of the data collection and analysis process, to build a clear chain of evidence. External validity is enhanced by the detailed framework's constructs' description, and even variables related to the specific agri-food context (e.g. long production cycles), can be generalized to

other sectors, with the product category being the only industry-related variable. Similarly, case studies were developed in Italy but, except for some regulatory-related variables, results can be generalized to the international context. Finally, reliability is entrusted by developing a case study database, where all the relevant information related to case studies performed (e.g. transcripts, secondary material and case study reports) was stored.

4. Findings

Empirical data confirmed that different SC stages adopt different SCF solutions, influenced by different contingent variables, drivers and barriers. Table 6 shows which solutions are implemented at different SC stages. The following paragraphs describe the main findings for each SC stage. Producers and cooperatives show very similar behaviors and are presented together.

4.1 Producers and cooperatives

4.1.1 Inventory finance and Minibond

Producers and cooperatives adopt Minibonds and Traditional IF to cope with their lack of liquidity, and with the lack of access to financial services.

Dealing with products with long production cycles, liquidity is trapped in stocks, increasing the NOWC. In the sector, this happens mostly with aged products: for example, Firm J stated "warehouse is large and composed of a huge wine stock that is kept ageing for minimum four years," and Firm K, a cheese cooperative producing Parmigiano Reggiano, a PDO product, confirmed that their cheese needs to age between 12 and 36 months. In the case of aged products, because their value increases over time, the stock can be used as collateral, also overcoming issues related to lack of collateral. Thus, these solutions were suitable to deal with aged products, while Traditional IF is also appropriate for commodities, being nonperishable goods.

Minibonds are also useful for producers to face the short maturity period of bank loans: Firm J stated:

> For banks, it is difficult to understand that our warehouse cannot be financed with short-term loans [. . .] since a new field becomes a productive vineyard after three years, and banks are not willing to accept three years of depreciation.

The main obstacle to SCF at this SC stage is the lack of knowledge, which according to Abbasi *et al.* (2018) is peculiar to SMEs, as the firms interviewed. The other barrier emerging is the cultural change needed to adopt these solutions, which is caused by a general distrust toward financial instruments, different from traditional loans.

4.1.2 Reverse factoring and dynamic discounting

Driven by the lack of liquidity and lack of access to financial services, according to informants at the processor and retailer stages, upstream SC stages can also adhere to RF and DD offered by their buyers. RF and DD are offered to decrease suppliers' DSO, while maintaining or increasing buyers' DPO in the case of RF, confirming the need for payment terms optimization for upstream SC stages, in particular when dealing with smaller firms. Table 7 summarizes these results.

4.2 Processors

4.2.1 Reverse factoring offered to suppliers

The first solution identified at this stage is RF: processors can both offer it to their suppliers and adhere to a RF program offered by retailers.

Both big and small suppliers can be onboarded on their RF program, even if some interviewees underlined the higher relevance of RF for smaller suppliers, who could access easier and cheaper financial resources. Firm C, for example, stated:

> Access to credit is difficult for some of these suppliers [. . .] The goal was to find a solution that could bring suppliers savings in interest rates paid [. . .] using our credit rating.

Offering RF, processors, while generally having bargaining power over their suppliers, adopt a cooperative approach aiming to help their suppliers, which face a lack of liquidity and lack of access to financial services, and generally have high DSO. Therefore, processors usually exploit this solution to optimize payment terms, decreasing suppliers' DSO while maintaining or increasing their own DPO.

In other cases, when payment terms required by suppliers are short, as for fresh products, with short payment terms imposed by law (i.e. Late Payment Directive), or for commodities that must be paid at sight, the main driver is the need for increasing the processor's DPO. This was Firm A's case, a coffee processor that offered RF to some of its international suppliers asking for payment at sight. Processors might offer RF to financially help suppliers to grow and develop their business, to be able to guarantee supply quality and continuity. Moreover, sustainability confirmed to be a driver to offer the solution. For example, as the coffee processor firm A states, "being sustainable means also to support suppliers financially."

The main barriers encountered in RF implementation between processors and producers or cooperatives are represented by the lack of knowledge regarding the solution,

Table 6 SCF adoption along the SC

	Producer	Cooperative	Processor	Retailer
Minibond	Implemented	Implemented		
IF Traditional	Implemented	Implemented	Implemented	
IF Control			Implemented	
RF	Adherence to buyer's offer	Adherence to buyer's offer	Adherence to buyer's offer Offered to suppliers	Offered to suppliers
DD	Adherence to buyer's offer	Adherence to buyer's offer	Adherence to buyer's offer Offered to suppliers	Offered to suppliers

Source: Authors' own creation

Table 7 Producers and cooperatives drivers and barriers

		M Activator	IF Activator	RF User	DD User
Drivers	Lack of liquidity	X	X	X	X
	Lack of access to financial services	X	X	X	X
	Long production cycles	X	X		
	High NOWC	X	X		
	Lack of collateral	X			
	Short maturity period	X			
	Payment terms optimization			X	X
Barriers	Lack of knowledge	X	X	X	X
	Technological barriers			X	X
	Cultural change	X	X		X
	Lack of high volumes			X	

Source: Authors' own creation

both of suppliers and less frequently of processors, and by technological issues generally faced by small suppliers. These issues, blocking small suppliers in upstream SC stages from adhering to RF, represented a relevant obstacle also for large processors in the onboarding phase. Moreover, in dealing with foreign suppliers, macro-institutional challenges might arise, related to regulations (i.e. in some countries it is not possible to implement this SCF solution) and language and cultural differences. To conclude, if the transactions between buyer and supplier do not involve high volumes or if transactions are not frequent, the solution is not worth to be implemented. This is relevant in the agri-food sector since the characteristics of some products (i.e. production seasonality) make them not suitable to be involved in RF.

4.2.2 Reverse factoring offered by retailers

Literature often presents RF as proposed mainly to SMEs. In this case, we identified a slightly different approach: big and creditworthy processors face financial issues just in isolated cases (i.e. Firm C considered the possibility of reducing its DSO by adhering to the retailer's RF program as a key driver), and their adoption drivers focus on bargaining power and collaboration. Indeed, a financially stable firm with good creditworthiness might accept to participate in a RF not to disappoint its customer and to strengthen their relationship. When this emerged, interviewees underlined that the customer was particularly relevant for their turnover and that being collaborative was their only driver as their rating was similar to the retailer's one. For example, Processor E declared "the retailer who proposed the solution represents a big portion of our turnover, therefore we adapted to the solution proposed by the customer," and processor D stated: "The reason we adhere (to the program) is to be more cooperative. We realized it appealed to the client [. . .] and it counts a lot on our balance sheet." In both cases, there was a slight power unbalance in the hand of the retailers as they are among the most important in Italy and therefore strategic and highly impacting on Processors D and E's turnover. Thus, suppliers' size influences participation drivers, and bargaining power plays an important role in the onboarding decisions of large processors. However, also Processors D and E are relevant for retailers as they need their products on their shelves, and therefore, also the need to collaborate emerges. Finally, processors might exploit RF to improve their balance sheet by reducing receivables.

Large processors taking part in RF generally do not face any relevant obstacle: just Firm E, a bakery processor, was slowed down by the cultural change required and by technological issues.

4.2.3 Dynamic discounting offered to suppliers

Processors can also be involved in DD, offering it to their suppliers and adhering to programs offered by retailers.

When offering it to their suppliers, processors find in DD a proper solution to profitably remunerating their liquidity excess, while financially helping smaller suppliers reduce their payment terms, and overcome their lack of liquidity and access to financial channels. This was relevant for cash-rich processors and for processors having liquidity peaks at certain times of the year due, for example, to sales seasonality. Similar to RF, the bargaining power is generally in the hand of processors, but a more cooperative approach emerged. Moreover, for firms that are particularly concerned with sustainable practices, social sustainability confirmed to be a driver also to implement DD: Firm F, an organic products' processor, wanted to implement DD:

> Not so much because it was an advantage for us. Because our mission is to bring more value to our farmers/producers, who are at the beginning of our value chain, and I analyzed this thing [. . .]. We also proposed it for sustainability, to help them.

The main obstacles faced are technological issues and suppliers' lack of knowledge regarding the specific solution. Together, these two barriers caused the failure of some programs' implementations, as for Firm F, where the two barriers together prevented the firm from developing DD. Another barrier emerging is the cultural change: because the solution is particularly innovative, agri-food firms, specifically small suppliers, showed a general distrust toward its use.

4.2.4 Dynamic discounting offered by retailers

Processors can also adhere to DD offered by retailers. In this case, according to what informants at the retailer level said, processors in financial difficulty might exploit the solution to have access to alternative financial channels, reduce their DSO and overcome the lack of liquidity.

4.2.5 Inventory finance

Finally, processors can implement IF. IF Control, which allows derecognizing inventories from the balance sheet, can be implemented mainly by large firms as it requires high volumes to allow the creation of a Special Purpose Vehicle by the LSP and the financial provider.

The main adoption driver, common to all SCF solutions, is the liquidity need. Moreover, processors choose IF to deal with products characterized by long production cycles and with a high NOWC caused by stocks, represented by commodities, aged or frozen products. For example, Firm B adopted IF Control to derecognize its inventory of Prosciutto di Parma, a PDO product needing to age between 12 and 36 months. Even if both IF models are available to large processors, the IF Control model allows for warehouse derecognition, and it is suitable to decrease DIH and NOWC.

The uncertain marketability is among the main barriers faced by processors dealing with IF Traditional solutions: a financial institution must be sure to be able to resell the goods pledged, and if the products' marketability is not granted, problems arise in managing the risk of not selling inventories. Moreover, the lack of regulation regarding the nonpossessory pledge can impede the IF Traditional development. Finally, processors can face obstacles related to the solution's complexity and to the time efforts required. Table 8 summarizes these results.

4.3 Retailers

4.3.1 Reverse factoring and dynamic discounting offered to suppliers

Retailers offer RF to their first-tier suppliers, which are processors and sometimes directly cooperatives, possibly involving all food product categories except for commodities, representing a valuable solution to optimize payment terms. Suppliers can be large firms or SMEs, and different bargaining power balancing can influence their adhesion choice, as explained in Section 4.2.2. Similarly, they can offer DD to all their suppliers, theoretically involving all the product categories. As for processors, DD is generally offered by large firms and used by their smaller suppliers, and with the bargaining power unbalanced toward retailers, who anyway show a cooperative approach to SCF offering. For example, the Retailer G offers DD to its suppliers, but stated that it should be considered a valuable solution in particular by smaller ones, with higher liquidity needs:

> We saw it as a service to strengthen the link with our suppliers, because obviously this is mainly addressed to SMEs suppliers, it is difficult that food giants use this tool, maybe it is possible but I don't think this is the target.

For both solutions, retailers aim to financially help suppliers optimize payment terms, reducing suppliers' DSO without the need of decreasing their own DPO, to help suppliers overcome their lack of liquidity, and to provide them with alternative access to financing.

Retailers offer RF also to reduce suppliers' risk and to ensure supply quality and continuity: it provides financial stability to suppliers that in turn "will supply better and higher quality products, preferring us instead of someone else," specifies Firm I. Besides, Firm I, in response to COVID-19, empowered the program by involving more suppliers, showing support and inclusivity. Firm L instead offered more convenient interest rates to organic products' suppliers: this aimed both to foster their strategy to increase their offering of organic products and to support higher quality suppliers.

DD instead is usually chosen by retailers to exploit and profitably remunerate liquidity excess: they always have high cash availability, and DD can be a way to financially help suppliers while exploiting liquidity.

Table 8 Processors drivers and barriers

		IF Activator	RF Activator	RF User	DD Activator	DD User
Drivers	Lack of liquidity	X	X(suppliers)		X(suppliers)	X
	Lack of access to financial services		X(suppliers)		X(suppliers)	X
	Long production cycles	X				
	High NOWC	X				
	Lack of collateral					
	Short maturity period					
	Payment terms optimization		X		X	X
	Quality and continuity of supply		X			
	Sustainability		X		X	
	Collaboration with a relevant buyer			X		
	Balance sheet composition			X		
	Profitably remunerating liquidity				X	
Barriers	Lack of knowledge	X	X(suppliers)		X(suppliers)	X
	Technological barriers		X		X(suppliers)	
	Cultural change		X(suppliers)		X(suppliers)	
	Lack of high volumes		X			
	Regulatory barriers	X				
	Uncertain marketability	X				
	Finding a fin. Inst. Willing to risk	X				
	Complexity and time efforts	X				

Source: Authors' own creation

Implementing RF and DD, retailers usually do not face huge barriers, except for a lack of knowledge on the suppliers' side, particularly with the smallest ones. From the interviews emerged that the lack of knowledge is linked to cultural change: suppliers usually face a fear of change dealing with innovative financial instruments. Thus, it is more difficult for retailers to onboard small suppliers and implement SCF. Finally, for RF, the lack of high volumes exchanged confirmed to be a barrier. Table 9 summarizes these results.

5. Discussion

In the following paragraphs, the main drivers and barriers and the other contingencies variables impacting different SCF solutions' adoption at different SC stages will be discussed, considering the influence of SC stages as implicit throughout the analysis, as it was part of the unit of analysis.

5.1 SCF drivers and barriers and the influence of SC stages

Empirical data proved that different SC stages adopt different SCF solutions, following different drivers and barriers. RF covers the whole SC: downstream in the chain buyers offer it triggered by their suppliers' financial difficulties, to optimize payment terms ensuring SC continuity and sustainability. Something similar happens with DD, and the main discriminant among the two solutions is the willingness to exploit liquidity excess.

Moving upstream, financial issues become a driver to implement a SCF solution (i.e. Minibond, IF) and/or to adhere to a SCF program offered by downstream players (i.e. RF and DD).

IF and Minibond adoption is driven by stock-related issues, and although all the stages hold inventories, these solutions are mainly adopted upstream and at the processor level. A peculiar case is represented by IF Control, which is more helpful to solve stock-related problems thanks to the warehouse derecognition, but that requires higher investments and volumes, thus being available only to bigger players.

The most common barriers are related to the lack of knowledge, linked with distrust toward nontraditional financial solutions, and technological issues, that are generally faced in upstream stages. The lack of knowledge is an obstacle for upstream players both in the implementation of Minibond and IF and in the adhesion to RF and DD offered by their buyers. Simultaneously, they became difficulties for downstream players in onboarding suppliers. Some barriers are then more specific to single SCF solutions, such as the regulatory issues faced when dealing with IF Control solutions, generally faced by processors.

Results confirm what was stated in previous literature: the lack of knowledge and technology are among the main SCF barriers (More and Basu, 2013) and are particularly relevant for smaller companies (Abbasi *et al.*, 2018). The lack of liquidity and access to financial channels are mentioned as drivers of SCF adoption (Hofmann and Belin, 2011; Miller and Jones, 2010), as well as the need for ensuring supply continuity and quality (Caniato *et al.*, 2016). Long production cycles and high DIH drive the adoption of SCF (Tsolakis *et al.*, 2014), specifying the suitability of IF. However, this research adds value to previous research as it links drivers and barriers to SC stages and SCF solutions, explaining their connection in different SC stages.

Focusing on sustainability, downstream in the chain, firms perceive it as a driver toward SCF adoption. This was the case of the coffee processor A, which stated: "We are certified for having sustainable products, being sustainable and trying to be sustainable means also giving financial solutions to suppliers." Also, Firm F, talking about DD, said it wanted to offer it:

> To provide a service to suppliers, to farmers [. . .], not so much because it was an advantage for us. Because our mission is to bring more value to our farmers/producers, who are at the beginning of our value chain, and I analyzed this thing [. . .]. We also proposed it for sustainability, to help them.

For these firms, implementing SCF solutions is a way to improve the financial stability of their supply base to improve their living and working conditions, positively impacting the social SC sustainability. This confirms what was stated in the literature (Jia *et al.*, 2020; Tseng *et al.*, 2021), opening the possibility for future research to focus also on the environmental impact of SCF solutions. Moreover, the literature considers mostly the positive sustainable impact of RF (Zhan *et al.*, 2018), while our results open the possibility also for DD, and possibly other solutions, to improve SC sustainability:

Table 9 Retailers drivers and barriers

		RF Activator	DD Activator
Drivers	Lack of liquidity	X(suppliers)	X(suppliers)
	Lack of access to financial services	X(suppliers)	X(suppliers)
	Payment terms optimization	X	X
	Quality and continuity of supply	X	
	Risk of failure of suppliers	X	
	Profitably remunerating liquidity		X
Barriers	Lack of knowledge	X(suppliers)	X(suppliers)
	Cultural change	X(suppliers)	
	Lack of high volumes	X	
	Finding a fin. inst. willing to risk	X	
	Complexity and time efforts	X	

Source: Authors' own creation

P1. The implementation of RF and DD solutions, offered by downstream players to upstream ones, can be driven by the need to increase social and economic SC sustainability.

Proposition 1 states that sustainability, and specifically social sustainability, can be a driver toward SCF adoption (e.g., Jia *et al.*, 2020) and it contributes to the literature by positioning the driver downstream in the SC, more specifically at the processor level. Stronger processors, oriented to sustainability, see in it a driver to offer SCF solutions to their weaker suppliers, to improve SC sustainability.

Finally, from the analysis of drivers and barriers, the need for the concurrent use of multiple SCF solutions along the SC emerges as key to supporting the SC's financial performance. Our results showed that this already happens, but without coordination: SCF solutions are exploited in all the stages of the agri-food SC, not because of the initiative of a single leading actor, but rather thanks to the combination of multiple independent initiatives of different SC actors. This opens new questions about the potentialities of integrated use of SCF solutions along the SC, through initiatives guided by the focal companies targeting also upstream and downstream stages, beyond the first supply stage.

5.2 The influence of size on supply chain finance adoption

The adoption of different SCF solutions along the SC can also be influenced by the size of the companies involved which leads to unbalanced bargaining power.

Minibond and IF Traditional are more flexible, and can be adopted by producers, cooperatives and processors, also when size decreases. For IF Control, instead, the firm's size becomes relevant because of the higher investments needed. According to the literature, the implementation of RF and DD generally involves a large buyer and smaller suppliers (Gelsomino *et al.*, 2016). However, a peculiar case is represented by the implementation of RF between retailers and larger processors: as represented by the cases of Processor E and Processor D, bigger firms can adhere to RF programs to collaborate with relevant customers, driven by the bargaining power of their buyer rather than by real financial needs:

P2.1. The size of suppliers involved in a RF solution discriminates between different approaches: smaller suppliers adhere to cope with financial issues, while larger firms adhere for collaborative purposes, and bargaining power can influence their onboarding decisions.

P2.2. The adoption of IF solutions is influenced by the size of the player implementing it: the IF Traditional model can be implemented both by small and big companies, while the IF Control model can be implemented only by bigger firms.

Proposition 2.1 advances a contribution regarding the possibility for RF to also involve large suppliers and sheds light on the bigger suppliers' perspective, which is impacted by the retailers' bargaining power. Indeed, our results seem to confirm that buyers can limit the use of bargaining power when offering SCF with the aim to help smaller suppliers, as their objective is to financially sustain their SCs, while they leverage more their bargaining power when their objective is that of improving their financial performance (Caniato *et al.*, 2016; Cho *et al.*, 2019). However, the cases in our analysis, when considering the retailer and larger processors, represent a situation in which the buyer and suppliers need to put in place also a cooperative approach, balancing how bargaining power influences SCF adoption (Cho *et al.*, 2019), as the buyer needs the suppliers' product on the shelves and the supplier needs to sell to the most important retailers not to lose an important share of the market. Moreover, De Goeij *et al.* (2021) found that bargaining power can lead SMEs to accept unattractive SCF offers, while in this case, we found that also bigger suppliers can be driven by their buyer's bargaining power to accept SCF offers that are not unattractive, but that do not bring actual financial benefits to the supplier.

Proposition 2.2 contributes to the literature by analyzing how size affects the adoption of IF, expanding previous knowledge regarding the specific solution (e.g. Hormann *et al.*, 2009).

5.3 The influence of product categories on supply chain finance adoption

The different product categories with their features and financial needs are linked to different SCF programs. Aged products are a peculiar case: they need to be stocked ageing for long periods, when their value increases, generating high inventory levels. For this reason, they are considered suitable to be used as collateral in IF and Minibond. Because the value of products increases with ageing, products can then be sold at a higher value, thus repaying the loan, and still generating profits. Also, commodities and frozen products can be involved in IF, being nonperishable goods.

Dealing with fresh products, whose payment terms are imposed by law (i.e. Late Payment Directive), or with commodities that need to be paid at sight, RF is a useful solution for processors to optimize payment terms. Retailers offer RF potentially involving all product categories, except for commodities that they do not sell. DD instead seems to be suitable possibly for all product categories. However, RF and DD do not solve problems related to long production cycles, not representing the best alternative for aged products:

P3.1. Minibond and IF solutions are suitable for aged products, which are kept at stock ageing for long periods during which their value increases.

P3.2. RF is a valuable solution for processors to deal with short payment terms for commodities and fresh products.

P3.3. DD represents a viable solution for all the product categories, except for aged products.

Propositions 3.1–3.3 contribute to the literature defining how product categories influence SCF adoption, and which SCF solution can be more suitable for different food product categories.

5.4 The influence of regulation on supply chain finance adoption

Two specific regulations influence the adoption of SCF in the industry in Italy: the introduction of the Late Payment

Directive, specifically of Article 62, and the lack of regulation regarding the use of the possessory revolving pledge, which emerged from the interviews. The Late Payment Directive influences the adoption of RF at the processor and retailer level: the regulation imposes short payment terms to these actors, and to cope with the strict regulation, they can implement these solutions. For example, Firm C stated that they wanted to offer RF to cope with short payment terms imposed by law, and Firm G described how the introduction of this law strongly influenced the bargaining power logic in agri-food SCs, and offering RF, on top of the DD solution described, was a good way to cope with that.

Moving instead to the lack of regulation regarding the revolving nonpossessory pledge, it strongly influenced the adoption of IF Traditional models. For example, according to financial institution M, the lack of regulation on the use of the revolving nonpossessory pledge causes difficulties in developing this solution. Indeed, if regulation exists for some agri-food products (e.g. DPO Cheese), in other cases it is not allowed or the normative is unclear, becoming a disincentive to IF adoption.

6. Conclusion

SCF literature has grown over the years because the complexity of SCs requires a better link between financial and physical flows. Despite this growth, most of the literature focused on a single solution (generally RF), and limitedly considered financial and operational differences in adopting different SCF solutions at different SC stages. To increase our understanding of SCF, there is the need to simultaneously consider multiple SCF solutions and multiple SC stages. This paper aimed at addressing this gap, by studying why and how different SC stages adopt different SCF solutions.

The adoption of SCF solutions depends on specific characteristics of the company and the industry; for this reason, this paper focused on the agri-food industry, given its need for liquidity, the low willingness of the financial world to support the industry and the lack of studies about the implementation of SCF solutions in this industry.

Through the development of case studies in 16 companies, distributed at different SC stages and considering multiple SCF solutions, this paper identified the main solutions implemented by each stage, the main drivers and barriers, and the impact of contingency variables on these solutions.

6.1 Theoretical contributions

From a theoretical viewpoint, this paper contributes to filling a gap in the literature regarding the application of SCF with a SC perspective and exploiting a contingent approach, in multiple ways. First, by explaining which SCF solutions, among RF, DD, IF and Minibond, are adopted at different SC stages, considering producers, cooperatives, processors and retailers. This paper shows the need to simultaneously use multiple SCF solutions along the SC to really support the financial performance of the SC. Our results displayed that this already happens, due to the autonomous initiative of the various actors of the SC, but lacking coordination. SCF solutions are adopted and used in all four stages of the food SC, not because of the initiative of a single leading actor, but rather thanks to the combination of multiple initiatives. This is an original contribution, which goes beyond the usual expectations of SCF solutions adopted by the focal firm in the supply chain only.

Second, we provided a framework summarizing drivers and barriers to SCF implementation at different SC stages, demonstrating that it is not just a matter of selecting a solution: although previous literature analyzed SCF drivers and barriers, this paper focuses on the differences among different SCF solutions adopted at different SC stages.

Third, we provided some preliminary evidence of SCF use for sustainability purposes, as suggested by some authors, but still lacking confirmation. This is highly relevant, given the strong call for sustainability-oriented solutions in SCM literature.

Finally, focusing on the peculiarities of the agri-food industry, we also contributed to SCF literature in the specific sector by showing which solutions are more suitable according to the product category involved, considering aged, fresh, packaged, frozen and commodity. This is also relevant, given the lack of studies in this domain and the need to develop sector-specific knowledge, in line with the contingency perspective.

6.2 Managerial contributions

From a managerial viewpoint, this paper might represent the basis to overcome the lack of knowledge about SCF that emerged as a relevant issue in the specific industry, providing knowledge useful to train practitioners on the use of SCF solutions. Results might increase the understanding of SCF drivers, guiding managers in the adoption of SCF solutions, and barriers, to help them figure out which major obstacles might arise in SCF implementation. Moreover, this work might be helpful to broaden the decision-making process of managers analyzing the adoption of SCF solutions at a SC stage, increasing the awareness that different SCF solutions might be needed to cope with different financial issues at different SC stages and that the whole SC should be taken into consideration. This result is interesting as buyers are used to just partially considering the main drivers and barriers faced by the supplier; this paper could support actors to better understand the counterpart's perspective. Finally, the paper contributes to an increase in awareness of the need for coordination in the development of SCF solutions across different SC stages and the need of developing deep-tier SCF solutions.

6.3 Limitations and further developments

This paper bears some limitations that generate opportunities for future research. First, players belonging to different SC stages were interviewed, mainly including processors and retailers, while for firms at the producer and cooperative SC stages, it was possible to conduct fewer interviews. Despite information related to upstream actors being gathered through interviews with their customers, a future improvement could be to interview more representatives of upstream stages, to gather data directly from them. Moreover, we were not able to interview different players taking part in the same SCF program, and firms in our sample are not mandatorily linked by commercial transactions: a future improvement should be to focus on a single SC, where actors are involved in different SCF solutions and linked by commercial transactions, to

conduct an explanatory analysis and test the results presented. Because of the focus on the agri-food industry, another limitation relates to the generalizability problem: although most of the variables considered are industry-agnostic, the food product category variable and the financial characteristics of SC actors at different stages might be influenced by the nature of the industry. Therefore, future research should consider the possibility to investigate different industries.

Finally, this paper considers just first-tier SCF solutions, involving a buyer and its direct suppliers; given that findings proved that financial issues increase as we move upstream in the chain, future developments could consider deep-tier financing solutions, directly targeting multiple tiers.

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Appendix 1. Semi-structured interview protocol

In Table A1, the macro-questions guiding the semi-structured interview protocol were reported, explaining which RQs they are referred to, and the main variables considered and some examples of follow-up questions.

Table A1 Interview protocol

RQ	Main question (for each SCF solution)	Variable considered	Following questions
RQ2	Do you use any SCF solutions? If yes, can you describe it in detail?	SCF solutions	How long has this solution been implemented?
RQ2	Which are the main actors involved in this solution?	SC stage	Who proposed the solution?
RQ1/RQ2	Which are the categories and products involved in this solution?	Product categories	
RQ1	Why did you choose to implement a SCF solution?	Drivers	Why did you choose to implement this specific SCF solution?
RQ1	Which were the main barriers that you faced when you implemented SCF?	Barriers	

Source: Authors' own creation

Appendix 2. Cross-case analysis

Table A2 Cross-case analysis producer and cooperative

Macro variable	Variable	Firm J		Firm K
SCF solution	SCF solution	3 Minibond 2017, 2018, 2019	IF Traditional. Repurchasing agreement, without dispossession under evaluation	Minibond revolving pledge, without dispossession 2016, 2018, 2019
	Technology	Digital registers, stock monitoring system	Digital registers, stock monitoring system	No technology system
SC stage	SC stage	Producer	Producer	Cooperative
	Activator	Producer	Producer	Cooperative
Size	Size	SME	SME	SME
Product	Category	Aged	Aged	Aged
category	Product	Wine	Wine	Cheese
Regulation	Late Payment Directive			
Drivers	Bankruptcy risk of suppliers			
	Payment terms			
	Lack of liquidity	X	X	X
	Exploit the excess of liquidity			
	Need of ensure quality			
	Lack of access to financial services	X		X
	Long production cycles	X	X	X
	Level of stocks	X	X	X
	Lack of collateral	X		
	Short maturity period	X		X
Barriers	Knowledge about SCF	X	X	X
	Technological barriers			
	Collaboration and visibility			
	Organizational policies			
	Regulatory barriers			
	Macro-institutional challenges			
	Asymmetric information			
	Lack of high volumes			
New barriers	Cultural change	X		X

Source: Authors' own creation

Table A3 Cross-case analysis processor – part 1

Macro variable	Variable	Firm E			Firm C	Firm D	Firm B			Firm A	
SCF solution	SCF solution	What: RF with Retailer When: 5–10 years	What: DD When: under evaluation	What: RF with retailer	What: RF When: proposed in 2018, not implemented	What: RF with retailer When: 2016	What: RF When: not implemented	What: RF When: 6 years +	What: IF Control How: repurchase option, no LSP, derecognition, without dispossession When: 2016, closed in 2018	What: RF When: 2016, 2018 (green coffee)	What: IF Control When: evaluated (2019) but not implemented
	Technology	No technology			Technological platform	Platform to support RF		No technological platform	General traceability system already present	Supplier portal	
SC stage	SC stage	Processor – Retailer	Processors SMEs – Processor	Processor – Retailer	Producers – Processor	Processor – Retailer	Processors SME – Processor	Producers – Processor Cooperative/Processors SME – Processor	Processor	Cooperative/ Processors SME – Processor	Processor
	Activator	Retailer	Processor	Retailer	Processor	Retailer	Processor	Processor	Processor	Processor	
Size	Size	Big Firm	Big Firm	Big Firm	Big Firm Used by SMEs	Big Firm	Big Firm Used by both big and small firms	Big Firm	Big Firm	Big Firm Used by both big and small producers	Big Firm
Regulation	Late Payment Directive				Art 62 fostering the solution						
	Nonpossessory revolving pledge								Lack of regulation on pledge making the solution stop		
Product category	Category	Category: Packaged	Fresh, commodity	Fresh	Fresh	Frozen	Fresh/ Commodity	Fresh	Aged	Commodity	Commodity
	Product	Bakery		Milk	Milk	Ice cream and frozen croissanterie	Butter, flour, milk powder	Milk	Ham	Coffee	Coffee
Drivers	Bankruptcy risk of suppliers							X			
	Payment terms	X (No change in payment terms)		X (Lower DSO)	X (Higher DPO)		X (Decrease suppliers' DSO)	X (decrease DSO for producers, increase DPO for processor)		X (increase DPO for processor; decrease DSO for suppliers)	
	Lack of liquidity				X		X (for suppliers)	X (for suppliers)	X (for processor)	X (suppliers)	
	Exploit the excess of liquidity		X (due to seasonality)								
	Need of ensure quality							X		X	
	Lack of access to financial services			X (no issues)	X (for suppliers)		X (for small suppliers)			X (for small suppliers)	
	Long production cycles								X		X
	Level of stocks								X (high NOWC)		X (high NOWC)
	Lack of collateral										
	Short maturity period										
	Sustainability									X	
New drivers	Need to collaborate with relevant customers	X				X					
	Need to improve balance sheet composition					X					
Barriers	Knowledge about SCF						X		X		
	Technological barriers	X	X		X (for small suppliers)						
	Collaboration and visibility										
	Organizational policies				X (Stop imposed by the parent company)						
	Regulatory barriers								X (noncompliant with accountability policies)	X (Government law)	
	Macro-institutional challenges				X (Language barriers)					X (Language and cultural differences)	
	Asymmetric information										
	Lack of high volumes						X	X		X	
New barriers	Cultural change	Fear of change									
	Complexity and time efforts										
	Uncertain marketability								X		
	Finding a financial institution willing to take the risk								X		X

Source: Authors' own creation

Table A4 Cross-case analysis processor – part 2

Macro variable	Variable	Financial institution (M)		Financial institution N	Financial institution O	Financial institution P	Firm F	Firm H
SCF solution	SCF solution	What: RF How: RF provider When: latest years	What: IF Traditional When: under evaluation (2019)	What: RF When: under evaluation	What: IF Control How: derecognition, Special Purpose Vehicle	What: IF Control How: derecognition, repurchase option When: 2000 in Europe, under development in Italy	What: DD When: 2015, proposed but not implemented	What: DD When: 2019
Technology	Technology			Technological platform	No technology in stock monitoring	No technology platform, no technology in stock monitoring	Supporting technological platform provided by a third party	Technological platform provided by a third party
Actors	SC level	Producer – Processor		Producer – Processor	Processor	Processor – Traders	Producers – Processor	Producers – Processors
	Size	–		–	Big firm	Big firm	Big firm	Big firm Used by small suppliers
	Activator	Processor					Processor	Processor
Product category	Category	Fresh			Frozen	Commodity	Commodity	Fresh/Commodity
	Product	Milk			Frozen vegetables			
Regulation	Late Payment Directive							
	Nonpossessory revolving pledge		Lack of regulation about nonpossessory pledge blocking the implementation					
Drivers	Bankruptcy risk of suppliers							
	Payment terms	X (DSO for producers)					X (reduce payment terms for suppliers)	X (reduce payment terms for small suppliers)
	Lack of liquidity Exploit the excess of liquidity	X			X	X	X (of suppliers)	X (for small suppliers) X (due to seasonality)
	Need of ensure quality Lack of access to financial services						X (for suppliers)	X (for suppliers)
	Long production cycles					X		
	Level of stocks Lack of collateral Short maturity period		X (High NOWC)		X (High NOWC)	X (High NOWC)		
	Sustainability						X	

(*continued*)

Table A4

Macro variable	Variable	Financial institution (M)	Financial institution N	Financial institution O	Financial institution P	Firm F	Firm H
New drivers	Need to collaborate with relevant customers						
	Need to improve balance sheet composition						
Barriers	Knowledge about SCF		X (farmers)			X (suppliers)	X
	Technological barriers		X (farmers)			X (suppliers)	
	Collaboration & visibility						
	Organizational policies						
	Regulatory barriers	X (nonpossessory pledge)			X (nonpossessory pledge, revolving pledge)		
	Macro-institutional challenges						
	Asymmetric information						
	Lack of high volumes	X		X			
New barriers	Cultural change	X	X			X	X
	Complexity and time efforts			X			
	Uncertain marketability	X					
	Finding a financial institution willing to take the risk						

Source: Authors' own creation

Table A5 Cross-case analysis retailers

Macro variable	Variable	Firm I	Firm L	Firm G
SCF solution	SCF solution	What: RF When: for 5 years	What: RF When: since 2013	What: DD When: 2019
	Technology	Supplier portal	Platform, integrated with the retailer's accounting systems	Technological platform provided by a third party
Actors	SC level	Processor/Cooperative – Retailer	Processor/Cooperative – Retailer	Processor/Cooperative – Retailer
	Size	Big firm Used by both big and small firms	Big firm Used by both big and small firms	Big firm Used by small suppliers
	Activator	Retailer	Retailer	Retailer
Product category	Category	Category: various	Category: various	Category: various
	Product	Various	Various	Various
Regulation	Late Payment Directive			Changing of power balance in agri-food SCs for RF
Drivers	Bankruptcy risk of suppliers	X		
	Payment terms	X (reduce payment terms for suppliers)	X (decrease payment terms of suppliers)	X (reduce payment terms for suppliers)
	Lack of liquidity	X (for suppliers)	X (for suppliers)	X (for suppliers)
	Exploit the excess of liquidity			X
	Need of ensure quality	X	X	
	Lack of access to financial services		X (for suppliers)	X (for suppliers)
	Long production cycles			
	Level of stocks			
	Lack of collateral			
	Short maturity period			
	Sustainability		X (sustain organic suppliers)	
New drivers	Need to improve balance sheet composition		X (big suppliers)	
	Collaboration and visibility			
	Organizational policies			
	Regulatory barriers			
	Macro-institutional challenges			
	Asymmetric information			
	Lack of high volumes	X		
New barriers	Cultural change		X (suppliers)	

Source: Authors' own creation

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