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Supply chain financing: using cash-to-cash variables to strengthen the supply chain

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Abstract

Purpose – The purpose of this paper is to show how firm financial management techniques may be used to improve over all supply chain profitability and performance.

Design/methodology/approach – This paper uses a case-based approach to demonstrate how supply chain financial management techniques, such as cash-to-cash and shared weighted average cost of capital (WACC), can reduce the financial costs experience by a supply chain.

Findings – This paper provides a methodology to identify and quantify the potential opportunities to increase profitability throughout the supply. Scenarios are offered that illuminate potential supply chain improvements gained by collaborative management of cash-to-cash cycles and sharing WACC with trading partners.

Research limitations/implications – These financial techniques are readily available for use in collaborative supply chain structures.

Practical implications – Coordinating financial management across the supply chain is a potential tool to align and improve the financial performance of collaborating firms. This method extends to the supply chain those historically firm-centric financial management concepts such as return on capital and cash flow. The impact is reduced overall cost generated by leveraging the financial strength of the entire supply chain. During economic downturns and times of tight credit proactively managing financials across the supply chain may be the only way some suppliers remain afloat.

Originality/value – Two firm level financial management approaches are extended and they are adopted for use across the supply chain: cash-to-cash management; and leveraging a shared supply chain financing rate. This paper builds on the increasing body of research and practice that suggests trading firm-optimized for supply chain optimized performance reduces overall cost and improves customer value.

Keywords Finance, Supply chain management, Cash flow, Supplier relations

Paper type Case study

Introduction

Research and practice is definitive; strong supply chain collaboration leads to increased profit and improved competitive advantage. This paper builds on that foundation to demonstrate that firms that establish strong collaborative structures may benefit by adopting a supply chain approach to their financial management techniques. A supply chain financial management approach means smartly extending classic firm-oriented practices dealing with cash-to-cash cycles, cash flow, and weighted average cost of

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capital (WACC) as they manage their supply chain partnerships. Firms can generate greater profits by recognizing and cultivating financially based advantage often overlooked by their competitors (Griffis *et al.*, 2007; Ambler, 2006; Gunasekaran and Kobu, 2007; Aberdeen-Group, 2006). This improved profitability comes when partners' trade firm-centric sub-optimized financial practice for a supply chain optimized financial management strategy (Aberdeen-Group, 2006). Taking a supply chain approach to financial management, such as cash-to-cash and supply chain financing, is yet another element that leads to greater profitability in highly collaborative supply chain partnerships (Kahn *et al.*, 2006; Ogden *et al.*, 2005; Bititci *et al.*, 2004). Doing so is even more critical during tight economic times (NABE, 2009).

This paper provides methods, tools, and scenarios that supply chain partners may adapt to their situation and improve their profitability. This is accomplished by utilizing cash-to-cash metrics, and financial management techniques to identify and quantify potential opportunities to increase profitability throughout the supply chain. Scenarios are offered to provide examples of potential improvements by shifting inventories or by implementing supply chain financing techniques with key trading partners. These scenarios suggest managers may achieve superior financial performance by taking a deliberate step toward establishing a collaborative framework for managing supply chain financial variables. These collaborative techniques outlined in this paper shows how sub-optimized opportunistic actions, such as delay of payment, can negatively impact channel partners and the end customer (Gaski and Ray, 2004). In this paper, we show how adopting collaborative supply chain financial management strategy may lead to increased profitability for all the supply chain partners.

This paper begins with a literature review. The goal of the literature review is to demonstrate that adopting a supply chain optimized approach to financial management fosters the positive kind of inter-firm cooperation at the heart of supply chain management. The literature review describes the collaborative nature of supply chain management, and how management techniques that once oriented toward improving intra-firm processes are successfully being applied to inter-firm processes. Following the literature review, the key elements of cash-to-cash and supply chain financial analysis are presented; this section forms a sort of primer, extending firm financial techniques to the supply chain. Using that foundation scenarios are presented that demonstrate how moving from a firm optimized financial management to supply chain optimized financial management improves net profitability for the supplier network. Lastly, a discussion and conclusion are presented. In this paper, we show how supply chain financial management strategies, such as cash-to-cash and supply chain financing, provides supply chain professionals a strategy that focuses individual actors on network optimized value propositions.

Literature review: collaborative supply chains and financial management

In the past decade, firms have outsourced to trusted partners large amounts of what was once vertically integrated into the firm (Varadarajan *et al.*, 2001). This trend of strategic deconglomeration and increased reliance on collaborative partnerships has made supply chain management the central element in coordinating inter-firm success (Bititci *et al.*, 2004; Lambert and Garcia-Dastugue, 2006). Two decades ago the supply chain management focus was limited to intra-firm collaboration with respect to traditional logistics functions (warehousing, trucking, and inventory), the success that has occurred

by extending this collaborative approach to logistics functions across trading partners in an inter-firm fashion, while adding processes, has led to the rise in supply chain management (Lambert and Garcia-Dastugue, 2006; Drucker, 1962; Langley, 1980).

There is a growing body of literature that suggests significant value may be created when firms leverage their supply chain through activities such as demand sharing (Kahn *et al.*, 2006), improved vendor development (Seetharaman *et al.*, 2004), joint innovation (Autry and Griffis, 2008; Santos, 2004; Roy *et al.*, 2004) and shared reward (Wathne and Heide, 2004; Lee, 2004). This paper adds financial management to the growing list of collaborative areas. This is a natural progression of a firm specific function taken to the supply chain.

In a sense, the rise of the supply chain seems to suggest that "what is new is indeed old". Things once the purviews of the firm have moved to the supply chain. For instance, innovation has moved from cross-functional within the firm to cross-functional across the supply chain (Lambert and Garcia-Dastugue, 2006; Cash *et al.*, 2008; Slone *et al.*, 2007), at the same time customer orientation moved from a firm focus to a supply chain focus (Jaworski and Kohli, 1993; Mello and Stank, 2005; Soonhong *et al.*, 2007). From a resource perspective, the economies of scale once at the heart of vertical integration have given way to supply chain-based resource augmentation, shared competency, focus on core capability, and supply chain-based economy of scale (Varadarajan *et al.*, 2001; Gunasekaran *et al.*, 2008; Walters, 2004).

This success associated with this rise in collaboration suggests that the days of "going it alone" in business are all but over. Companies now rely on global partner to augment core capability and maintain competitive advantage; it is unlikely they could go back to the "old way" even if they wished to (Gunasekaran *et al.*, 2008; Bernabucci, 2008). The increasing complexities of the modern market encourage collaborative structures where firms cooperate to compete (Christopher and Ryals, 1999; Prahalad and Hamel, 1990). In this evolution from firm to the supply chain financial management presents an area that is ready for inter-firm collaboration. Adopting a supply chain financial management perspective has the potential to increase profit, reduce risk, and improve competitiveness (Aberdeen-Group, 2006; Tibben-Lembke and Rogers, 2006).

Systems theory

Supply chain management is based on the systems theory of the firm (Drucker, 1962, 1954). Systems theory suggests that stove-piped decisions aimed at maximizing a particular transaction in a single function, e.g. distribution or purchasing, may result in sub-optimized outcomes that negatively impacts overall firm performance (Drucker, 1962). Classically systems theory is a firm level management technique. The adoption of a systems approach means reducing total cost by linking previously separate functions such as in- and out-bound transportation (Poist, 1974; Ellram, 1993). Modern supply chain management extends the systems approach to the network of firms. In doing so, the goal of supply chain management is to optimize the inter-firm flows of material, information, and knowledge (Lambert *et al.*, 2005; Forrester, 1958).

The systems approach considers "all activities associated with the flow of goods from the raw materials stage, through the end-user, as well as the associated information flows" (Ballou, 1999, p. 5). Supply chain managers and researchers have continually sought ways to take firm based cross-functional activities and extended those to the supply chain (Langley, 1980; LeKashman and Stolle, 1965). Moving process

and flow optimization from the firm to the supply provides a "total channel perspective in which vendors and customers create win-win logistical decisions which benefit both parties" (Langley, 1980, p. 8). From that venue, it is smart to recognize that financial management, such as cash flow management, represents yet another technique ripe for optimization at the supply chain level (Bernabucci, 2008; Tsai, 2008).

Cash flow and cost of capital

The shift to supply chain-based collaboration means that the management of flows, such as material, information and cash flows, has increased in both complexity and criticality (Shunk *et al.*, 2007). While research has been clear on the importance of integrating the supply chain offering (Bowersox *et al.*, 2000) integrating financial variables in a supply chain-optimized fashion has been largely overlooked (Gunasekaran *et al.*, 2008; Shunk *et al.*, 2007; Ketchen and Hult, 2007). According to recent research, few firms are harvesting the gains derived from manipulating supply chain financing cost savings (Aberdeen-Group, 2006). Firms that consider the financial strengths and weaknesses of key trading partners generate increased profits.

Supply chain financing costs have a substantial impact on the cost of goods sold (COGS) experienced by the end customer. Aberdeen-Group (2006) found financing costs account for 4 percent of finished goods. They also found few firms are looking at finance cost strategically, yet those that do achieve higher profits. As Aberdeen-Group (2006) points out, suppliers often have more restrictive access to financing and pay a higher money rate. Invariably, these results in a higher cost from the supplier, and higher COGS to the customer.

Financial variables represent a commonly overlooked element in that search for network optimal least cost. Lay logic has suggested managers should sub-optimize their own cash flow at the expense of their partners. Firms do this by forcing supply chain partners to bare capital interest costs, or by generating paper profits by selling products before paying vendors (Aberdeen-Group, 2006; Henry, 2003; Zimmerman, 2006). The real lessons of successful supply chain partnerships suggests that trust, cooperative cash flow management, and shared cost of capital is likely to improve overall rate of return on investment when a supply chain perspective is adopted (Walters, 2004).

Defining cash-to-cash and supply chain financial variables

> There is always interest in getting a balance between payment terms and the flow of your inventory. Certainly we all love to sell something before we have to pay for it. And you know that being an ultimate goal I think of any retailer. But there is no free lunch. We are more focused on lowering inventory levels without additional demand for terms from the vendor (Chief of Supply Chain Management Major Retailer).

A total cost perspective suggests managers look at end-to-end supply chain costs in order to make decisions which maximize customer value. This requires an open-and-honest information sharing environment; partners must compare financial strengths in order to identify gain/gain synergistic opportunities. Cash-to-cash cycle management and supply chain-optimized capital financing provides value that has previously been left on the table. After a decade of decreased budgets, and insatiable appetites for wringing out efficiencies, this is a significant claim.

This paper used three primary techniques to improve financial metrics associated with cash-to-cash:

(1) reduce inventories held at the firm;

(2) reduce accounts receivable by having customers pay faster; and

(3) extend accounts payable by taking longer to pay suppliers.

According to Moss and Stine (1993), certain firms possess comparative advantage in their WACC and their inventory carrying cost (ICC). A firm's debt position, a firm's cash flow, and firm's assets all combine to provide one firm's access to capital at a lower interest rate than the next firm. Additionally, a firm's past insurance payouts, their inventory velocity, their control of overhead costs, and their tax burden means that one firm may likely have a lower ICC for the same good than another firm. Supply chain partners may use these differences in financial strength to increase profitability (Aberdeen-Group, 2006).

Proper manipulate key cash-to-cash variables, such as inventory, receivable terms, and payable terms to reduce inventory carrying and capital costs reduces overall cost for the supply chain. The result is more customer value, and increased competitive advantage for the co-operating network. However, steps must be taken to compensate those supply chain partners who compromise their profit position in order to maximize the network profit position. Doing so may strengthen and increase the chance of survival for the supply chain.

Supply chain financial management optimization

This section provides a primer of supply chain financial management techniques. These are essentially firm-oriented financial techniques that have been adapted as supply chain management techniques. Following this primer section, key strategies are presented and then a number of scenarios are provided to demonstrate how to apply these techniques. These scenarios use information that is available for publically traded companies and rely on generally accepted accounting principles (GAAPs) data for publically traded companies. The information is found in the following:

- balance sheet: inventory, accounts receivable, and accounts payable; and
- income statement: revenue and COGS.

To generate a cash-to-cash calculation, the financial variables may be converted from dollars to days to create a standardized measure for analysis. The formulae associated with these calculations are presented below:

$$\text{Days of Inventory}_{(C2C)} = \frac{\text{Inventory (\$)}}{\text{Cost of Goods Sold (\$)}} \times 365 \quad (1)$$

$$\text{Days of Receivables}_{(C2C)} = \frac{\text{Accounts Receivable (\$)}}{\text{Net Sales (\$)}} \times 365 \quad (2)$$

$$\text{Days of Payables}_{(C2C)} = \frac{\text{Accounts Payable (\$)}}{\text{Cost of Goods Sold (\$)}} \times 365. \quad (3)$$

Cash-to-cash is then calculated using those three variables:

$$\text{Cash} - \text{to} - \text{Cash Cycle} = \text{Inventory}_{(C2C)} + \text{Receivables}_{(C2C)} - \text{Payables}_{(C2C)}. \quad (4)$$

The number of days may then be either a positive or negative number. The number of days indicates how much time the particular firm has their capital expended on the particular transaction. As an example +29.4 days at $10M would mean a transaction ties up $10M for 29.4 days. A shown in Figure 1, for the firm a positive number indicates capital is tied up awaiting payment from a customer.

A negative number shows how many days the firm holds cash from a sale before supplier payment is required. In this case, a negative 49 days, at $10M means the firm holds $10M for 49 days.

The cash-to-cash goal for most firms is to be close to 0 days (or negative) for their cash-to-cash metric. In the past, the cash-to-cash metric has been used as a measure of efficiency and profitability with respect to the firm's financial resources. At that firm level, zero or negative numbers means that the firm is "profitable" with respect to cash-to-cash optimization, the problem arises when this local optimization results in a supply chain sub-optimization. In general, the cash-to-cash number should be inversely related to a company's cost of capital and ICC. That is, the firms with the lower costs of capital should carry more cash-to-cash cycle days. To determine the supply chain optimal cash-to-cash algorithm, a firm should model their cash-to-cash impact on profitability and then cash-to-cash performance of their supply chain partners. This calculation gives a baseline that supply chain partners may use to identify opportunities for improvement.

Supply chain financial management strategies

The next section begins with an overview of key financial management strategies; these are:

- the idea of payback leverage points;
- shifting inventory; and
- differing cost of capital.

After that scenarios are provided that demonstrate various applications of cash-to-cash and supply chain finance techniques. The objective of these scenarios is to show ways that these, previously firm-centric, methods may be successfully applied in collaborating supply chains to improve financial performance. Using actual data, some scenarios results are impressive, while in others the results are more marginal. The objective is not the level of increased profit in these particular scenarios, but to

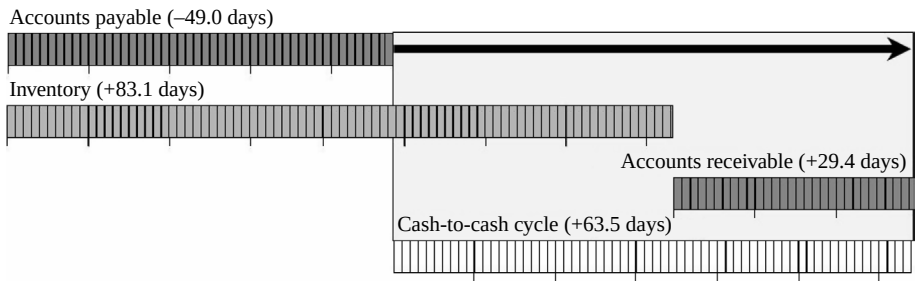

Figure 1.
Cash-to-cash for target company

demonstrate the method and provide a replicable template for both researcher and practice.

The objective function therefore is to optimize financial management-based cost saving at the supply chain level. To make the scenarios more simple, and comparable, a single data set, shown in Table I, is used for each scenario. The data provided in Table I come from a major component manufacturer in the semiconductor industry (SIC 3674) which sells to an OEM, a communications equipment company (SIC 3663), and buys from a sub-component supplier, a company in the electronic measurement and test instruments industry (SIC 3825).

Actual gross margin data are used for each company as determined from publicly available Research Insights data. The weighted average cost of capital, ICCs, initial selling price and units purchased per year are created for example purposes. For supply chain financial management to be effective requires an expectation and acceptance that each trading partner will share their best estimate of ICC and weighted average cost of capital. In the absence of shared information, most firms may develop a best estimate of these variables for their trading partners.

For example, purposes, the scenarios assume the component manufacturer desires to begin managing the financials from a supply chain perspective. The firms are publicly traded so the GAAP financial data with each firm's financial data (balance sheet and income statement) to calculate cash-to-cash variables and gross margin is available[1]. Next an overview of the key strategies:

- the idea of payback leverage points;
- shifting inventory; and
- differing cost of capital is provided.

(1) Payback/leverage points for target company

Determining the payback/leverage points of change for each of the cash-to-cash variables for the component manufacturer serves as a starting point for initial negotiation with trading partners. Table II reflects the benefit of improving the cash-to-cash variable by one day. For example, eliminating one day of inventory allows the firm both a one-time benefit and an annual, on-going benefit. This benefit is created by shifting a day of inventory to one of the component manufacturing firm partners.

	Sub-component supplier (SIC 3825)	Component manufacturer (SIC 3674)	OEM (SIC 3663)
WACC (%)	12.0	15.0	10.0
ICC (%)	24.0	27.0	22.0
Gross profit margin (%)	59.2	57.4	64.2
Selling price (per unit) ($)	57.40	100.00	155.76
Units per year	10,000	10,000	10,000
Purchases ($)	339,808	574,000	1,000,000
Sales revenue ($)	574,000	1,000,000	1,557,632
Accounts payable (days)	141.0	49.0	59.3
Accounts receivable (days)	68.6	29.4	57.1
Inventory (days)	207.9	83.1	28.3
Cash-to-cash (days)	135.5	63.5	26.1

Table I.
Supply chain management data

The day of inventory may, over time, convert into cash equal to one day of COGS ($1,573). Eliminating this inventory also reduces annual ICCs for that inventory ($1,575 × 27.0 percent = $425). Assuming the firm chooses to maintain this new inventory position, this cost savings represents a reduction in operating costs for all future years. Shifting inventories may be a sound strategy if one of the trading partners has lower ICCs and those inventories are not a long-lead item in a manufacturing process. Identifying the payback/leverage helps the firm consider if the saving generated by the shift is worthwhile.

Accounts payable, the second line in Table II, is treated in a similar fashion. Paying the supplier one day later will increase the liabilities portion of the balance sheet but will also result in a corresponding increase in available cash as shown by the one-time benefit. The increase in cash may be invested or used to reduce debt. The weighted average cost of capital provides the rate of return for the increased amount of cash. In similar fashion, the reduction debt, or shift to investment, will result in a proportional out year rate of return based upon the weighted average cost of capital. Receivables, last line in Table II, also benefits. One day of early payment results in a return of one day of sales revenue. Similar to the treatment of accounts payables, converting the receivables into a cash asset allows the firm to "earn" one additional day at the WACC annually.

Cash-to-cash literature commonly assumes the greatest one-time leverage point is receivables. However, as demonstrated in this analysis, from an on-going basis, the best leverage point is inventory. One explanation for this is that managing receivables is more difficult, because it is less controllable, than managing firm inventories. This is particularly true if supply chain partners act opportunistically. Most firms have the greatest control managing payables and inventory. The use of the financial management techniques presented in Table II may serve as an initial guide directing the component manufacturer's actions. In all cases, adjusting these cash-to-cash variables will be beneficial to the component manufacturer; however, identifying the payback/leverage is just the first step in determining if the change is beneficial to the overall supply chain.

(2) Shifting inventory

There has been a historical trend for firms shifting inventories in the supply chain upstream toward suppliers (Goldsby *et al.*, 2006; Erlebacher and Meller, 2000; Dixon, 2001). In general, this financial management technique is supported by the idea that the value of any product is reduced further back in the supply chain and therefore the holding cost is less. Cost and value increase with the forward movement into the supply chain manufacturing and logistics processes.

Using Research Insight, as shown in Table III, the authors analyzed the 2006 financial reports of 1,255 publicly traded companies for SIC codes 3000 to 3999 to demonstrate this technique. These SIC codes capture manufacturing companies.

Table II. Payback of leverage points

	One time improvement	Annual improvement
Inventory ($)	1,573	425
Payables ($)	1,573	236
Receivables ($)	2,740	411

Number of companies	Standard industrial classification (SIC)	Average COGS (%)	Gross profit margin (%)
37	3000-3099	70.2	29.8
20	3100-3199	57.8	42.2
21	3200-3299	70.3	29.7
54	3300-3399	75.5	24.4
48	3400-3499	69.1	30.9
250	3500-3599	59.3	40.7
389	3600-3699	59.5	40.4
102	3700-3799	77.3	22.7
299	3800-3899	47.4	52.6
35	3900-3999	57.3	42.7
1,255	All	59.5	40.5

Table III.
Average profit margin of manufacturing industries

This analysis compared net sales revenue with COGS to determine an aggregate gross profit margin for the ten sub-categories.

This example supports holding inventories earlier in the supply chain. The firms analyzed averaged just over a 40.5 percent gross margin with a corresponding average COGS of 59.5 percent. If all other factors are equal, and inventory is held at the supplier, there should be a subsequent ICCs that is about 60 percent of the cost than if held at retail.

If the supply chain partners are able to shift inventory from the component manufacturer to the supplier by even one day, those partners may harvest the ICC associated with the lower product value due to delay in burdening the product with the cost of transportation. In addition, the product has not yet been burdened with the component manufacturers profit margin. Therefore, stopping the inventory further back in the supply chain should result in lower incurred cost, which lowers carrying costs, and ultimately lower overall inventory expenditure as experienced by the network.

(3) Differing cost of capital by trading partners should be cultivated

The last, most overlooked, financial management technique, and the subject of this paper, is to take advantage of the differing cost of capital by supply chain trading partners. Throughout the supply chain there are key differences in the WACC for each firm. Shifting the financial burdens associated with supply chain transactions to the company with the lowest the lowest WACC is a strategy which takes advantage of the fact. Supply chains that act on these differences in cost of capital generate higher profits (Aberdeen-Group, 2006).

In some supply chains, particularly during time of tight credit, collaborative financial management may become critical. In a recent survey by the National Association of Business Economics – NABE (2009), 52 percent of their respondents noted that credit conditions are moderately to severely affecting their business. Supply chain partners with strong credit and lower cost of capital have an increasing opportunity to reduce financial costs across their supply chain. For some supply chain partners shared WACC may be the only way to survive during times of tightened credit. Sharing cash-to-cash savings, and WACC is what separates these techniques

from those just-in-time (JIT) techniques the manage cash-to-cash at the expense of their trading partners.

In many buyer-supplier relationships, firms give discount terms as a means of encouraging customers to pay earlier. A recent study by Xign (2005, 2006), suggests 80 percent of vendors offer early payment discounts. They do this to incentivize against deliberate, or commonly accepted, opportunistic financial activities such as delayed payment, and shifting inventories back to the supplier in a way that provides the manufacturing firms sub-optimized benefit. Many firms develop a generic discount policy and apply it to all customers. The "mass application" of discount policy foregoes potential profits gained through "customized" application of supply chain financing. The development of discount terms specific to a trading partner may guide and reward on-going relationships by equally sharing and cultivating the inherent advantages of each firm.

A recent observation depicts the idea of optimizing the financing of supply chain activities. We found a leading edge manufacturer was dependent upon a "Mom and Pop" supplier. That manufacturer, being financially strong, had a cost of capital around 6 percent. During initial low-production output stages of the program the mom and pop supplier was able to keep up with the production demands. However, the supplier did not have the capacity to support full rate production. To generate the needed production capacity, the supplier needed the support of a venture capitalist. While the venture capitalist was a rational alternative in such situations, that arrangements would result in cost of capital as high as 20 percent. The manufacturer, who enjoyed close collaboration with the supplier, was aware of the supplier cash positions and acted to extend their WACC to reduce overall cost.

As shown in Table IV, there is a potential for real savings when the OEM extends their WACC to cover a $20M investment. In this case, the manufacturer financed the supplier's capacity increase in order to avoid passing the venture capitalist cost on to the end customer. The manufacturer, with higher credit rating and access to the necessary financing in house, was able to significantly reduce (from 20 to around 6 percent) the cost of additional capital. That action resulted in a year to year savings of $2.8M.

Global transportation presents similar opportunities for savings. As shown in Table V, supply chain financing may be used to reduce the costs incurred transporting goods in the Asia-US shipping lanes. This transportation may take as much as three to four weeks. During that time, one of the supply chain partners must pay for the interest

Table IV.
Impact to supply chain-extending WACC balancing

	OEM	Mom and pop	Supply chain savings
WACC (%)	6	20	14
Financial costs of $20M per year (in million dollar)	1.2	4.0	2.8

Table V.
Impact to supply chain-extending WACC balancing

	Retailer	Supplier	Days in transit
WACC	5%	20%	28
Value of goods	$40M	$40M	
Yearly finance costs	$2M	$8M	Supply chain savings
28 day finance costs	$154K	$624K	$460K

charge on those goods (Bernabucci, 2008). If the cargo is worth $40 million and the manufacturer with a strong credit rating holds the cargo at 5 percent, their cost of capital is $153,424. Conversely, if the supplier with the riskier credit rating holds the cargo at 20 percent, their cost of capital is $613,699. If the manufacturer decides to implement supply chain financing, the firms gain $460,274 in extra profit due to foregone interest charges.

In general, the calculation of discount terms aimed at harvesting WACC savings should be based on:

- recouping the cost of the new financing;
- identifying the old costs; and
- determining the methodology to equitably spread the cost savings between the firms based upon units traded, and to be adjusted at the end of the year.

Cash-to-cash and supply chain financial management scenarios

The following section of the paper offers scenarios where these strategies are employed. The scenarios involve shifting inventories, modifying receivables, and adjusting payables while sharing the savings between trading partners. This is a critical as managing cash-to-cash variables at a supply chain-optimized level may decrease finance costs and increase profitability.

Scenario no. 1: inventory shift to key supplier

In certain circumstances, to reduce cost of inventory the component manufacturing company should consider arranging to have the supplier hold dedicated finished goods at their COGS, even if the goods are moved forward. In return, the supplier should receive full reimbursement of the cost to hold the inventory plus half of the cost savings. Table VI provides the data to support this analysis.

In this example, shifting ten days from the component manufacturer raw material inventory to the supplier finished inventory reduces the annual ICC for the component manufacturer by $4,246 but increases the annual ICCs of the supplier by $2,234. The calculations supporting this analysis are shown below:

(1) Annualized ICC for the component manufacturer = 10,000 annual demand/365) × 10 days × $57.40 purchase price × 27 percent target company ICC = $4,246.

(2) Annualize ICC for the supplier = (10,000 annual demand/365) × 10 days × $33.98 supplier COGS × 24 percent supplier ICC = $2,234.

	Supplier	Target company
ICC (%)	24.0	27.0
Gross profit margin (%)	59.2	57.4
COGS (per unit) ($)	33.98	57.40
Selling price (per unit) ($)	57.40	100.00
Units per year	10,000	10,000
Purchases ($)	339,808	574,000
Sales revenue ($)	574,000	1,000,000

Table VI. Supplier-focal firm data for inventory shift

(3) Net saving for the supply chain = \$4,246 target company ICC savings − \$2,234 increase in supplier ICC = \$2,012.

(4) Savings per unit = (\$2,234 increase in supplier's ICC + (\$2,012/2))/10,000 units = \$0.324 marginal unit price increase.

(5) Supplier revenue increase = unit price increase \$57.724 from \$57.40; \$0.324 × 10,000 units = \$3,240 increase in supplier revenue.

(6) Component manufacturer and supplier profit increase = \$1,006 = \$2,012/2.

The net savings to the supply chain is \$2,012. The supplier recoups the additional cost to hold the inventory plus their half share of the supply chain savings by increasing their selling price to component manufacturer company by \$0.324 per unit. The component manufacturer company recoups its half share of the savings through lower annual ICCs partially offset by a unit price increase. As a result, sales revenue, based on the per unit price increase, is raised by increases by \$3,240 for the supplier; profits increase \$1,006 for both the component manufacturer company and the supplier. The per unit price increase represents one mechanism to share the cost avoidance savings. In some scenarios, other options such as an aggregate rebate from the customer to cover the supplier's financial costs may be more effective so as to avoid negative impressions of a unit price increase. Either way, the technique results in savings that are equitably distributed.

Scenario no. 2: inventory shift from key customer

A similar arrangement may also be made between the component manufacturer company and its business-to-business (B2B) OEM customers. Even though the OEM customer has a lower cost to carry inventory, the OEM customer will still benefit from shifting ten days of inventory to the component manufacturer company because that inventory will be held at the lower value based upon percentage of COGS. The following details these calculations:

(1) Annualized ICC for the OEM = (10,000 annual demand/365) × 10 days × \$100.00 purchase price × 22 percent customer ICC = \$6,027.

(2) Annualized ICC for the component manufacturing company (10,000 annual demand/365) × 10 days × \$57.40 OEM company COGS × 27 percent target company ICC = \$4,246.

(3) Net saving for the supply chain = \$6,027 OEM ICC savings − \$4,246 increase in component manufacturing company ICC = \$1,781.

(4) Savings per unit = (\$4,246 increase in component manufacturing company ICC + (\$1,781/2))/10,000 units = \$0.5137 marginal unit price increase.

(5) Revenue increase for the component manufacturer = unit price increase \$100.5137 from \$100.00; \$0.5137 × 10,000 units = \$5,137 increase.

(6) Component manufacturer and OEM profit increase = \$891.

Shifting ten days to the target company inventory from the B2B customer will reduce the annual ICC for the B2B customer by \$6,027 but would increase the annual ICCs of the component manufacturing company by \$4,246. As shown in the list above the net savings to the supply chain is \$1,781. The component manufacturing company recoups

the additional cost to hold the inventory plus their half share of the supply chain savings by increasing their selling price to the OEM customer by $0.5137 per unit. The component manufacturing company recoups its half share of the savings through lower annual ICCs partially offset by a unit price increase. As a result, sales revenue increases by $5,137 for the component manufacturer company; profits increase $891 for both the target company and the B2B customer.

As shown in Table VII, the net impact of shifting ten days of inventory from the OEM to the sub-component supplier reduces the overall cost to the supply chain by $3,794. This amount is then shared across supply chain partners. In doing so, the profitability of all companies is increased. As the facilitator of this improvement to the supply chain, the component manufacturing company receives the greatest benefit. As shown in this scenario by shifting a dedicated inventory to the source with the lowest ICC and cost of capital, the collaborating partners by avoiding unnecessary finance costs. On the surface, these techniques may appear like a new angle on JIT (Dixon, 2001; Giunipero *et al.*, 2005). However, there is a very fundamental difference. In this case, the trading partner is committing to a purchase and the focus is on reducing financial costs. Whereas, JIT is an argument to delay arrival to the last minute.

Scenario no. 3: higher WACC then customer or lower WACC than supplier

Using the information found in Table VIII, the next scenario illustrates the impact of when the component manufacturing company has a higher WACC than the customer. Earlier payment from the OEM customer may lower supply chain costs and raise profitability if the incentives are in place to encourage this behavior. In order to make this attractive, these financial management based savings should be equitably distributed. To accomplish this, the component manufacturing firm should articulate the mechanics of supply chain finance and offer a reduced purchase price or a specific discount terms to the OEM customer to encourage early payment.

	Sub-component supplier	Component manufacturing firm	OEM customer	Supply chain
Days of inventory	+10 days 217.9 from 207.9	No change	−10 days 18.3 from 28.3	No change
Profitability	+$1,006	+$1,897	+$891	+$3,794

Table VII. Impact to supply chain

	Sub-component supplier	Component manufacturing firm	OEM customer
WACC (%)	12.0	15.0	10.0
Selling price (per unit) ($)	57.40	100.00	155.76
Units per year	10,000	10,000	10,000
Purchases ($)	339,808	574,000	1,000,000
Sales revenue ($)	574,000	1,000,000	1,557,632
Accounts payable (days)	141.0	49.0	59.3
Accounts receivable (days)	68.6	29.4	57.1

Table VIII. Supply financial burden shift

As shown below, reducing ten days from the target company receivables will reduce the annual receivables financing cost for the target company by \$4,110:

(1) Annualized receivables financing = 10,000 annual demand/365) × 10 days × \$100.00 selling price × 15 percent component manufacturer WACC = \$4,110.

(2) OEM customer forgoes of ten days WACC = 10,000 annual demand/365) × 10 days × \$100.00 purchase price × 10 percent OEM customer WACC = \$2,740.

(3) Net saving to the supply chain = \$4,110 component manufacturer company WACC savings − \$2,740 increase in OEM Customer WACC = \$1,370.

(4) Component manufacturer reduction in price = \$2,740 increase in OEM customer WACC + (\$1,3701/2))/10,000 units = \$0.3425 marginal unit price decrease.

(5) Sales revenue decrease = unit price increase \$99.6575 from \$100.00; \$0.3425 × 10,000 units = \$3,425 decrease in component manufacturer company revenue.

This requires the OEM Customer to forego ten days of WACC at a cost of \$2,740. The net savings to the supply chain is \$1,370. Assuming strong supply chain relationships the B2B customer may then recoup the additional cost associated with accelerating payment plus their half share of the supply chain savings.

The most efficient way to manage this transaction is for the OEM customer to receive a reduction in price from the component manufacturer company of \$0.5137 per unit. Based on original \$100.00 purchase price this amounts to a 0.3425 percent discount. While these costs add up, simply reducing the purchase price is most efficient mean of dealing with a relatively small transactional variable. The component manufacturer company recoups its half share of the savings through lower receivables cost partially offset by a unit price decrease. As a result, sales revenue decreases by \$3,425 for the component manufacturer company; profits increase \$685 for both the component manufacturer company and the OEM customer. If the component manufacturer company has a lower WACC then the supplier the scenario is similar. It may be beneficial to propose this scenario with key suppliers while taking into account that these are based upon forecasts. The greater the demand variability the greater the share risk. As such, any strategy should include periodic review and adjustment based upon true volumes.

Scenario no. 4: higher WACC then supplier or lower WACC than customer

The next scenario considers the case where the component manufacturer company has a higher WACC then the supplier. In this case, later payment from the component manufacturer company may lower supply chain costs and raise profitability. In order to make this attractive, there must be benefit for the supplier and the component manufacturer company. To accomplish this, the supplier should receive a higher market price for the product. This cost must be equal to their cost of capital for the additional days plus half of the annual cost savings spread over the number of units traded per year. The component manufacturer company pays a higher unit price but is able to reduce the amount requiring internal finance.

As shown below, adding ten days from the component manufacturer company payables reduces the annual payables financing cost for the component manufacturer company by $2,359:

(1) Annualized accounts payable reduction = 10,000 annual demand/365) × 10 days × $57.40 purchase price × 15% target company WACC = $2,359.

(2) Supplier forgoes ten days WACC = 10,000 annual demand/365) × 10 days × $57.40 sale price × 12 percent supplier WACC = $1,887.

(3) New supply chain savings = $2,359 target company WACC savings − $1,887 increase in supplier WACC = $472.

(4) New per unit price = $1,887 increase in supplier WACC + ($472/2))/10,000 units = $0.2123 marginal unit price increase.

(5) Sales revenue increase = unit price increase $57.6123 from $57.40; $0.2123 × 10,000 units = $2,123 increase in supplier revenue.

To do so requires the supplier to forego ten days of WACC at a cost of $1,887. The net savings to the supply chain is $472. By receiving a higher purchase price of $0.2123 per unit from the component manufacturer company, the supplier may recoup the additional cost to receive later payments plus their half share of the supply chain savings. Based on original $100.00 purchase price, this amounts to a 0.2123 percent discount. Again, the most effective mechanism to address this discount is to embed it into the purchase price quoted. The component manufacturer company recoups its half share of the savings through lower payable costs partially offset by a unit price increase. As a result, sales revenue increases by $2,123 for the supplier; profits increase $236 for both the component manufacturer company and the supplier.

If the component manufacturing company has a lower WACC then the OEM customer the scenario is similar. It may be beneficial to propose this scenario with key OEM customers. Table IX illustrates the net impact of these differing supply chain financials. Shifting ten days of the OEM customer payables, ten days of component manufacturer company receivables, ten days of the component manufacturer company payables, and ten days of supplier receivables results in no change to the cash-to-cash metric for the component manufacturer company but an increase in revenues for the supplier and the component manufacturer company. This has a net result of increased profitability for all three companies due to shared cost reductions. As the facilitator of this improvement to the supply chain, the component manufacturer company receives the greatest benefit.

Table IX. Impact to supply chain

	Sub-component supplier	Component manufacturing firm	OEM customer	Supply chain
Days of receivables	+10 days 78.6 from 68.6	−10 days 19.4 from 29.4	No change	No change
Days of payables	No change	+10 days 59.0 from 49.0	−10 days 49.3 × from 59.3	No change
Profitability	+$236	+$921	+$685	+$1,842

Total results of managing using the scenarios

The net impact of adopting a supply chain approach to financial management provides the component manufacturer company increased profitability as shown in Table X. By shifting the cash-to-cash variables to take advantage of the differing capital and inventory cost of each member of the supply chain, profitability increased for all participants. The component manufacturer company benefits the most by increasing profitability 2.8 percent. Through collaboration, the supply chain is stronger and more likely to survive during tough economic times.

Managerial implications

Supply chain management extends a systems approach to the supplier network to optimize functions and processes across the network of firms in a collaborative fashion. We show how supply chain management offers an opportunity to cultivate the inherent financial advantages of trading partners by strategically shifting inventories and implementing supply chain financing techniques. As with any supply chain, this is predicated upon trust, openness and shared risk and reward. Increasingly companies are finding increased profit by managing functions and process from a supply chain perspective; we add financial management to that list.

As with any strategy, there are certain conditions where these financial techniques obtain optimal results. For instance, the approach demonstrated in scenarios 1 and 2 almost always provides a positive impact on profitability but requires a dedicated commitment to purchase the materials. The execution of scenarios 3 and 4 are more dependent upon who has the inherent advantage and the strength of the relational structure. In all scenarios, since the initiation of the strategy may be based upon forecasted requirements, a clear contract is recommended which includes periodic adjustments based on actual volumes.

It takes an innovative supply chain manager and a cooperative chief financial officer recognizes the opportunity to further a gain-gain supply chain management strategy. Critical to this approach is application of performance measurements that look past silo myopic internal measurements and accept that a profit-driven collaborative strategy allows degradation of internal performance measures, such as days of cash-to-cash, so the supply chain may mutually benefit in a manner that ultimately decreases firm operating costs and increases firm profits.

We believe that the collaborative structure required to share supply chain financial risk and reward may be indicator of other more embedded structures that lead to increased profitability through inter-firm sharing, and lower transaction monitoring and enforcement costs. The end result may be a stronger, more competitive supply chain that is more likely to weather uncertain economic situations.

Table X.
Net profitability impact

	Sub-component supplier	Component manufacturing firm	OEM customer	Supply chain
Inventory shift (+ $)	1,006	1,897	891	3,794
Receivables/payables shift (+ $)	236	921	685	1,842
Total change in profitability (+ $)	1,242	2,818	1,576	5,636

Implications for theory and future research

The techniques proposed in this paper require a strong relational foundation. Relational supply chain structures represent a significant area of ongoing supply chain research (Kahn *et al.*, 2006; Lambert *et al.*, 2005). This research suggests that supply chain financial collaboration is likely to improve the overall collaboration and collaborative structures. The Aberdeen-Group (2006) research suggests that those firm that do financial collaborate generate greater profits. Follow up research should be considered that identifies relational antecedents involved in collaborative supply chain financial management. More specifically, we wonder what normative structures support decision processes that lead to suboptimization at the firm level in hopes of supply chain gain sharing at the network level. What are the key decision variables and the conditions under which they are best suited to pursue these proposed scenarios?

Modelers may find a rich field in developing the algorithms incorporating the trade-offs of expedited transportation versus the cost savings resulting from the shifting inventories or in designing a method to easily calculate company-specific discount terms. This modeling may be extended to include supply chain financing variables. Taken together, there is potential for a suite of supply chain financial management decision support tools.

Conclusions

It is important for supply chain professionals to consider how a systems approach to supply chain management may be logically extended to include supply chain financial management such as cash-to-cash and supply chain financing metrics to generate increased competitive advantage for the co-operating firms. The research presented here suggests that supply chain financial management strategies provide demonstrable profitability. In doing so, supply chain financial management may provide a normative foundation for increased collaboration. By taking advantage of the comparative strengths of each firm, the network generates profit previously foregone by operating independently. Balanced communication, focused through a supply chain financial management relationships embraced by all trading partners, may help ensure supply chain profits for the whole are not sub-optimized to the benefit of one firm in particular.

When partners in the supply chain focus decisions on aggregate optimization (what we call "a supply chain view") the customer wins; and when the customer wins the partners win. Most recall how Womack, Jones, and Roos's book *Machine that Changed the World*, showed American CEOs what supply chain professional could accomplish when these professionals were unleashed to find best value suppliers. The results were fewer partners (all of whom were high quality), increased information flows, greater trust, significantly enhanced efficiency, and increased profitability. Managing the cash-to-cash and supply chain financing variables from a strategic supply chain perspective provides a similar, non-zero sum gain approach.

The examples presented in this paper show how companies may increase profit by adopting a supply chain management view. That view is guided by cash-to-cash and supply chain financing rather than a traditional sub-optimized, internally focused view, of the firm. For supply chain financial management to work a company must be willing to accept degradation in its own cash-to-cash numbers, supportive of total cost

reductions for the customer. This localized degradation is required to bring overall gains for the company and its trading partners. Doing so brings increased trust, commitment, and profitability to the network. This collaborative structure is reinforced when aggregate level profits are equitably distributed to counter act that localized degradation. With supply chain financial management collaboration as the foundation, more comprehensive risk and reward sharing strategies are likely to result.

Supply chain financing works because it is highly coherent with fundamental tenets of supply chain management:

- make decisions at the aggregate;
- open up the flow of information; and
- encourage commitment among partner to make decisions that result in the best value for the customer.

In *The Practice of Management*, Drucker (1954) made this all very clear; when the firm, and its partners, provide customers superior value, profits will take care of themselves.

Note

1. If a trading partner is not publicly traded, the estimate of cash-to-cash variables must be obtained directly; benchmarking against publicly traded firms in the same industry is unlikely to work due to differences in debt, cash, and sources of cash.

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