



Inventory financing in supply chains

A logistics service provider-approach

Erik Hofmann

University of St Gallen, St Gallen, Switzerland

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Purpose - Against the background of the scanty knowledge about inventory financing in supply chains, the goal of this paper is to provide a conceptual explanation of the relevance and the implications of alternative inventory financing by a logistics service provider (LSP).

Design/methodology/approach - First, based on a literature review, inventory-related conflicts of interest between actors in the supply chain are discussed. Second, a concept of inventory financing through an LSP is developed. Third, the concept introduced is illustrated by means of a numerical example.

Findings - The results of an illustrative example from Switzerland and a rough revenue and expenditure calculation highlight the effects that inventory financing through a logistics service provider may have for LSP. For the LSP profit depends mainly on the value and amount of the goods to be financed.

Practical implications - The results of this paper can be applied to logistics service providers. The model developed can accordingly be used to calculate the additional effects of inventory financing service.

Originality/value - This research offers initial insights into the importance of inventory financing from an LSP perspective. As activities in this field may offer additional profits and differentiation options, decision makers at logistics service providers might want to estimate the potential resting in this expansion of their service catalogue.

Supply chain management, Retailing, Cost of capital, Interest rates, Switzerland

Paper type Research paper

1. Introduction

Starting point

Production or retail companies are usually faced with the temporal decoupled flow of goods and cash flows in their supply chains. On the one hand, the invoice is not issued necessarily at the time of delivery. On the other hand, the management of receivables usually grants a certain time frame for payments, which results in a demand for capital for the selling company to bridge the gap. According to Pike *et al.* (2005), the payment terms can vary substantially in the international context. In Switzerland, a period of grace of 30 days is usual on average whereas in Italy, 60 to 90 days apply. Approximately 90 percent of companies in Germany regularly record defaults in payments that account for more than 1 percent of total sales. Default events are defined on the basis of international standards, such as the ISDA (2009), i.e. failure to pay within a certain time frame, bankruptcy or unfavourable restructuring activities from a creditor's point of view. As well as the consideration of debtors and potential defaults



in payments, which result in cost of tied-up capital, the performance-driven returns are also of importance.

In this context, a frequently aspired to multidimensional goal of shipping manufacturing companies is to achieve a certain production level with the lowest possible costs accompanied by a minimal tied-up capital (Wilson, 1991). As Presutti and Mawhinney (2007) stated:

[...] the firm needs to minimize the asset levels used to deliver [...] value. Factors such as capital utilization, cash velocity, inventory turns, and cycle time reduction will impact how effectively the firm is managing its assets.

Yet achievement of these goals is, however, rather rare as, e.g. shippers in supply chains demand high levels of delivery services in distribution in order to satisfy customer needs with short delivery times. This implies either holding high levels of inventory or the adoption of fast and flexible means of transport. While the latter implies higher costs for transportation processes a high level of inventory creates significant cost of tied-up capital (Farris and Hutchinson, 2002). Furthermore, strong credit-collection procedures (e.g. demanding payments in advance) or selling goods against payment in cash from customers is quite difficult, as Mian and Smith (1992) reported.

The dilemma illustrated for the different players in the supply chain leads to a strong demand for integrated logistics services (e.g. Bolumole, 2003; Persson and Virum, 2001; Stefansson, 2006) as well as financial services (e.g. Atkinson, 2008; Bernabucci, 2007; Barovick, 2007; Jones, 2008). Specialized logistics companies may therefore seize this opportunity to expand their original service portfolio of transportation, handling and storage with an additional service in financing.

Objectives, method and structure of the analysis

Despite the obvious practical relevance of the topic, business research has only recently started to deal with financing in supply chains in general and with financing inventory from a logistics service provider (LSP) perspective in particular (e.g. Lai *et al.*, 2009; Buzacott and Zhang, 2004; Gunasekaran *et al.*, 2001). Thus, to date, only few conceptual or empirical studies have been conducted in this interdisciplinary field. Moreover, logistics service providers have been entirely excluded from the existing studies. While considering this deficit the present paper contributes to the field by answering the following research questions (RQ):

- RQ1. Which concepts can be derived from the existing literature (related research) to be applied to the field of inventory financing in supply chains through LSPs?
- RQ2. How can traditional relationships between supply chain parties exchanging goods and capital be described? What kind of conflicts of interest could occur with regard to inventory?
- RQ3. How can alternative inventory financing in supply chains by LSPs be structured?
- RQ4. What influence would the new service of inventory financing have on the profit and loss of an LSP?

The methodological approach to answer these questions is based on “conceptual” theory building like in Meredith (1993) and Wacker (2008). The initial thoughts on inventory financing are further developed and exemplified using an illustrative example from Switzerland. This example rests on open-ended interview protocols with relevant decision makers of “SwissPostLogistics” (Schweizerische PostLogistics) in 2007 and 2008, along with financial reports, project presentations and newspaper excerpts. The Swiss LSP distributes over 300 different consumer goods of Procter & Gamble (P&G), manufactured in Germany and other EU-countries, to small and

medium-sized retailers in Switzerland, like Volg (), CC A Cash & Carry Anghem () or Manor (). The LSP handles over 50,000 pallets and 200 points of delivery annually via one distribution centre near the city of Basel. The overall order volume is over 100 million Swiss Francs per year.

The underlying methodological approach of the paper is explorative and conceptual in nature. The explorative character seems to be necessary due to the immature scientific discussion of the topic. Accordingly, a linked query for (“financing” , “inventory” and “supply chain”) on the EBSCO-Host (Business Premier) for scientific articles between 1999 and 2009 provided only 15 results (EBSCO-Host, 2009) from scientific journals. A further query in EBSCO-Host (2009) with the “finance” and “supply chain” as well as “inventory” and “financing” in the s of academic journals resulted in 36 hits for the time period between 1999 and 2009. If popular scientific “Trade Publications” are included in the query the hits increased to 176 for the past ten years. This shows that the topic is more a practitioner phenomenon. Concerning the conceptual approach theoretical and, if possible, also empirical findings will be conducted, analysed and consolidated in a simple numeric model. The results offer insights for future enhancements of the model as well as primary empirical studies. The methodological goal of the paper is thus a clarification of the formulated questions as well as an evaluation of the economic relevance of a discussion on the inventory financing in supply chains by logistics service providers.

The research questions guide the structure of the present analysis. A short overview of related research will first be given (Section 2, *RQ1*). Section 3 provides an explanation of the traditional relationships within a supply chain regarding the flow of goods and capital that are relevant in the context of inventory financing. Also, a closer examination is made of typical conflicts of interest between the supply chain parties (*RQ2*). Subsequently, Section 4 offers potential solutions to the problems. Additional thoughts are presented on the basis of a real Swiss case in which a logistics provider provides the financing of inventory (*RQ3*). The financial impacts for the LSP will be discussed within a simple theoretical case study (*RQ4*). Section 5 summarizes and concludes the paper.

2. Related research

This section provides an overview of related research in order to gain a comprehensive outline of the current state of inventory financing in supply chains by LSPs (see Figure 1). From a scientific point of view, mainly articles from the field of logistics and supply chain management, services industry as well as financing apply. These topics and their interrelations are well established and belong to the fundamentals of business administration with a variety of both scientific- and practitioner-oriented articles available. Especially, the conjunction between research in services and logistics

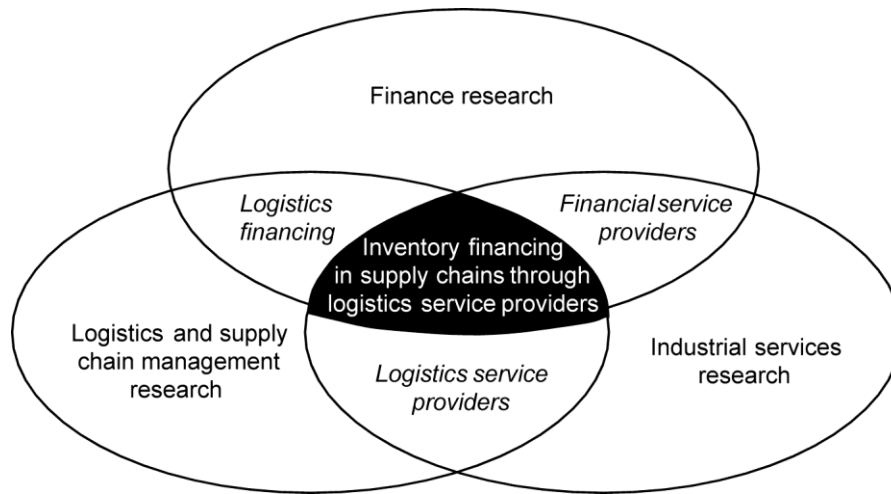


Figure 1.
Research fields related to
the topic “Inventory
financing in supply chains
through LSPs”

(logistics services), as well as services and finance (financial services), is an established intensively analysed area of study. In contrast, research in logistics financing is relatively scarce.

The scientific discussion in the area of logistics services mainly deals with topics such as “Third party logistics provider” (3PL) (e.g. Sheffi, 1990; Bask, 2001; Hertz and Alfredson, 2003 Juga *et al.*, 2008). As the centre of interest these papers focus on the complex services package of logistics service providers in connection with outsourcing activities by a shipper (e.g. Bhakoo *et al.*, 2007). Apart from the traditional transport, turnaround and storage functions, Knemeyer and Rabinovich (2006) and Selviaridis and Spring (2007) underline various supporting functions, which the LSP can use for differentiation purposes. The main financial issues in this context are invoicing, clearing and settlement functions of payment systems (e.g. Min, 2002) or – in an international context – export financing solutions (e.g. Ling-ye and Ogunmokin, 2001). Contributions, which focus on inventory financing as part of the services offered by logistics service companies cannot be identified in the literature, yet.

Current papers in the field of financial services focus on the changes in the banking sector in general (e.g. Angkinand, 2009; Gorton, 2009; Boyd *et al.*, 2005), on the changes in credit risk management (e.g. Basel Committee on Banking Supervision, 2001; Felsenheimer *et al.*, 2006) or on new fields of activities (e.g. Tam, 2007; Lerner, 2006). Single references are made to the field of logistics in the articles by Tibben-Lembke and Roger (2006) on the issue of a real option approach in the logistics sector or of Holdren and Hollingshead (1999) who develop a pricing scheme for inventory financing services. Nonetheless, a direct reference to LSPs cannot be found in this body of literature.

Research in the area of logistics financing is relatively young and mainly relates to topics such as “Financial supply chain management” (e.g. Fairchild, 2005) and “Supply chain finance” (e.g. Atkinson, 2008; Hofmann, 2005). Geunes and Pardalos (2003) address the interaction of supply chain management and financial engineering, while Badell *et al.* (2005) focus on financial budgeting in the supply chain context. Also, Buzacott and Zhang (2004) investigate the interrelations between logistics and finance.

Their paper “Inventory management with asset-based financing” provides an approach which does not limit inventory management to obeying budget restraints but interprets liquidity management as a component of inventory management. However, many articles are rather journalistic in nature (e.g. Hoffman, 2005; Lugli, 2006; Croft, 2007) and thereby disregard the LSP perspective.

Articles addressing all three areas cannot be found in the relevant literature. Therefore, this article provides an initial contribution to the field.

3. Traditional financing of inventory in supply chains

Initial situation

According to Walters (2008), end customer needs are the starting point for relations within the supply chain. This demand leads to orders and interaction-based activities in different steps of the value chain (Rainbird, 2004). Since interaction can evolve through several steps in the supply chain, the role of buyer and seller varies. For the initial situation described here a dyadic relationship is assumed between a manufacturer of consumer goods and a retail company while considering that manufacturers, in turn, work with other suppliers and retail companies serve additional customers.

The business relationship between the players is usually based on contracts. For instance, a supplier will arrange with a retailer a shipment of goods within a specific period including a scheduled time of transfer of ownership and the means of transportation. The latter, as the recipient, will compensate the manufacturer with a stipulated price. Nowadays, a logistics service provider is usually charged with the physical processing of the transactions within the supply chain (Selviaridis and Spring, 2007) while a financial service provider will be assigned to provide capital and settlement facilities.

A brief glance at the capital endowment of European companies provides evidence of a high debt rate (Gaud *et al.*, 2007, p. 201). Even inventories are often financed with short-term borrowings from commercial banks (Hill and Sartoris, 1995). This can be explained through advantageous tax effects due to interests on debt (tax shield) and the so-called “leverage effect”: if the cost of debt capital is lower than the return on total capital, the company’s return on equity can rise even if overall risk is increased and creditworthiness deteriorates at the same time (Ross *et al.*, 2005, p. 423).

The topic “inventory financing” is a short term financial management problem, as inventories are current assets and carrying such circulating capital is a commitment of funds that has to be financed. Short-term financial management is interdependent with decisions influencing the operating cash flows of a company (Hill and Sartoris, 1995). Thus, it encompasses decisions about activities that affect cash inflows, cash outflows, liquidity, back-up liquidity as well as firm-internal cash flows. From a shipper’s point of view, inventory financing is related to the classical approach used to determine the optimal level of inventory, the trade-off between setup costs and holding costs (Wilson, 1991). Any funds required for inventory can be covered by spontaneous financing related to the cash conversion cycle (because they arise in the course of the normal business transactions), or by other short-term sources like bank credit arrangements (e.g. single-payment loans, letters of credit) as well as unsecured or secured borrowings (Buzacott and Zhang, 2004). From a

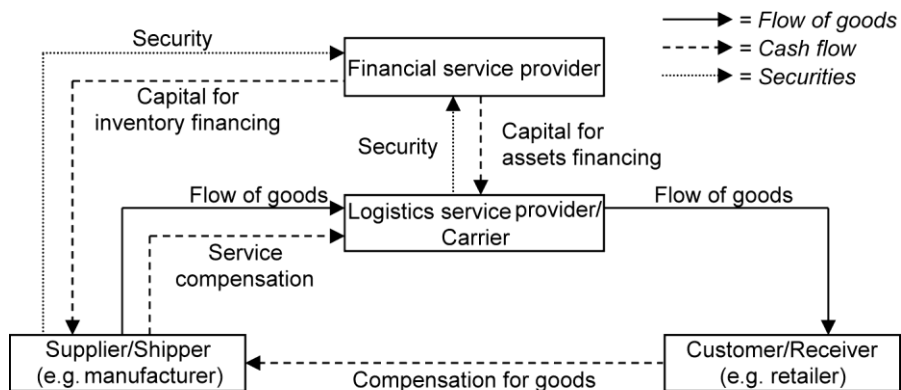
financial service provider's perspective, in the case of inventory financing firm's current assets are used as security or as collateral for short-term loans. A basic problem is the "marketability" of inventory in the hands of the lender. Unlike accounts receivables or back-up liquidity, inventory does not turn to cash by itself. It has to be sold. The closer the inventory is to being a commodity item, the easier it is for the lender to sell and the higher its collateral value (Lasher, 1997). As for raw materials, commodity items such as iron ore used by a steel maker are easier to resell than customized items such as specialty pigments used to manufacture paint. Customized component parts may have only nominal resale value. Work-in-progress goods are frequently excluded from a collateral used to determine the borrowing base. Since work-in-progress goods require additional production activities to be converted to saleable merchandise, they have limited liquidation value. This is the reason why a shipper in general obtains easier an external financing for raw materials or finished (consumer) goods than for work-in-progress goods.

LSPs are usually debt financed with average equity ratios of 20 to 30 percent;

according to van Laarhoven *et al.* (2000) they do not use this capital to finance inventory but for resources such as fleet, personnel or IT systems. An alternative form of financing would be factoring to sell receivables to specialized financial intermediaries: the logistics service provider could thereby transfer the entire credit risk to the factoring intermediary (Fiordelisi and Molyneux, 2004). Since the capital from factoring does not correspond with the flow of goods between supplier and recipient it will not be further discussed in this article. Also, bank guarantees, which ease the borrowing of money from a third party (from suppliers in the international business) will be disregarded (Kappler, 2006).

Figure 2 exemplifies a traditional supply chain including the involved parties and the relevant flow of goods and cash flow between them (including collateral). Thereby, the seller is mainly responsible for the inventory financing which is equal to a trade credit (Bougheas *et al.*, 2009), and the compensation of the LSP. Owing to reasons of complexity the information flows are not considered.

Within this supply chain setting, the participants have different goals. In the following, we analyse these conflicts in detail.



Source: Stefansson (2006)

Figure 2.
Flow of goods and capital
in a typical supply chain

Goals of the supplier/seller

One goal of the supplier is to sell finished products as fast as possible to transfer the ownership to the recipient. According to Nicholas *et al.* (2000) the supplier can thereby reduce the duration of tied-up capital. One way to achieve the latter is to shorten the time of payment, e.g. through prepayment or a more aggressive way of managing outstanding receivables (Paul, 2008). Ideally, a producer can manage to achieve a very short or even a negative Cash-to-Cash Cycle (Farris and Hutchinson, 2002, p. 288) by ordering products according to his own demands and making the customer pay on order. According to Gentry *et al.* (1990) the Cash-to-Cash Cycle – also called Cash Conversion Cycle – is based on days inventory hold (DIH) plus days sales outstanding (DSO) less days payables outstanding (DPO). The Cash-to-Cash Cycle measures the duration between the payment for input factors and the income from sold products thanks to an integrated view of the three components mentioned previously. The shorter the Cash-to-Cash Cycle, the lower the capital requirements of a company. Hence, cost of financing can be reduced (Jose *et al.*, 1996). Nonetheless, a negative effect on the attractiveness of products due to short times of payment must also be considered.

Goals of the customer/recipient

A recipient wishes to assume ownership of products at the moment his demand occurs. Preferably, the customer not only seeks to determine the time but also the quantity of a delivery according to his needs. However, this goal creates a conflict of interest as the customer also seeks guaranteed availability of goods at any time. These goals can be achieved, for instance through consigned inventory (Lee and Wang, 2008) or vendor-managed inventory (VMI) solutions (Pohlen and Goldsby, 2003). This procedure helps to keep customers' inventory capital costs low and hence reduce DIH. At the same time, the customer tries to pay the supplier as late as possible in order to keep DPO high. Finally, in order to have low DSO the recipient also pursues the goal of preferably early payment receipts by its own customers in order to reduce the dependency from outside creditors and to shorten its Cash-to-Cash Cycle. If the recipient cannot manage to establish a consignment pickup on the supply side, he will hold inventory for certain goods if inventory and capital costs are lower than the cost of shortfalls caused by inventory gaps. To determine the costs of shortfalls the probability of unexpected interferences due to lacking availability of input factors must be comprehended. The classification of these goods can be conducted on the basis of the critical value. As well, the recipient has a strong interest to keep the number of order activities low since they also create costs (mainly transaction costs). Thus, higher transportation and personal costs arise in performing the ordering process, accepting consignments and checking and stocking the received goods.

Goals of the financial service provider

The financial service providers, e.g. banks directly involved in the inventory financing process have two main goals: first, they demand a risk-adjusted price for the provided debt capital in the form of interest; and second, they want to ensure that the underlying counterparty risk does not deteriorate beyond priced expectations (migration risk) to avoid credit events causing default. To achieve both goals, the prices are risk-adjusted by the calculation of the expected loss (EL). The EL comprises two factors, probability

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