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Supply Chain Finance

'Is SCF ready to be applied in SMEs?'

**Contribution to the
International Business Engineering Conference (IBEC)
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(Final version, 18 July 2016)**

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Key words

Supply Chain Finance (SCF), Working capital, Supply Chain Management (SCM), Procurement, Advanced Planning and Scheduling (APS), Economic Value Added (EVA), Risk Management and Enterprise Resource Planning (ERP).

Abstract

This article provides an overview of the main ingredients of the new academic topic of supply chain finance (SCF), as well as a practical case study in order to illustrate the state of the art of its business implementation at an SME. The literature review shows that the main theoretical influences on SCF is corporate finance. Topics like working capital management, DuPont analysis, Risk management, Capital Asset Pricing Model (CAPM) and Economic Value Added (EVA) are discussed. The following contextual theoretical influences will also be discussed: Supply Chain Management, Purchase, Forecasting, Advanced Planning and Scheduling, and ICT/ERP. On the basis of a case study we investigate whether SCF is ready to be implemented in the SME context of an SME or not.

Acknowledgements

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1 Introduction to Supply Chain Finance

1.1 Lead-in

Supply Chain Finance (SCF) is a relatively new topic in logistics (Coyle, 2003), (Seifert, 2009). Some recent studies show that it may reduce the working capital of the focal company by 40%, as well as the costs of capital (because of the better credit rating of the focal¹ company) (Hofmann E. e., 2010). Supply Chain Finance has its roots in reverse factoring. Factoring has traditionally been used for financing the Accounts Receivable (Debtors) of a company by selling the ARs to a factor – often related to a bank; the factor collects the debt from the company’s clients, and the company immediately receives the agreed amount of money after deduction of a discount (Brealey, 2011). In most definitions, Supply Chain Management comes down to the design and optimisation of the flows of goods. In many cases the flows of information are included more explicitly. But in general, financial flows and the costs of financial flows gain a lesser interest. By using (already existing) supply chain information, the usage of working capital and its costs can be reduced according to the Supply Chain Finance Cube model (Pfohl H.-C. e., 2009), see Equation 1 for the summary of the factors that influence the capital costs (i.e. Volume of working capital, and Duration and Costs of Capital (WACC²).

$$\text{Capital Costs} = \text{Volume of Working Capital} \times \text{Duration} \times \text{Costs of Capital (WACC)}$$

Equation 1. Capital Costs (Pfohl H.-C. e., 2009).

1.2 Problem

Supply Chain Finance is rather a new phenomenon in Supply Chain Management and Finance & Control. As for MNEs (multinational enterprises), SCF is a more common practice (Steeman, The Power of Supply Chain Finance, 2014). However, SCF is relatively unknown to SMEs.

On the other hand, we assume SCF offers opportunities for SMEs as well, and that SMEs might profit from SCF. In corporate finance many similar theories exist and they are applied to business practices. The question is what SCF may add to the existing theories of Corporate Finance and Supply Chain Management, and applications of Corporate Finance, Supply Chain Management, and ICT concepts.

The main research question to be addressed in this paper is:

What in fact is SCF, and how may it contribute to the reduction of capital costs in the supply chain, especially in SMEs?

1.3 Methodology and research model

In order to answer the main research question, a literature review in the new field of Supply Chain Finance (SCF) has been conducted in the existing (related) fields of expertise:

- Supply Chain Management.
- Finance (especially Working Capital Management, Weighted Average Costs of Capital, Capital Asset Pricing Model and Risk Management).
- Procurement & Sourcing.
- Advanced Planning & Scheduling (APS), and IT tools.

¹ Focal company is the leading or dominating company in the supply chain

² WACC = Weighted Costs of Capital (Hillier, 2011)

A case study is described in order to evaluate whether there is some empirical evidence of the Supply Chain Finance theory in real business life of an SME.

The research model (see figure 1) was based on Verschuren’s *Designing a research project* (2010), where the research was carried out in four stages. Most of the time has been allocated for the desk research. The conceptual model will be developed for designing supply chain finance, and a case study was added in order to validate the theoretical concepts in the business environment of a small and medium-sized company (Agrifac).

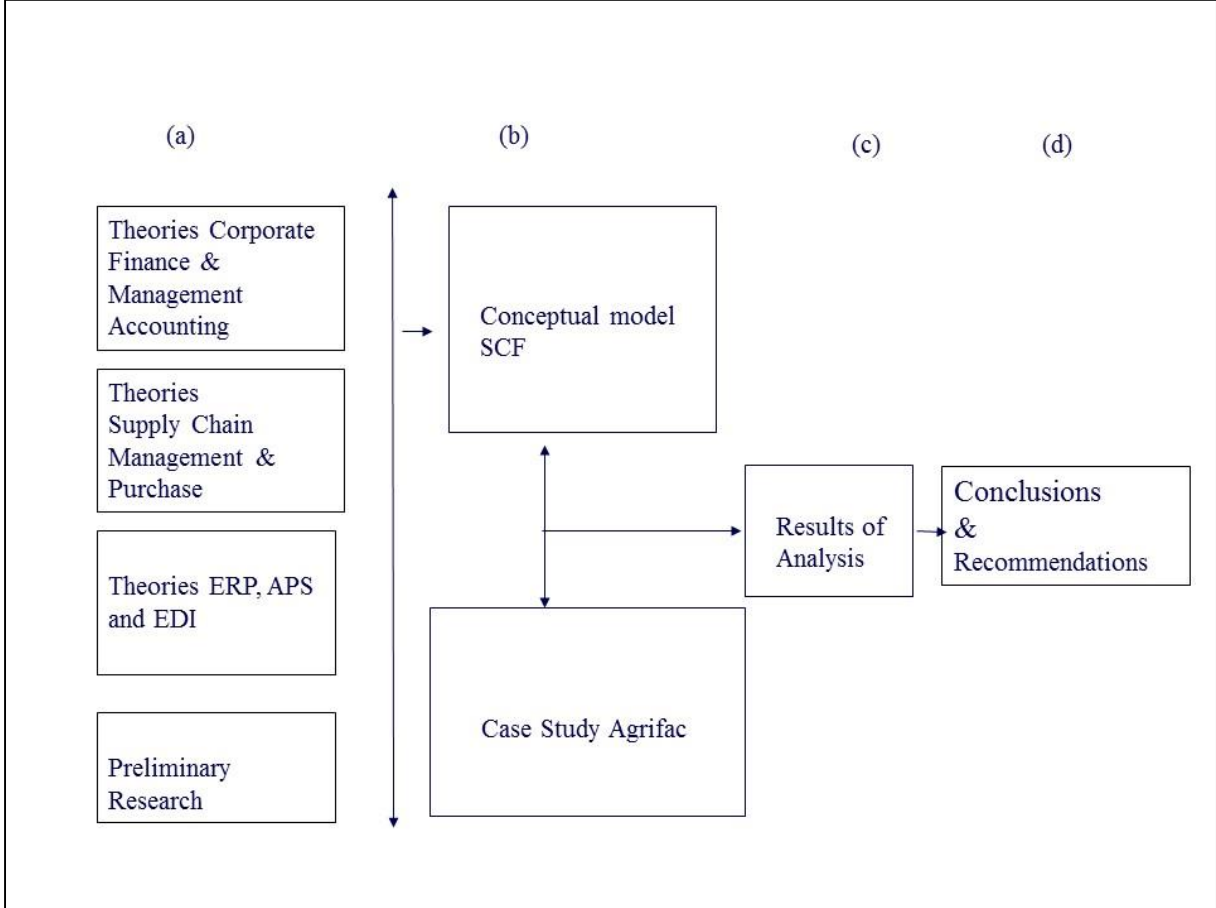


Figure 1. Research model (Verschuren, 2010).

1.4 Limitations / Scope

Development of a new paradigm is not only based on reading the latest contributions to the field of expertise, but also based on discussions with peers. Knowledge DC Community SCF (KDC, 2014), Dinalog SCF community (Dinalog, 2014) and Supply Chain Finance Community (scfcommunit, 2014) bring together peers from universities of applied sciences in the Netherlands to facilitate the discussion about supply chain finance. The academic development of the SCF paradigm is the process that develops gradually, and has its own dynamics. For universities of applied sciences (UAS) there is an extra drive to update their curricula with new fundamental trends, like SCF probably is.

1.5 Supply chain finance

The literature review of recent contributions to the field of Supply Chain Finance will be presented; and its foundations in Supply Chain Management, Finance and Procurement & Sourcing. A summary of this new paradigm called Supply Chain Finance is provided in figure 2.

The SCF paradigm developed by Cosse (see figure 2) is focussed more internally on the value chain of the (focal) company. A more recent contribution of Steeman (2014) focuses on:

1. A set of supply chain financing instruments (trade financing, fixed asset financing, working capital financing and supplier financing) to manage the financial supply chain. Collaboration and IT platforms are important characteristics.
2. The purpose of SCF models. What value does SCF create? Lower financial costs, and mitigating supply chain/suppliers' risk.
3. The perspective of SCF programmes. Is the programme initiated by a (dominant) buyer (focal company) or supplier?

Partly in line with Steeman (2014), SCF is to be considered as a part of SCM (Supply Chain Management), but the severe theoretical foundations in Corporate Finance as well as the recent developments in the role of (business) controller (Desroches, 2013) might argue to place SCF under the business controller or CFO.

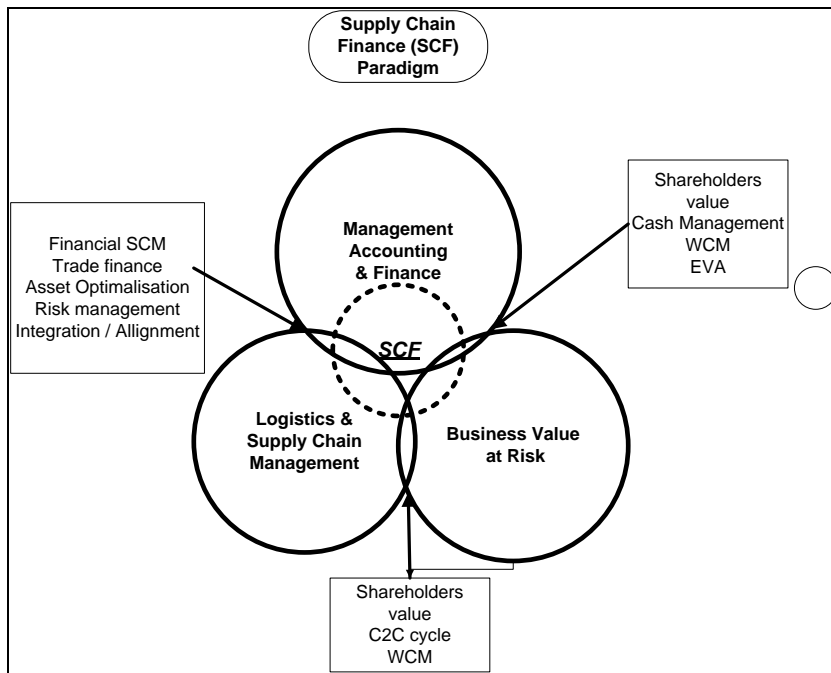


Figure 2. Supply Chain Finance Paradigm (Cosse M. (2011)).

2 Corporate Finance

In this paragraph the financial building blocks of SCF will be described, and an overview of financial topics like Working capital management, Risk management, Planning & Control and Economic Trade-Offs will be provided. This overview is partly based on the level of the value chain (corporate level) and partly on the level of the supply chain.

According to the law of one price (investment arbitrage) and the Modigliani-Miller propositions, the value in the long run, if under the perfect market conditions, is not affected by how the company manages its short-term financial needs (Berk, 2007). As we do not live in a perfect world, and most of the company decisions are short-term related, we have to think about short-run financial decisions (i.e., working capital management). According to Berk (Berk, 2007), working capital is defined as: “*Current assets minus current liabilities*”, so using the layout of a standard balance sheet, working capital can be presented in the following (decomposed) way:

- Current Assets
 - Inventories
 - Raw materials
 - Work in process
 - Final goods
 - Accounts Receivables (AR) or Debtors
 - Cash & Cash Equivalents
 - Accruals (prepaid expenses)
- Current Liabilities
 - Accounts Payables (AP) or Creditors
 - Bank overdraft
 - Tax obligations
 - Accruals

In traditional textbooks on corporate finance (Brealey, 2011) (Berk, 2007), (Arnold, 2008), (Brigham, 1999) and international finance (Eiteman, 2013), only one company is within the scope of the study. The scope of this article will be a chain of companies in the so-called supply chain of a certain product or service. The aim is to investigate whether it is possible to minimise the (financial) costs of working capital in the supply chain.

In figure 3, an overview of a supply chain of bikes is provided, where the bike producer is the focal (Lambert, 1998) (Wisner, 2009) or the leading company in the supply chain (often an end-product manufacturer like Gazelle, Volkswagen, Shell, Unilever, Philips, etc. between companies in the supply chain (a bold line with two arrows).

- Goods flow from the left to the right (a dotted line).
- Information flows between companies in the supply chain (a bold line with two arrows).
- Money (finance) flows from the right to the left (a grey line)

So, financial flows in the supply chain “follow” the flows of goods in the opposite direction; in an ex-ante or ex post way of (pre-) financing.

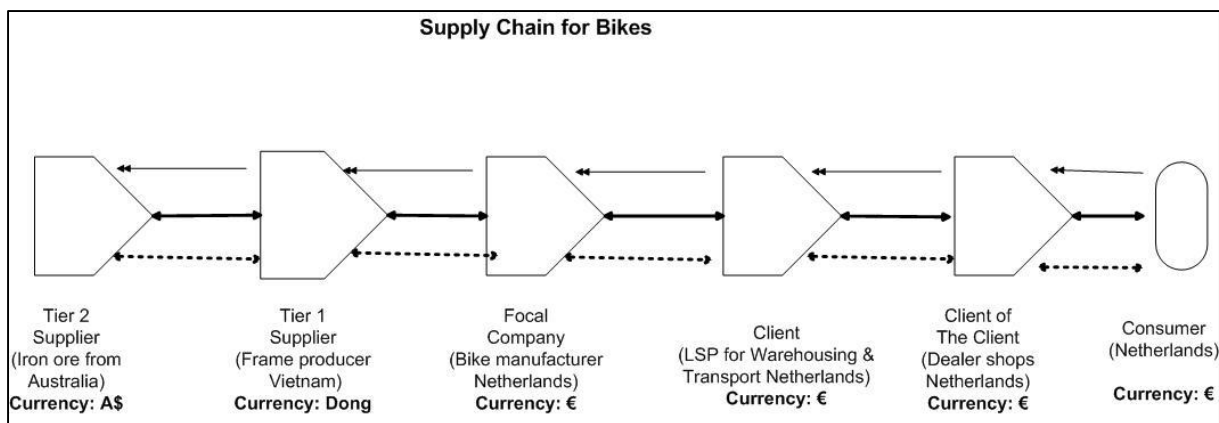


Figure 3. Supply Chain of bikes in the Netherlands (Wisner, 2009) (developed by the author).

The basic idea of supply chain finance is to share the sales forecast from the focal company with its Tier 1 and Tier 2 suppliers³, so inventory in each company can be based on JIT/LEAN concepts and thus, realise economic order (EOQ) benefits (Horngren, 2012); because of this not only the level of inventory can be lower per company, but also the amount of debtors (accounts receivable) and creditors (accounts payable) can be lower and of less duration. This idea is expressed in figure 4, for a chain in the \$-area. The inventory costs will be minimised because of economic order benefits, as well as the aspect of financing the inventory on the balance sheet.

Balance sheet Tier 1 Supplier			
Inventory			
Debtors	\$ 50,00	Creditors	

Balance sheet Tier 2 Supplier			
Inventory			
Debtors	\$ 80,00	Creditors	\$ 50,00

Balance sheet Focal company			
Inventory			
Debtors		Creditors	\$ 80,00

Figure 4. Balance sheets of Tier 2, Tier 1 and focal company in \$-area.

Optimal inventory costs in the supply chain are realised by using a tool like advanced planning and scheduling (APS) techniques (Goor van, 2009) (Lee, 2002). The concept of APS is used among other things to manage the level of inventories in the supply chain of a multinational firm with its foreign subsidiaries, however APS techniques can also be used for collaboration within the supply chain. So, APS tooling might be used in a supply chain to minimise the inventories of Tier 1 and Tier 2 suppliers, thus inventories costs will be lower, as well as the costs of financing them and the use of financial capacity. Trade platforms (Tradecloud, 2014) might be a substitute for APS systems; in the case study of Agrifac the role and function of the trade platform will be discussed as a collaboration tool in supply chain finance. Complexity increases when several exchange rate areas are involved in a supply chain (see figure 5), because of exchange rate exposure like transaction exposure and economic exposure (Eiteman, 2013).

Balance sheet Tier 1 Supplier (\$ area)			
Inventory			
Debtors	\$ 50,00	Creditors	

Balance sheet Tier 2 Supplier (\$ area)			
Inventory			
Debtors	\$ 80,00	Creditors	\$ 50,00

Balance sheet Focal company (€ area)			
Inventory			
Debtors		Creditors	€ 64,00

Figure 5. Balance sheets of tier 2, tier 1 and focal company in \$ and €-area (exchange rate: \$ 1.25 = €1)

For the sake of convenience, in this article we assume that the supply chain will be in one currency area, so we abstract from the currency exposure complexity (Jansen, 2011).

³ Tier 1 supplier is the direct supplier to the focal company, the Tier 2 supplier is the supplier of the supplier (Tier 1)

2.1 Working Capital Management

Traditional working capital management (WCM) is to be found in textbooks on corporate finance (Arnold, 2008), (Berk, 2007), (Brealey, 2011), (Brigham, 1999), but also in textbooks on logistics a lot of attention is paid on managing inventories (and debtors) and its relationship with the DuPont formula (Weele van, 2010) (Stock, 2001). A good summary of the working capital cycle can be found in figure 6, where the relationship between the conversion from flows of goods into cash flows is plotted.

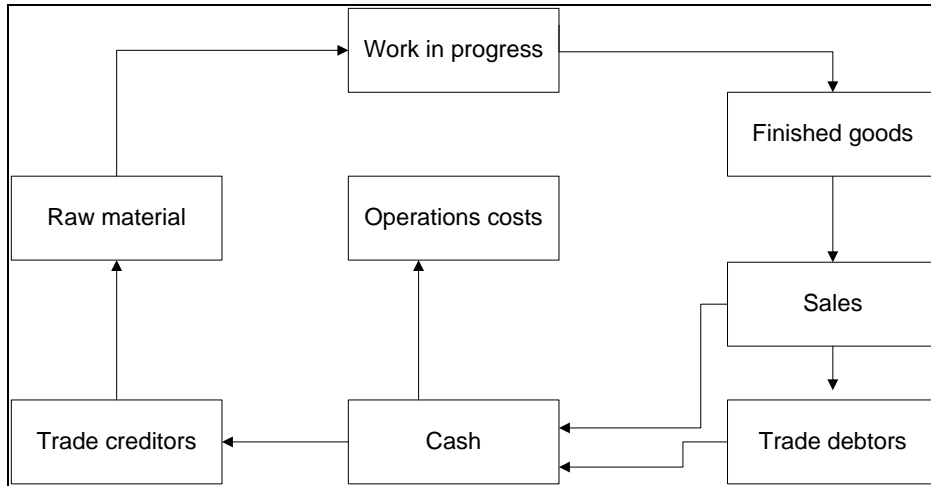


Figure 6. Working capital cycle (Arnold, 2008).

In figure 7 the dynamic relationship in the cash conversion cycle (C2C) is explained using a well-known dynamic working capital formula:

$$C2C = (DII - DPO) + DSO$$

Equation 2 C2C formula

The days in inventory (=DII) minus the days of purchases outstanding =DPO) plus the days of sales outstanding (DSO) determine the Cash to Cash Cycle (C2C); where DII represents the days in inventory, DPO the days of purchases outstanding and DSO the days of sales outstanding. All three factors influence the dynamic liquidity in term of working capital in the so-called Cash to Cash Cycle (C2C).

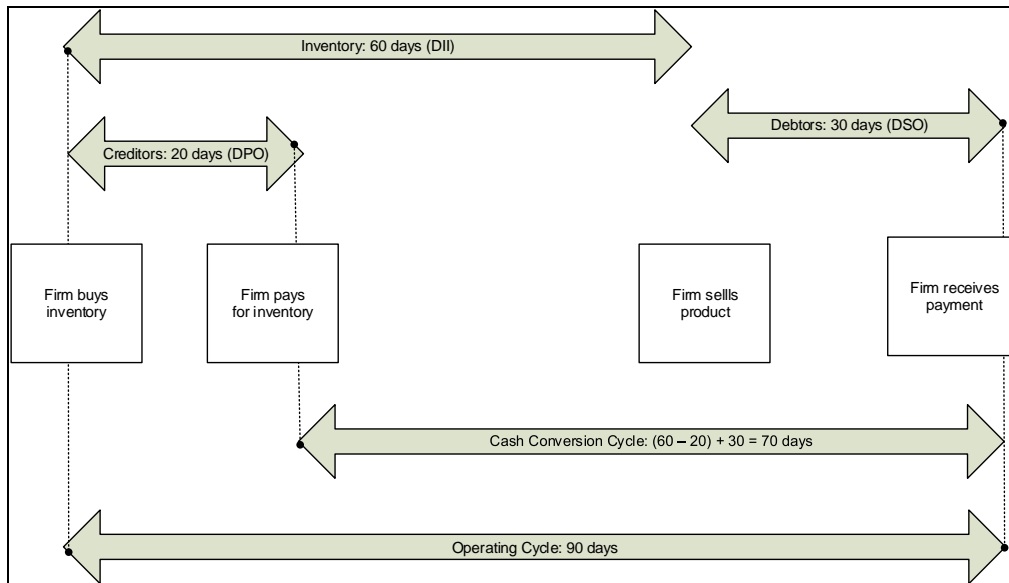


Figure 7. Operating cycle and Cash Conversion Cycle (Arnold, 2008) (Berk, 2007).

The net cash flow and the profit are related (Hillier, 2011), like: Profit + Depreciation = Cash flow (from operating activities).

The relationship between return on equity (ROE) operating efficiency (profit margin), asset use efficiency and financial structure of financial leverage is explained in the DuPont identity (Hillier, 2011):

$$ROE = \frac{Profit}{Equity} = \frac{Profit}{Sales} * \frac{Sales}{Assets} * \frac{Assets}{Equity}$$

Equation 3. DuPont identity.

The ROE is linked to the Return on Assets (ROA) over the equity multiplier.

$$ROE = ROA * Equity\ multiplier$$

$$ROA = \frac{Profit}{Sales} * \frac{Sales}{Assets}$$

In finance and logistics, the decomposition of the DuPont identity (Hillier, 2011), (Weele van, 2010) is often used to gain an insight into the root causes of profitability. In logistics, there is a trend to minimise the inventory level (Lean management and JIT approaches), and thus, the working capital or current assets, and also to increase the asset turnover ratio (Sales/Assets) in order to have a better utilisation of the company's assets.

2.2 Risk management

The COSO/ERM risk framework (Deloach, 2014) is a general framework for managing company's business risk, including supply chain risk as its sub-category (Waters, 2011). Supply chain risk management (Waters, 2011) distinguishes the two main groups of risk in the supply chain:

1. Internal Risks
 - Late deliveries
 - Excess stock
 - Poor forecasts
 - Minor accidents
 - Human errors
 - ICT system faults

- Etc.
- 2. External Risks
 - Hurricanes, earthquakes, etc
 - Fluctuating prices
 - Financial irregularities
 - Shortage of raw materials
 - Outbreak of disease
 - Problems with trading partners
 - Etc.

An example of supply chain risk management for Philips can be read in the text box below. It is extracted from the annual report 2013. *Supply chain risk management* is a part of the so-called Philips Business Control Framework (BCF). The BCF is based on the COSO risk model, and it distinguishes four main categories of risks for Philips:

- Strategic
- Operational
- Compliance
- Financial

The supply chain risk is categorized as operational risk in the Philips BCF framework.

In the BCF Philips manages its risk in an integrated way in terms of business control (Philips, 2013).

If Philips is unable to ensure effective supply chain management, e.g. facing an interruption of its supply chain, including the inability of third parties to deliver parts, components and services on time, and if it is subject to rising raw material prices, it may be unable to sustain its competitiveness in its markets.

Philips is continuing the process of creating a leaner supply base with fewer suppliers, while maintaining dual sourcing strategies where possible. This strategy very much requires close cooperation with suppliers to enhance, amongst other things, time to market and quality. In addition, Philips is continuing its initiatives to reduce assets through outsourcing. These processes may result in increased dependency on external suppliers and providers (Philips, 2013).

2.3 Planning & Control

Planning & Control are typical instruments of the financial department in business (Horngren, 2012), (Simons, 2000) but they are getting more and more integrated into business and risk control (Claassen, 2009). So, the planning & control activities are in every layer of the organisation, but also outside the company's value chain (i.e., Tier 1 and Tier 2 suppliers and customers). In the operations Slack (Slack, 2011) distinguishes four planning and control activities:

1. Loading (How much to do?)
2. Sequencing (In what order to do things?)
3. Scheduling (When to do things?)
4. Monitoring & Controlling (Are activities according to plan?)

In figure 8 the planning and control activities are summarised for the operational processes in a company. This planning & control cycle is ultimately based on a well-known Plan Do Check Act cycle (PDCA-cycle) (Atkinson, 2012).

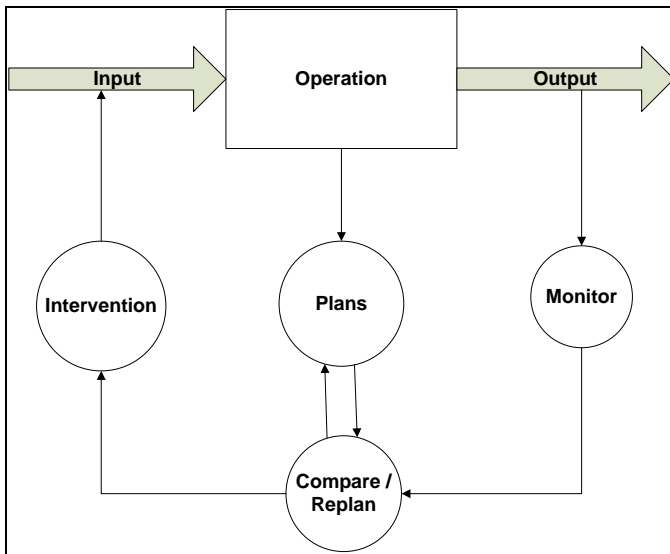


Figure 8. A model of control (Slack, 2011).

The development of IT-systems like ERP and EDI over web-portals have accomplished the data interaction between companies in the supply chain (see figure 9), so forecasts are shared by the focal company with its Tier₁ and Tier₂ suppliers and customers.

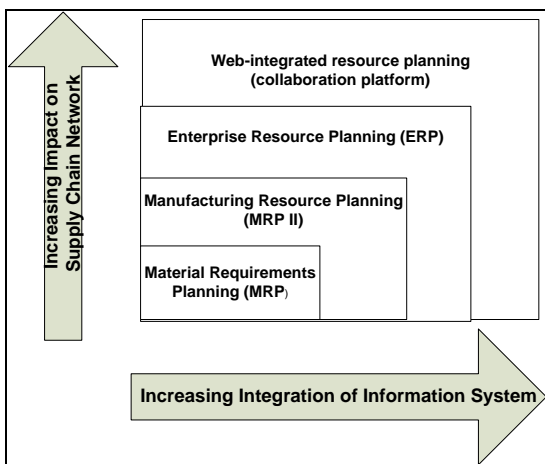


Figure 9. Development of (collaborative) IT systems, (Slack, 2011), adapted by the author.

2.4 Economic Trade-Offs (ETOs)

Just In Time Management (JIT) and Lean Manufacturing concepts have made the logistics operations in the company focused on how to prevent high levels of (unnecessary) inventory levels. High levels of stocks are seen as waste and inaccurate planning, although inventories fulfil, according to Slack, A. et al. (Slack, 2011), five essential reasons:

1. Buffer inventory
2. Cycle inventory
3. De-coupling inventory
4. Anticipation inventory
5. Pipeline inventory

It is clear that JIT and Lean have enormously lowered the companies' inventories (raw materials, com-

ponents, work in progress and final product), so the effect on the working capital (allocation of finances) and interest costs have had a significant impact on many companies.

A well-known trade-off in purchase is the optimal economic order quantity (EOQ) problem { (Horngren, 2012), (Slack, 2011)}, that is solved by using Camp's formula (with quite strong assumptions):

$$Q = \sqrt{\frac{2 * D * OC}{IC}}$$

Equation 4 EOQ formula

Q = Optimal Order Quantity
D = Usage or demand per period
OC = Costs per order
IC = Inventory carrying cost per unit

When having the appropriate forecast for purchases (D in the formula) under JIT and Lean systems, the EOQ formula can be a useful tool for calculating the right level of purchases (order size). This will result in lower inventory and ordering costs, and thus, will have a positive impact on the company's profitability.

3 Supply Chain Management and Purchases

3.1 Purchase

In Porter's Value Chain diagram (see figure 10), procurement relates to purchasing inputs used in the firm's value chain; as well as for the primary activities (inbound logistics) and support activities (for instance, for infrastructure) (Weele van, 2010). In this article a separate supporting activity, Finance, is isolated from the Infrastructure, because the relationship between Supply Chain Management, Purchase, and Finance is the crux of this article. Infrastructure is a container which is full of managerial tools capable of facilitating the primary activities.

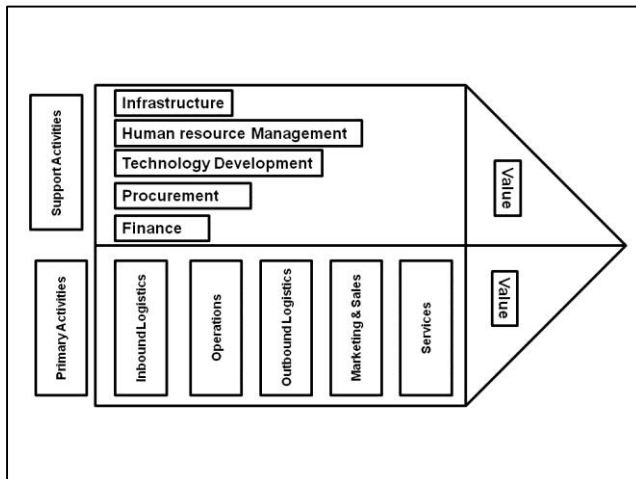


Figure 10. Porter's Value Chain (Adapted from (Weele van, 2010) by the author with Finance as a new support activity).

In table 1, Kraljic's portfolio matrix (Weele van, 2010) is observed to characterise the company's purchase portfolio. Depending on the sort of products purchased (Leverage, Routine, Strategic and Bottleneck), the financial impacts of the purchase and the supply risks are mapped. According to (Weele van, 2010), the supply risk is based on the matters like the product availability, number of potential suppliers, substitutes, distance, costs of changing a supplier, etc.; and the the impact of purchasing decisions on financial results like cost of material, total costs, volume purchased, share of purchase costs, quality performance, business growth, etc.

Supply Risk →	Low	High
Financial Impact ↓		
High	Leverage products	Strategic products
Low	Routine products	Bottleneck products

Table 1. Kraljic's purchasing portfolio (Weele van, 2010).

Purchasing has the following main functions:

- Determining the purchasing specifications
- Selecting the best suppliers
- Contracting
- Ordering

- Monitoring and control of the order to secure supply (expediting)
- Follow-up and evaluation

Purchase function is also responsible for trade-offs between the total cost of ownership (TCO) and (incoming) quality control of the goods purchased, in such a way that there is a good balance between:

- Value improvement
- Risk management
- Purchasing cost reduction

Managing the company's external resources in such a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company's primary and support activities is secured at the most favourable conditions (Weele van, 2010)

Moreover, the purchase function is a strategic function between the three important stakeholders in the business process. In figure 11 the three main stakeholders are illustrated, as well as how they relate to the business.

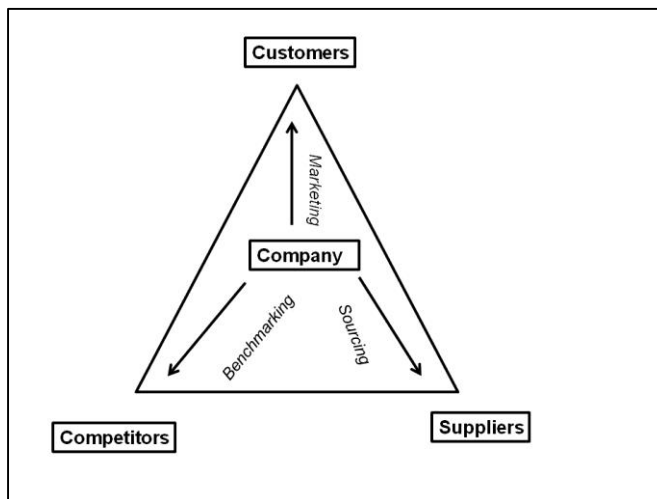


Figure 11. Strategic Triangle (Weele van, 2010).

Purchase management (in case of Purchasing Excellence) is definitely not an operational issue for the company's management, but it fits into strategic management issues of the company, including the strategic set up of supply chain management according to Monczka's model of purchasing excellence (Weele van, 2010). So, Kraljic's purchasing portfolio (see also table 1) presents the overview of four main categories of products, linked to the supply risk and the financial impact on the company. The logistics structure of operations plays an important role (see figure 12) in the complete overview of the (strategic) purchasing management. The order decoupling point (or penetration point) in the company has a huge impact on the planning process (e.g. MTS, ATO, MTO and ETO) and thus, on the purchase process.

The purchasing product portfolio, according to van Weele (Weele van, 2010), finally determines the strategic options of the purchasing strategy:

- Strategic products > Partnership
- Bottleneck products > Secure policy
- Leverage products > Competitive bidding
- Routine products > Category management & E-procurement

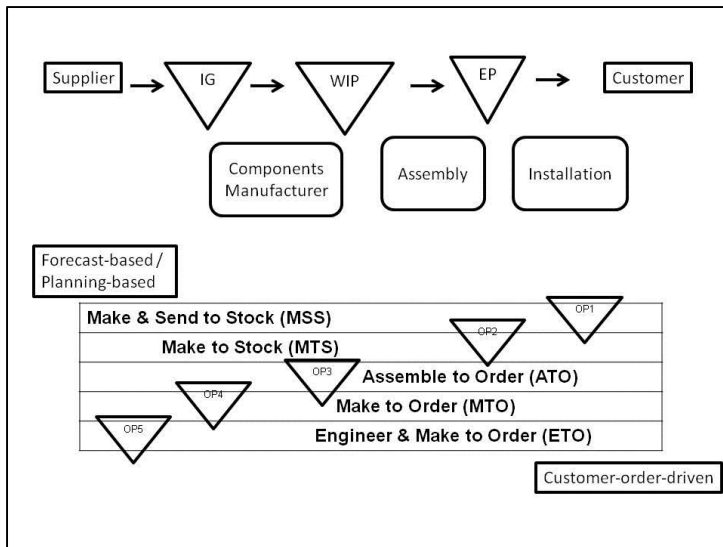


Figure 12. Order decoupling point/penetration point (Weele van, 2010).

3.2 Supply Chain Management

Supply Chain Management has its roots in the Porter's value chain concept (see also figure 10) and Porter's supply chain concept. In an integrated supply chain concept a group of integrated companies share information and coordinate physical execution to realise the flow of goods, services, information, and cash through the supply chain (Coyle, 2003).

The integration of the supplier, distributor, and customer logistics requirements into one cohesive process to include demand planning, forecasting, materials requisition, order processing, inventory allocation, order fulfilment, transportation services, receiving, invoicing, and payment. Also, the management and control of all materials, funds, and related information in the logistics process from the acquisition of raw materials to the delivery of finished products to the end user (Coyle, 2003)..

According to Coyle (Coyle, 2003), an integrated logistics management has the following structure (based on Porter's value chain concept):

- Support activities
 - Firm infrastructure (incl. Finance & Accounting)
 - Human resource management
 - Technology development
 - Procurement
- Primary activities
 - Inbound Logistics
 - Demand forecasting
 - Purchasing
 - Requirements planning
 - Production planning
 - Manufacturing inventory
 - Operations
 - Warehousing
 - Materials handling
 - Industrial packaging
 - Outbound logistics
 - Finished goods inventory
 - Distribution planning
 - Order processing
 - Transportation

- Customer service

Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements.

Source: Definition of the Council of Logistics Management (Stock, 2001).

Collaboration among partners in the supply chain will add value to each partner and the supply chain as a system, because:

- Risks can be shared
- Costs can be saved
- Lead and response time can be reduced in an ever changing business environment

In the context of this article, the approach of supply network management developed by Slack et al. (Slack, 2011), is an interesting one, and supply chain management or supply network management is defined as:

'Supply chain management is the management of the interconnection of organizations that relate to each other through upstream and downstream linkages between the processes that produce value to the ultimate consumer in the form of products and services' (Slack, 2011).

The supply network management model can be visualised in figure 13, where the overview is provided of how supply network management is split up into:

- Purchasing
- Materials management
- Physical distribution
- Logistics

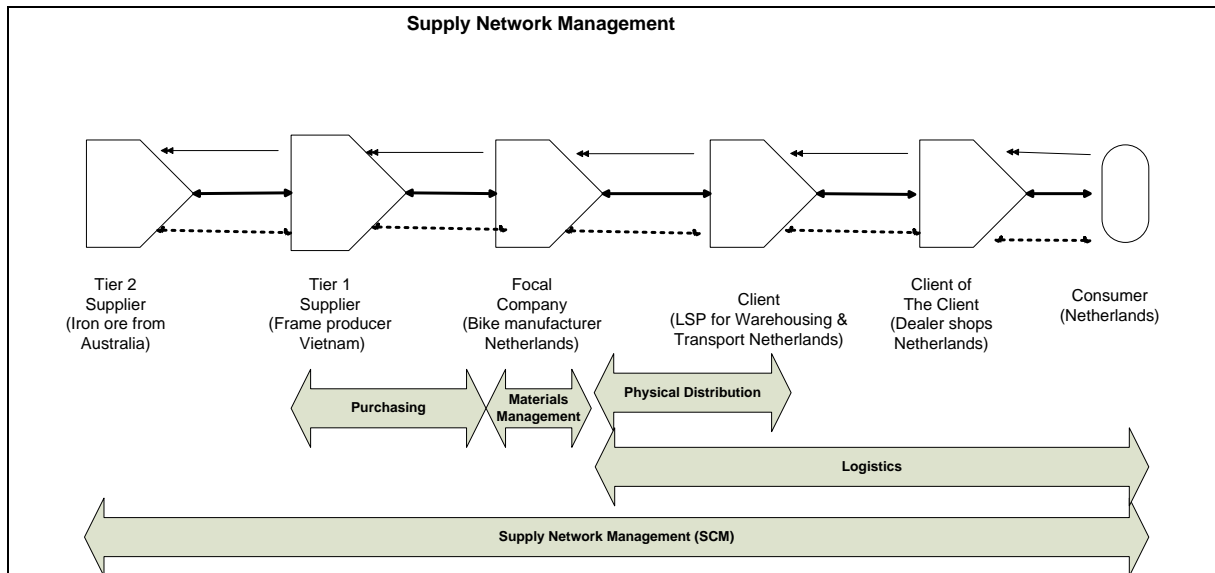


Figure 13. Supply Network management as defined by Slack, A. et al. (Slack, 2011).

4 IT Platform

The IT platform has an important function to execute SCF concepts (e.g. faster payment of suppliers/creditors) in the chain of companies using state of the art ICT technology: APS, ERP and EDI.

APS is a system of supply chain planning in a more complex environment than the more basic standard logistics planning tools like Manufacturing Resource Planning (MRP) (Theeuwens, 2016).

In figure 9, the structure of APS is presented in the following way:

- the time dimension
 - Supply chain planning
 - Long term (strategic)
 - Mid-term (tactical)
 - Short-term (operational)
 - Supply chain execution
- the value chain process dimension
 - Procurement
 - Production
 - Distribution
 - Sales

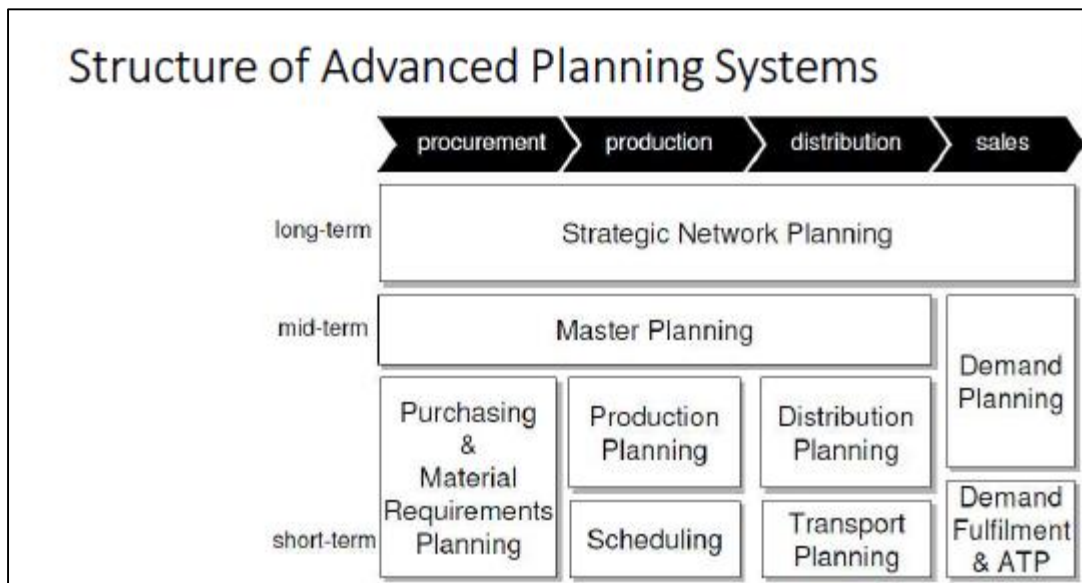


Figure 8. APS (Meyr, 2008).

Enterprise Resource Planning software is an integrated business software; this means that the logistics processes and the financial accounting are integrated into one software system.

So, the typical standalone MRP software and bookkeeping applications are now integrated into one enormous relational database by such well-known providers as SAP, QUAD, MS Navision, PeopleSoft, Oracle DJ Edwards, Sage, etc.

Electronic data interchange (EDI) facilitates online data exchange between companies in the supply chain, so they are able to exchange data concerning forecasting, inventory levels, order and billing information, etc.

Therefore, several providers of cloud services in the supply chain (e.g. PrimeRevenue, TradeCloud, GTNexus, etc.) transformed it into Supply Chain Finance instruments.

5 Supply Chain Finance

5.1 Analysis desk research

The financial model in use, is based on a standard balance sheet (Hillier, 2011), and instead of using real figures, symbols are used. In table 2 this standard balance sheet is presented and each component of the model is explained.

Balance Sheet					
Fixed Assets		A_F	Equity		$E = \epsilon * A$
Inventory	A_{C-I}		Long term Debt	$D_L = \lambda_L * A$	
Debtors (AR)	A_{C-D}		Short term Debt	$D_S = \lambda_S * A$	
Cash	A_{C-C}		<ul style="list-style-type: none"> • Creditors (AP) • Bank overdraft 		
Current Assets		A_C	Debt		$D = \lambda * A$
Total Assets		$A = A_F + A_C$	Total Equity & Liabilities		$E + D = A$

Table 2. Standard balance sheet.

To use the model for showing the influence of lesser working capital, the following assumptions are made:

- Cash = $A_{C-C} = 0$
- Debt to Asset ratio (λ) and Equity to Assets ratio (ϵ) equals 1 (or $\lambda + \epsilon = 1$)
- The fixed assets (A_F) are financed by Equity (E) and long term Loans or Debts (D_L), the so-called "Golden Rule of Finance"; so $A_C = D_S$ and Net Working capital ($NWC = A_C - D_S$) is 0.

The interest costs of Working Capital are:

$$D_S * T * R_{D-S} \text{ or } A_C * T * R_{D-S}$$

Where D_S stands for short-term Debt, T stands for time or duration, R_{D-S} stands for short-term interest rate for loans. For the sake of simplicity, we assume that $T = 1$, so the duration is a period of one year.

The weighted average costs of capital (WACC) is in the equation:

$$WACC = \epsilon * R_E + \{ \lambda_L * R_{D-L} + \lambda_S * R_{D-S} \} * (1 - t)$$

R_{D-L} is the interest rate for long-term debts, R_{D-S} is the interest rate for short-term debts and it is the average corporate tax rate.

According the Capital Asset Pricing Model (CAPM), the required return on equity (R_E) is:

$$R_E = R_{RF} + \beta * (R_M - R_{RF})$$

The risk free interest rate (for instance, on state bonds or T-bills) is: R_{RF} ; and the β is a yardstick for risk (a technical measure for the company's volatility in the market) (Hillier, 2011).

Finally, the Economic Value Added (EVA^{TM}) equals the Net Operating Profit After Taxes (NOPAT) minus the weighted average costs of capital multiplied with the total assets (A), or in the equation:

$$EVA^{TM} = NOPAT - WACC * A$$

The EVA™ formula can be decomposed into the factors influencing Net Operating Profit After Taxes (NOPAT) and the total costs of capital (WACC * A):

- 1) NOPAT
 - a) + Revenues
 - b) - Cost of Goods Sold (COGS)
 - c) - Overhead expenses
 - d) - Financial expenses ($\lambda_L * R_{D-L} + \lambda_S * R_{D-S}$) * A
 - e) - Taxes
- 2) WACC * A
 - a) WACC
 - i) $\epsilon * R_E$
 - $R_E = R_{RF} + \beta * (R_M - R_{RF})$
 - ii) $\{ \lambda_L * R_{D-L} + \lambda_S * R_{D-S} \} * (1 - t)$
 - b) A
 - i) A_F
 - ii) A_C
 - A_{C-I} (Inventory policy)
 - A_{C-D} (Collection policy)
 - A_{C-C}

Under the assumptions mentioned earlier in this paragraph, we can conclude that the EVA is influenced by managing the Working Capital:

- Inventory policy (2-b-ii: A_{C-I})
- Collection policy of Debtors/Accounts Payable (2-b-ii: A_{C-D})

So, there is a cause and effect relationship between lower inventory levels and lower debtor levels, the WACC, and finally higher Economic Value Added. This is visualised in the conceptual model in figure 18.

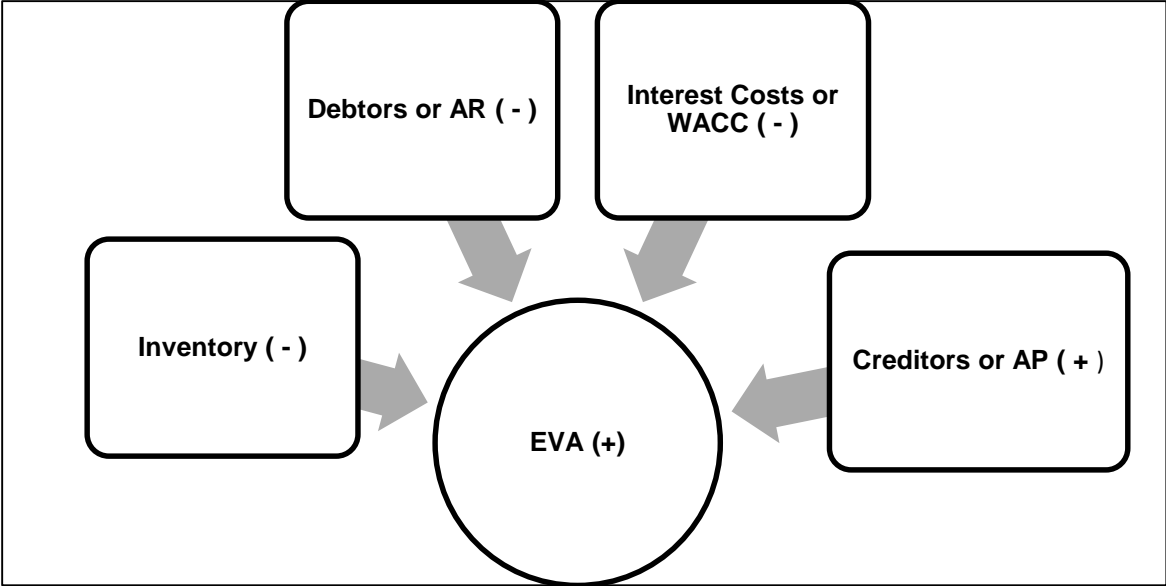


Figure 18 Conceptual model: Working Capital influencing EVA

In his article Hofmann et al. (2010) develops a similar model for a supply chain; and found empirical data of the C2C cycles in different sectors. If it's based on optimizing C2C cycles in a supply chain, it will result in a better EVA, and so in a better SVA (Shareholder Value Added). The total SVA is calcu-

lated by the gains from the C2C optimisation multiplied by the WACC's of each company in the supply chain. Hence, a collaborative C2C cycle for a supply chain can create gains (in terms of EVA and SVA), only the distribution of the gains between the companies is a point of discussion. Trust and power in the supply chain might be the leading principles for a 'fair' distribution of the gains in the long run.

According to figure 10, the adjusted Porter's value chain model, the financial aspect of logistics in the supply chain is stated in a more explicit way. Supply Chain Finance can be interpreted as the impact of supply chain strategies on the operating income and the Economic Value Added (EVA™) of the company (Coyle, 2003). Using the DuPont and EVA™ tree techniques, the effect of logistics measurement (e.g. lower inventory level, lower working capital financing, etc.) can be mapped in such a way that the consequences for the operating income (or profit) and the EVA™ are visualised. The management of financing the working capital in the supply chain (Coyle, 2003) was focused on the following topics:

- Reduction warehousing costs
- Reduction in inventory level
- Reduction in transportation costs
- Increasing service level to customers
 - Order fill rate improvement
 - On-time delivery improvement

Further development in SCF can be found in more recent contributions of (Pfohl H.-C. e., 2009), (Seifert, 2009), (Cosse, 2011), (Steehan, 2012), and (Steehan, 2014). Most of these recent contributions have in common:

- The aspect of reverse factoring for suppliers
- Interdisciplinary approach between:
 - Supply Chain management
 - Purchasing (procurement & sourcing)
 - Finance & Accounting
- Alignment in the supply chain between:
 - Physical flows
 - Information flows
 - Financial flows
- Linking
 - Competitive strategy
 - Supply chain strategy
 - Supply chain finance strategy

Supply chain finance is primarily focused on financing the working capital needs of the focal company's suppliers. In figure 19 the roles of the focal company, the suppliers and the banks are presented. As the focal company is often situated in a more financial stable business environment (with low interest rates), and the suppliers to be found in emerging economies (like the BRIC and Next 11 countries) which typically experience high real economic growth, high inflation rates and high interest rates, the conclusion is evident for the supply chain as an integrated system: borrow money in a low interest country (focal company) and allocate the loan to the high interest country (supplier). In fact, this is a kind of interest rate arbitrage. The bank is dealing with the focal company, which probably has a higher credit rating and can borrow against a lower interest rate (De Goeij, 2014).

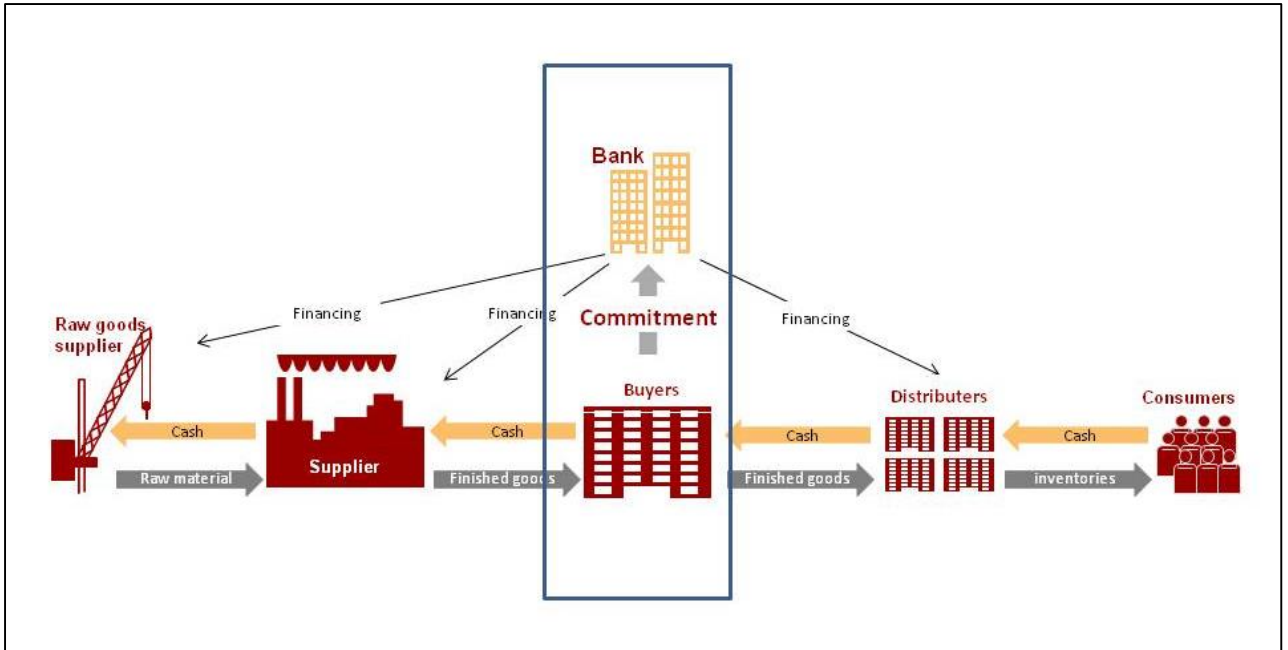


Figure 19. The role of the focal company and the banks in the managing supply chain finance (Steeman, Supply Chain Finance, 2013).

Supply Chain Finance Strategy is linked to Supply Chain Strategy over the Finance. In its turn, Supply Chain Strategy is linked to Competitive Strategy over the Competencies (see figure 20). An attempt to define Supply Chain Finance Management is presented in the text box below:

Financial arrangements in the form of debt, equity or financial contracts used in collaboration by at least two supply chain partners and facilitated by the focal company with the aim to improve the overall financial performance and mitigate the overall risks of the supply chain (Steeman, Supply Chain Finance, 2013).

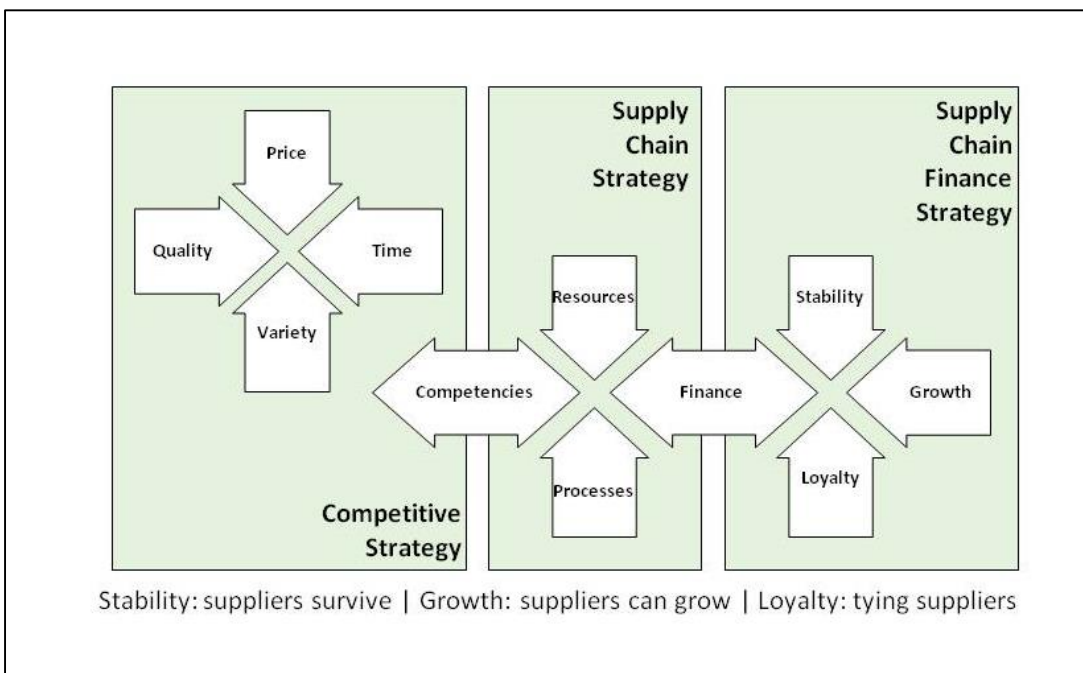


Figure 20. The link between strategies (Steeman, Bridging physical and financial supply chains, 2012).

5.2 SCF instruments

According to a well-known classification of SCF instruments, Strategic, Tactical and Operational levels can be distinguished (Boer de, 2015), as plotted in figure 11.

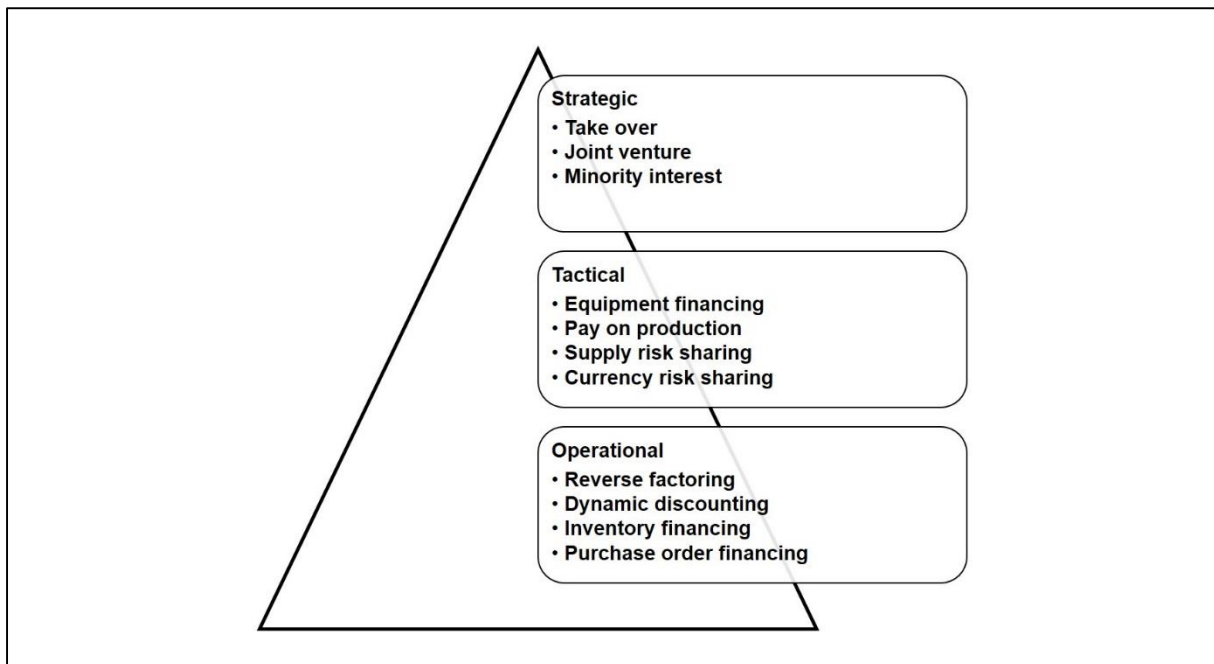


Figure 9. SCF instruments (Boer de, 2015).

We can often observe strategic SCF instruments in multinational firms like Philip, Unilever, Shell, Microsoft, Volkswagen, etc., which act as focal companies in the supply chain. The focal companies often want to safeguard their procurements in the long term, so they buy a stake from their suppliers via buying shares or starting a joint venture.

Tactical SCF instruments are often used to finance the equipment (e.g. trucks) of the focal company's supplier, because the supplier does not have the financial funds to do and/or is not powerful enough to get a loan from a bank.

Operational SCF instruments are used to directly improve the liquidity of the companies in the supply chain (i.e., reverse factoring, dynamic discounting, Inventory financing and purchase order financing).

A more detailed overview of operational SCF instrument can be found in the report *Supply Chain Finance* of the European Banking Association (Bryant, 2014), the EBA splits up the operational SCF instrument into four categories:

- I. Accounts payable/Buyer centric
 - a. Reversed factoring (Confirming/Approved payables financing)
 - b. Dynamic discounting
- II. Inventory centric
 - a. Pre-shipment
 - b. Purchased Order-based finance
- III. Accounts receivable/Supplier centric
 - a. Receivables purchase
 - b. Invoice discounting
 - c. Factoring
 - d. Forfaiting

- IV. Related
 - a. Documentary trade finance
 - b. Bank payment obligation (BPO)
 - c. Asset-based lending
 - d. Payments & Foreign exchange

In the EBA report mentioned above, each category is very well explained.

5.3 Example of a SCF instrument

An imaginary company K2F is introduced to show the advantage of financial collaboration in the supply chain.

The Dutch bike company K2F (Kievit Fietsenfabriek BV) operates as a focal company in an international supply chain for bike components. Except the focal company (K2F), the supply chain for K2F bikes has two main suppliers (Tier 1 and Tier 2), For a few sea container loads of bike frames the following data are available:

	DSO ⁴	Amount
Sales Tier 2 supplier to Tier 1 supplier	90 days	€ 600.000,00
Sales Tier 1 supplier to Focal Company	60 days	€ 900.000,00
Sales Focal Company to B2b Clients	30 days	€ 3.000.000,00

Table 2. Imaginary data for three companies.

We assume that all sales/purchases are made in Euros and the foreign bank loans are also possible in Euros (at international banks).

The following (imaginary) data are available for the (bank) interest rates for the three companies in this supply chain, based on Moody's credit ratings (Moody, 2016) .

	Moody's	Interest Rate
Rating Tier 2 Supplier	Caa3	11,0%
Rating Tier 1 Supplier	Baa1	6,0%
Rating Focal Company	B1	3,0%
Mark-up for SCF facility		0,4%

Table 3. Imaginary data for the three companies.

The focal company is able to offer credit facilities to the Tier 1 and Tier 2 suppliers using its own credit facilities at their Dutch bank. As there is more risk for the local (Dutch) bank, a mark-up of 0,4% is agreed with the focal company. For the sake of convenience we assume that there are 360 days in the year.

⁴ DSO = Days of Sales Outstanding

	TIER 2	TIER 1	Focal Company
Debtors (AR)	€ 600.000,00	€ 900.000,00	€ 3.000.000,00
DSO	90	60	30
Interest %	11%	6%	3%
Interest costs	€ 16.500,00	€ 9.000,00	€ 7.500,00

Table 4. Interest costs without a SCF instrument.

	TIER 2	TIER 1	Focal Company
Debtors (AR)	€ 600.000,00	€ 900.000,00	€ 3.000.000,00
DSO	90	60	30
Interest %	3,40%	3,40%	3,40%
Interest costs with SCF	€ 5.100,00	€ 5.100,00	€ 8.500,00
Interest costs no SCF	€ 16.500,00	€ 9.000,00	€ 7.500,00
Advantage	€ 11.400,00	€ 3.900,00	€ 1.000,00-

Table 5. Interest costs with a SCF instrument.

How should the gains of the SCF facility be distributed among the three companies?

Sharing the gains in the supply chain depends on what value proposition is adequate (Osterwalder, 2010)?

For instance, Tier 1 and Tier 2 pay the focal company 'pro rata' € 1000 in total, or the focal company can negotiate higher discounts at the Tier 1 supplier to compensate the extra costs of € 1000 and/or the Tier 1 supplier can negotiate higher discounts at the Tier 2 suppliers, etc.

6 Case study Agrifac

In this paragraph a real case study of a company that has implemented SCF is presented. Agrifac, a producer of agricultural equipment (Agrifac, 2014) (Tradecloud, 2014) is added. The case study information in this paper is partly based on literature review (website of the company), and two interviews with members of the management team of Agrifac (CFO and COO) and the CEO of the IT platform called TradeCloud. Agrifac is not yet in the final stage of SCF, but all the relevant steps for the take-off are realised in terms of collaboration with the Tier 1 and Tier 2 suppliers, and the trading platform is in full operation (Agrifac C. &., 2014).

6.1 Case study

Agrifac is a B2B producer of agricultural equipment (Sugar beet harvesters and Sprayers) for a niche market. It delivers solutions to its clients that is custom made equipment of high quality and perfect after sales (maintenance, spare parts, etc.). The '4E for growers' concept is about: *Efficiency, Economy, Ergonomics* and *Ecology*; they all are **value** drivers for Agrifac and its customers (Agrifac C. &., 2014).

Agrifac's Mission (Agrifac, Mission, 2014)

The world needs food, more and more

The world needs more and more food. More efficient agricultural production and higher yields are needed from less cultivated land to satisfy this growing demand. Therefore Agrifac manufactures "*Brilliant Simple*" machines. To help feeding the world. Brilliant Simple means innovative and easy to use. That's why all Agrifac machines are produced following the "*4e for growers*" concept.

For growers

From sowing to harvest, our spray machines support the growth of your crops, by protecting and nourishing them, and by combating disease. After that, our harvesters assure a fast and problem-free harvest. The combination of carefully considered technology, an attractive and sturdy design, very low maintenance costs, high trade in value and efficient service system make each Agrifac machine a glowing example of innovation and efficiency. And that means growth in every respect! The growth which farmers, contractors, dealers, employees and agricultural specialists are happy to choose.

Agrifac aims at creating so-called 'self financing' chain, taking into account the seasonal patterns of its customers (Farmers, Agricultural co-operations and Contracting companies). In fact, no or less external financing by banks of the working capital is provided. The leading principle of the collaboration in the chain is that the payment period should be limited to 14 days. Suppliers deliver according to the JIT principle, because the sales forecast of the focal company (Agrifac) is shared with the Tier 1 and Tier 2 suppliers. So a good and in-time delivery is rewarded with a quick payment of the (digital) invoices. Agrifac's supply chain is summarised in figure 16.

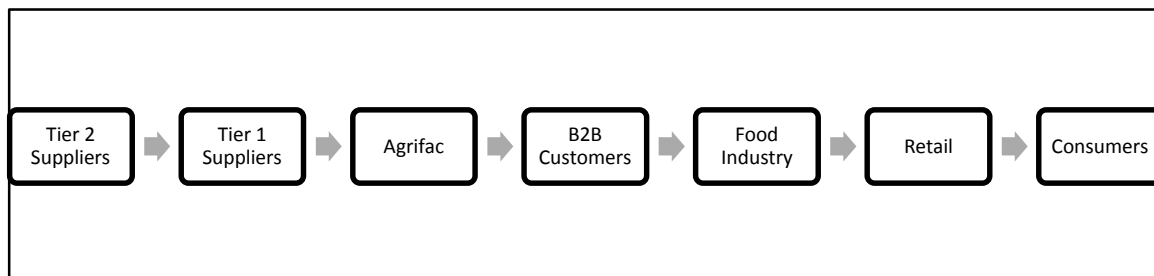


Figure 16. Agrifac's supply chain (Agrifac C. &., 2014).

Composition of the sales:

- Dealer sales
- Direct sales (using a kind of configurator)

- Agricultural co-operations
- Contracting companies
- Large farmers

The geographical distribution of direct sales in descending order are:

- Netherlands
- France
- Germany
- United Kingdom
- Russia
- Australia

Agrifac is a niche player in this market of agricultural equipment (Sugar beet harvesters and Sprayers), and in contrast to John Deere, is not a supplier of the full range of agricultural equipment. During the past four years, Agrifac had an annual growth of about 20%. Agrifac has about ten strategic suppliers, most suppliers are based in the Netherlands or just over the border with Germany. The chain of suppliers (Tier 1 and Tier 2) is quite stable in terms of participating companies. There are no formal agreements in the chain concerning collaboration, but cooperation is based on a very long tradition of collaboration and trust. Agrifac organized its logistics in the following way (see figure 17):

- Suppliers of Agrifac have access to a web-based B2B supply chain platform hosted by Trade Cloud; suppliers are able to observe when and what will be produced by Agrifac. So, Agrifac's suppliers can now forecast their own activities on production and purchases, in order to deliver their components just in time (JIT) to Agrifac.
- Agrifac's forecast is essential for Agrifac's own capacity planning in the ERP system called Exact Globe and also recorded in the database of the B2B supply chain platform hosted by Trade Cloud.
- At present, purchase orders are still used but in the near future these flows of purchase orders will be processed in the Trade Cloud system. Although, some legal issues still have to be solved in the fields of transferring property right and consignment. The ultimate goal is to lower inventories in the chain using concept of QRM and Lean (Suri, 2011).
- The liquidity in the chain is sufficient, the payment period was 90 days but is now reduced to 50 days.

Agrifac's investment in working capital is about € 16 million, and spreads over the following working capital components:

- Accounts Receivables: € 6 million with the duration of 50 days
- Inventories: € 10 million with the duration of 85 days
 - Components
 - Work in process
 - Finished products

The issues that play a role in Agrifac and their suppliers are:

- Mapping the working capital position
 - Current situation
 - Ideal situation based on QRM/Lean principles
- Estimating the financial needed resources (in terms of liquidity) in the chain
- Estimating the costs of financing (WACC⁵)
- Possible savings in working capital and the consequences for the EVA⁶
- Developing a business model to distribute the gains in EVA between the partners in the supply chain in a 'fair' way

⁵ WACC: Weighted Average Costs of Capital

⁶ EVA: Economic Value Added

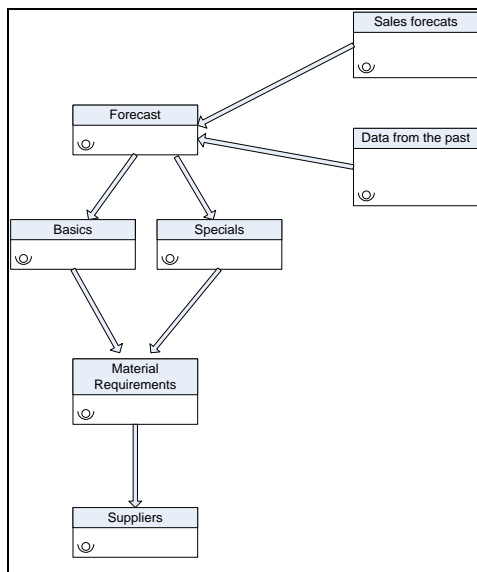


Figure 17. Organisation of logistics at Agrifac (Agrifac C. &., 2014).

6.2 Analysis case study Agrifac

According to the classification of Steeman (Steeman, The Power of Supply Chain Finance, 2014), Agrifac is ready for a take-off for the SCF 1.0 stage.

Most certainly, the real world of Agrifac cannot be in fact described in a theoretical model like it is done in the previous section(s), but some of the theoretical features can be observed as well in this case study. The necessary pre-conditions for Agrifac's take-off are now an operational stage to share information about the sales forecast from the focal company (Agrifac) to its Tier 1 and Tier 2 suppliers in the supply chain, using the Trade Cloud platform. So the inventories in the supply chain have a tendency to be lower at the Tier 1 and Tiers 2 suppliers and Agrifac. The next steps to be implemented are the workflow of invoices, as well as the confirmation process of invoices. These steps will result in the reduction of the payment period between:

- Tier 2 – Tier 1
- Tier 1 – Focal company (Agrifac)

To sum up, this case will not completely fit into SCF 1.0 (Basic SCF instruments like reverse factoring and dynamic discounting) and SCF 2.0 stages (Advanced SCF instruments that integrate physical, information and financial flows in the supply chain) (Steeman, 2014), because the discussion about sharing the gains is still a subject of a business model that has to be developed between the companies which collaborate in this supply chain (Agrifac C. &., 2014).

7 Conclusions and further research

From the theoretical analysis we can conclude that the Supply Chain Finance concept is developing into a clear concept for the boardroom of companies, as a good system of supply chain finance can contribute to a higher EVA™. Standard theories of finance and management accounting might contribute to the development of new approaches in supply chain finance, as well as to the integration of supply chain management and procurement, and sourcing. From the case study we can conclude that there are a lot of possibilities to connect the different ERP systems of companies in the supply chain with EDI technologies. A point of attention is still on how to divide the gains of having a more efficient (lower costs of supply chain finance) supply chain performance, so business models have to be developed between partners to share the gain of lower costs (Jonker, 2012), (Osterwalder, 2010). Besides the technological solution, it is important to collaborate between companies and its managers; and to share the so-called `win-win` situations with each other. In figure 19 it is summarised how the new SCF paradigm might fit into existing subjects (as also was shown in the literature review), combined with new trends IT platforms (EDI and ERP) in the supply chain. Like in the case study, business can join the theoretical framework (often based on MNE cases) of SCF and/or SCF theorist has to adapt their theories to the business cases of SMEs.

Definitely, SCF is adding value to controlling (e.g. business controlling) by adding value to the company (lower working capital, reduction of the cash cycle, sharing the benefits of interest arbitrage, and reduction of risks), also the collaboration with other departments in the company to integrate their processes: Supply Chain Management, Purchases, Marketing, Finances, and IT.

Another challenge is to help SMEs with the introduction of SCF instruments, because SCF is not only about reversed factoring and dynamic discounting but a paradigm shift about collaboration in the supply chain and creating value by having better working capital management (lower working capital, because of sharing forecast in the supply chain, lower interest rates and a shorter cash cycle). This paradigm shift is also about the fact that departments like Controlling (or Finance), Supply Chain management, Production, Marketing & Sales and ICT have to cooperate more tightly in the future. This might be also a shift in a business culture especially for small and medium-sized companies.

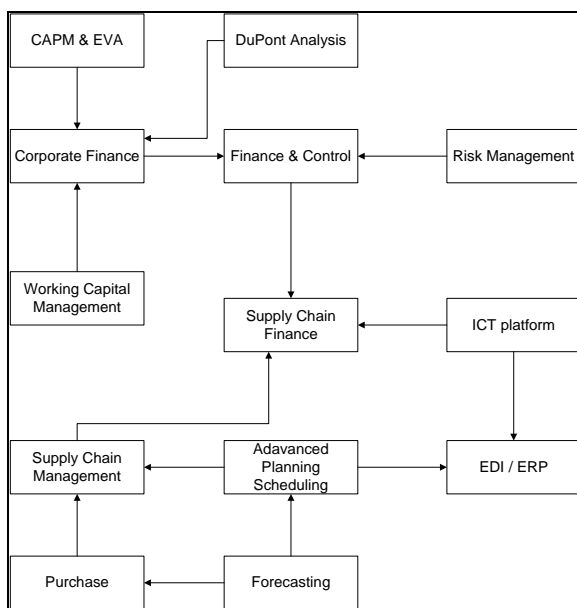


Figure 19. Supply Chain Finance: How it all fits together (developed by the author).

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