LINKING SCM STRATEGY TO FINANCIAL PERFORMANCE: A SCENARIO ANALYSIS APPROACH

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1. Introduction

Companies increasingly compete through the strength, resilience and flexibility of their supply chains (Rice Jr. and Hoppe, 2001). Presutti Jr. and Mawhinney (2007) stated that 70 per cent or more of manufacturing firms' expenditures are on supply chain-related activities, which highlights the potential impact of effectively linking supply chain (SC) performance and financial performance. Although supply chain performance and the organisation's financial performance have been widely studied, few studies have been conducted to find the links between supply chain management (SCM) practices and financial performance improvements (Gardner, 2004; Toyli et al., 2008). According to Camerinelli and Cantu (2006), there is no direct and clear link between the measurement of day-to-day SC operations and the overall financial performance of the chain, which creates difficulty to translate SC operational measures, with their focus on day to day operations, into financial targets.

This paper introduces a new approach to link SCM strategy to a company's financial performance by focusing on the performance of the relevant SC operations and formulating the appropriate SC strategy to enhance it. Different scenarios are proposed to illustrate the most influential SC strategy with regard to the targeted financial results. This approach can be used as a strategic performance management tool to increase the effectiveness and the efficiency of a company's SCM strategy in meeting targeted financial performance results and to contribute to the overall improvement in the company's performance.

According to the proposed approach, financial performance results for a company are evaluated and analysed using Du Pont ratio analysis in order to identify financial performance drivers that require improvement (revenue, cost, and/or assets). Then, the focus areas for enhancing the financial performance in terms of relevant SC operations are traced and their corresponding SC performance measures are identified based on the standard performance metrics of the supply chain operations reference (SCOR) model. Finally, the appropriate SC strategy is formulated in order to enhance and control the performance of relevant SC operations and consequently the company's overall financial performance. Scenario analyses are undertaken to illustrate how this approach can be applied according to various possible financial performance results. To demonstrate the applicability of the proposed approach, a case study of a manufacturing company has been conducted.

The remainder of this paper is organised as follows. In the next section, the SCOR model and Du Pont ratio analysis are introduced in more detail. In section 3, the framework for the proposed research method is illustrated. In section 4, a case study is presented and analysed. Finally, conclusions are presented in section 5.

2. Literature review
2.1 SCOR Model

The SCOR model was developed by the Supply-Chain Council (SCC) in 1996 and has been used by many researchers since (Huan et al., 2004; Theeranuphattana and Tang, 2008; Elgazzar et al. 2011, 2012). The model aims to further enhance supply chain systems by integrating concepts such as business process reengineering, benchmarking, process measurement and best practice analysis. Plan, source, make, deliver and return are the five core processes considered within the SCOR model.

The model is classified into three levels of process detail from top level followed by the configuration level and process element level. Within each individual level, standard descriptions of SC processes and the relationships among these standard processes are detailed (Lockamy and McCormack, 2004; Huang et al., 2005).

The top level includes ten performance measures which are designed to provide an overall view of SC performance. Measures such as perfect order fulfilment, order fulfilment cycle time, upside supply chain agility, upside supply chain adaptability, downside supply chain adaptability, supply chain management cost, cost of goods sold, cash to cash cycle time, return on supply chain fixed assets and return on working capital are included here with the scope to assist companies in selecting the right performance measures for their SCs. These are also part of five standard performance categories, namely: reliability, responsiveness, agility, cost and asset metrics. The SCOR model levels 2 and 3 (configuration level and process element level) provide supporting metrics. These lower levels metrics are generally associated with a narrower subset of processes and used to diagnose variations in performance against plan (Supply-Chain Council, 2008).

2.2 Du Pont ratio analysis
Du Pont ratio analysis is a financial ratio commonly used to measure an organisation's financial performance. The analysis of the Du Pont ratio evaluates the areas of profitability and operating efficiency through assessing the performance of the components contributing to return-on-assets (ROA), namely: revenue (sales), cost, and total assets. ROA measures how much profit a company generates compared to the assets employed in the business. It consists of a profitability measure (Net Profit Margin) and an efficiency measure (Total Assets Turnover) which can be expressed in the following formula (Dehning and Stratopoulos, 2002):

Return on Assets $\quad$ = Net Profit Margin x Total Assets Turnover
$\qquad\qquad\qquad$ = (Net Income/Sales) x $\quad$ (Sales/Total Assets) $\qquad\qquad\qquad\qquad$ (1)

The Du Pont ratio can also be broken into more components depending upon the needs of the analysis. It can be decomposed based on the return on equity (ROE) ratio into the three multiplicative ratios of Profit Margin, Asset Turnover, and Equity multiplier (Nissim and Penman, 2001).

Return on Equity = Net Profit Margin x Total Assets Turnover x Equity multiplier
$\qquad\qquad\qquad$ = (Net Income/Sales) x (Sales/Total Assets) x (Total Assets/Equity) $\qquad\qquad$ (2)

3. Framework for the proposed methodology
A new approach derived from Presutti Jr. and Mawhinney (2007) and followed by Elgazzar et al. (2011, 2012) is developed in order to link SCM strategy to a company's financial performance. Presutti Jr. and Mawhinney demonstrated how SC metrics can be linked to corporate financial metrics in order to achieve the critical link between SC performance and an organisation's overall financial performance. The SC performance metrics used were based on the SCOR model, while the financial metrics used were based on the Economic Value Added (EVA) concept as a comprehensive measure of the company's profitability in relation to the amount of capital employed. The SCOR model level 1 standard performance metrics (reliability, responsiveness, agility, cost, and assets) were linked to the EVA components (revenue, cost, and assets). SCOR metrics performance attributes that have a direct impact on the customer (customer facing) were linked to the revenue component of EVA, while SCOR metrics performance attributes that have a direct impact on the firm (internal facing) were linked to the cost and assets components of EVA.

This method was developed further in Elgazzar et al. (2011, 2012) by incorporating Du Pont analysis in the financial performance metrics to illustrate the impact of SC performance on financial performance through assessing the contribution of each financial performance driver (revenue, cost, and assets) to the improvement of the company's profitability and operating efficiency (see Figure 1).

SC performance attributes					Financial performance metrics	
Customer- Facing			Internal -Facing		EVA components	Du Pont analysis
Reliability	Responsiveness	Agility	Cost	Assets		
■					Revenue	Profitability & Efficiency driver
	■					
		■			Cost	Profitability driver
			■			
				■	Assets	Efficiency driver

(Developed from: Presutti Jr. and Mawhinney, 2007 and Elgazzar et al., 2012)
Figure 1: Linking SCOR model performance metrics to the financial performance drivers

In this paper, the scenario analysis approach is developed to illustrate how SCM strategy can be linked to a company's financial performance according to various possible financial performance results and to suggest the most influential SC strategy with regard to the targeted financial outcome. Ratcliffe (2000) defined scenarios as "an *approach that involves developing future environment situations and describing the path from any given present situation to these future situations*". Scenario analysis is not forecasting of the future but the exploration of alternative situations that could possibly happen in the future and proposing strategies to respond to these future alternatives given different possible present paths leading to such alternatives (Mietzner and Reger, 2005; Dutta and Babbel, 2010). It can be used as a strategic decision making tool focusing on identifying the most appropriate actions under different possible future circumstances (Duinker and Greig, 2007).

As presented in Figure 2, the analysis of a company's financial performance may result in one of two main targeted outcomes: increasing profitability or improving efficiency. Based on the result of the Du Pont ratio analysis, the priorities of financial performance objectives (profitability or efficiency) are determined. If the analysis reveals that the company has a problem in generating profit from its sales, then the focus area for enhancing the financial performance should be increasing the profitability. On the other hand, if the analysis reveals that the company has a problem in generating sales from assets employed in business, then the focus area for enhancing the financial performance should be improving the efficiency.
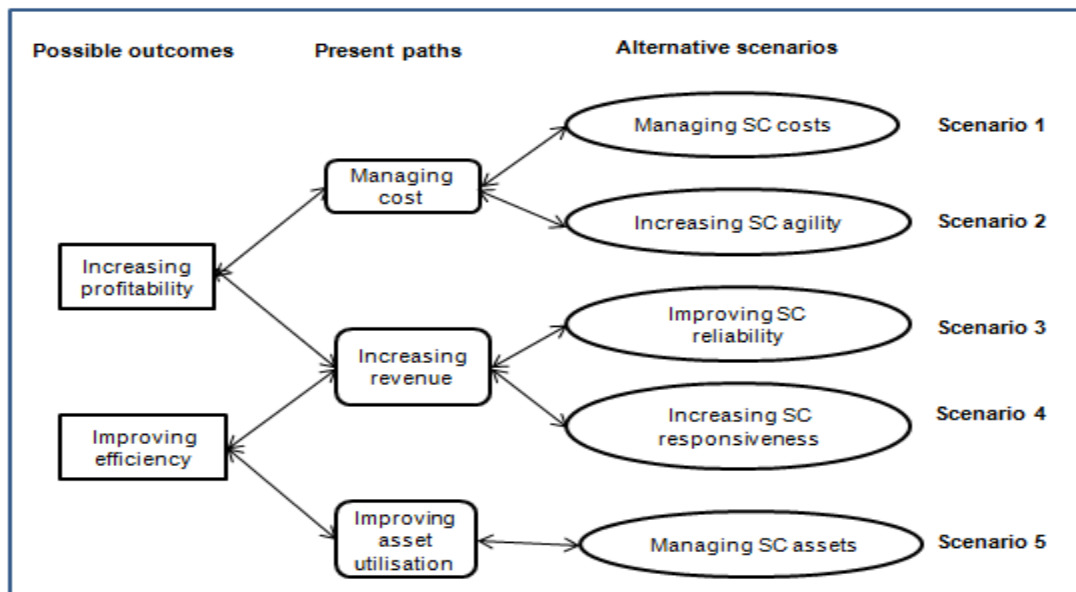

Figure 2: The main possible targeted financial outcomes and their corresponding scenarios

These targeted financial outcomes can be achieved through three different paths: increasing revenue, managing costs and improving asset utilisation. The appropriate path can be identified through assessing the contribution of each financial performance driver (revenue, cost and assets) to the company's financial performance in terms of profitability and operating efficiency.

Figure 2 demonstrates five main alternative scenarios can be established with respect to these three different paths. However, these five scenarios are not mutually exclusive. They can be combined with each other resulting in more possible scenarios. For each path, the source of poor performance in terms of specific SC processes is traced and the corresponding SC performance measurement category (reliability, responsiveness, cost, agility and asset management) is identified. Consequently, the relevant scenario is determined and the appropriate SC strategy can be formulated. In addition, Figure 2 indicates that these scenarios are not one-way scenarios as they can be operated in both directions. It is not necessary to start with an inappropriate financial performance outcome and then identify the related path to improve this outcome. A scenario might start with identifying a path to achieve a specific targeted financial outcome.

To demonstrate the applicability of the proposed method, a case study on a manufacturing company is presented and analysed in the next section.

4. Case study
Step one: Analysing financial performance results and identifying the relevant scenario
The case study company's financial data for the year ended December 31st 2010 (period 1) was extracted from its financial statements (see Table 1). The Du Pont ratio was calculated and compared to the industrial average. As illustrated in Table 1, a negative return on asset ratio has been registered by the company. To identify the drivers behind this low performance, the Du Pont ratio was broken into its components (Net Profit Margin and Total Assets Turnover) reflecting the company's financial performance in terms of profitability and operating efficiency. The analysis revealed that the company had a reasonable Total Asset Turnover compared to the industrial average. However, the company's financial performance in terms of profitability was very poor and well below the industry average which indicates that the company has a problem in generating profit from its sales.

ROA	-0.0727595
Net Profit Margin (%)	-4.89%
Total Asset Turnover (times)	0.7

Table 1: The case study company's financial performance at the end of 2010 (period 1)

Based on these financial performance results, the targeted financial outcome in 2011 (period 2) should be to improve profitability, particularly through managing SC costs. Therefore, the relevant scenario to be applied is scenario 1 (see Figure 2). According to this scenario, the highest priority at the top level of the SCOR hierarchy should be assigned to cost measures and consequently, the appropriate SC strategy would focus on enhancing the processes to which cost performance measures correspond.

Step two: Identifying the corresponding SC performance measures and formulating the appropriate SC strategy
Table 2 illustrates the contribution of each cost performance measure to the overall aggregated SC cost performance in 2010 based on the standard performance metrics of the SCOR model. As shown in Table 2, freight expense, direct marketing expense, direct sales expense, and labour (L) costs were high resulting in very poor performance (**VP**) with respect to the performance rating scale. Material cost (M) and indirect costs related to making product had a good performance (**G**), while an excellent performance (**E**) was assigned to administrative expense.

Supply Chain Cost measures	Min	Max	Weight	Annual performance (2010)	Rate
Freight expense (%of total cost)	17%	12%	65%	17%	**VP**
Direct marketing expense (% of total cost)	8%	4%	7%	8%	**VP**
Direct sales expense (% of total cost)	20%	17%	21%	21%	**VP**
Administrative expense (% of total cost)	2%	1%	7%	1%	**E**
Material Costs (% of total manufacturing cost)	75%	60%	56%	67%	**G**
Labour Costs (% of total manufacturing cost)	15%	10%	15%	14%	**VP**
Indirect Costs Related To Making Product (% of total manufacturing cost)	25%	15%	29%	19%	**G**

Table 2: The cost performance measures of the case study company in 2010

To improve the performance of SC costs, the formulated SC strategy should focus on managing SC costs that had low performance and a relatively high importance weight. The company can then determine the objectives and action plans required to implement this strategy.

Due to the long distance and the unpaved road between the plant and the market, the freight expense has a high importance weight and consequently, a significant impact on the overall performance of SC costs.

The company used for this analysis has limited control on activities such as sales and distribution due to the fact that these activities are under the control of the parent company or other sister companies. Direct sales expense has a relatively high importance weight which contributes to the inability to manage SC costs.

Although direct marketing expense was high, its low importance weight has resulted in a low impact on the overall SC costs performance. Labour cost had a very poor performance; however it had a relatively low importance weight comparing to other components of cost to make (M cost and indirect cost related to making products). Focusing on enhancing these other components especially M cost can result in a greater impact on enhancing the overall SC costs performance.

Based on the analysis of SC costs, SC cost performance measures that require improvement have been identified. The highest priority should be assigned to SC processes to which the freight expense measure corresponds. Since the freight expense measure had a very poor performance and the highest relative importance weight, managing freight expense could highly impact SC cost performance. The second priority should be managing SC processes that impact M cost. M cost had the highest relative importance weight compared to other cost measures. The third priority should be given to direct sales expense as it had a very poor performance and a relatively high importance weight. While a lesser priority should be assigned to L cost, indirect costs related to making product and direct marketing expense.

Table 3 illustrates the objectives and the plan of actions at the top level in the SC to implement the formulated SC strategy. As shown in Table 3, level 1 objective should be to reduce SC costs to reach the level at which maximum performance could be achieved. For example, freight expense represented 17% of total SC management cost resulting in a very poor performance. Reducing freight expense by 5 percentage points - to be 12% of total SC management cost - will lead to achieving the maximum targeted performance in terms of managing SC's freight expense. However, it should be noted that these objectives are not mutually exclusive. The interrelationship between SC costs may result in the increasing in the contribution of one cost when another cost is lowered. Costs trade-offs should be considered by giving priorities for costs that have a relatively high importance weight in order to achieve a higher impact on the overall SC costs' performance. In addition, the decision to lower costs should be taken at a level that will not affect the effectiveness of SC processes to which SC costs measures correspond, or the effectiveness of any other processes in the SC that have interrelationship with such processes.

Table 3 also identifies the departments responsible for carrying out the plan of action. Since the SC processes' map assigned a department responsible for each process, the departments responsible for SC processes to which SC costs measures correspond can be identified. Finally, key performance indicators to evaluate the effectiveness of accomplishing the planned objectives are identified based on SCOR model level 1 metrics. SC costs' key performance indicators are classified into two main categories: supply chain management cost and cost of goods sold.

Level 1 objectives	Level 1 plan of action	Responsibilities	Key performance indicators at level 1 metrics
Reducing freight expense by **5** percentage points	Redesigning distribution network Searching for freight service providers at lower rates with the same quality	Commercial department	Supply Chain Management Cost
Reducing direct material cost (M) by **7** percentage points	Searching for other suppliers at lower price with the same quality	Commercial department	Cost of Goods Sold
Reducing direct sales expense by **4** percentage points	Remapping the distribution channels	The distribution company	Supply Chain Management Cost
Reducing labour cost (L) by **4** percentage points	Minimising 3 shifts' days to 2 shifts' days while maintaining the same target outputs	Production department and Engineering department	Cost of Goods Sold
Reducing indirect costs related to making product by **4** percentage points	Proposing a plan to optimise the efficiency of indirect costs related to making product	Production department and Engineering department	Cost of Goods Sold
Reducing direct marketing expense by **4** percentage points	Shifting from the traditional marketing mediums to social media marketing	The distribution company	Supply Chain Management Cost

Table 3: The case study company SC's top level strategy

Step three: Evaluating the significant impact of the formulated SC strategy in contributing to achieving the company's targeted financial outcome
After implementing the formulated SC strategy, SC total cost decreased by 5.3% from 2010 to 2011. Consequently, the changes in SC costs impacted the performance of the related SC performance measures. As illustrated in Table 4, SC costs measures and some of SC asset management measures were affected positively by decreasing SC costs resulting in improvement in the overall SC performance assuming that all other variables would not change and remain constant.

Supply Chain Cost measures	For the year ended 2010	For the year ended 2011
Freight expense (% of total cost)	17%	12%
Direct marketing expense (% of total cost)	8%	4%
Direct sales expense (% of total cost)	21%	17%
Administrative expense (% of total cost)	1%	1%
Material Costs (% of total manufacturing cost)	67%	60%
Labour Costs (% of total manufacturing cost)	14%	10%
Indirect Costs Related To Making Product (% of total manufacturing cost)	19%	15%
Supply Chain Asset Management measures		
Return on Supply Chain Fixed Assets	-6%	0.8%
Return on Supply Chain total Assets	-7.3%	0.5%

Table 4: The performance of the related SC performance measures before and after implementing the formulated SC strategy

In addition, managing SC costs impacted on financial performance drivers (revenue, cost and assets). Table 5 shows improvements in the financial performance after implementing the formulated SC strategy. The company's total costs were affected directly, while revenue and assets were affected indirectly through increasing Net Income and efficiency of assets management. Du Pont results at the end of 2011 show improvement in Net Profit Margin and ROA which reflects the impact of managing SC costs on achieving the targeted financial outcome (improving profitability) and consequently, contributing to enhancing the company's overall financial performance.

Measure	Period 1	Period 2	Change direction
Net Profit Margin (%)	-4.89%	0.65%	Favourable
Total Asset Turnover (times)	0.7	0.7	No change
ROA	-0.0727595	0.005	Favourable

Table 5: The case study company's financial performance before and after implementing the formulated SC strategy

5. Conclusion
This paper proposed a new approach to link SCM strategy to a company's financial performance using scenario analysis. For each scenario, the targeted financial outcome is identified (increasing profitability or improving efficiency). Then, the corresponding path to achieve this targeted financial outcome is determined (managing cost, increasing revenue, or improving asset utilisation) through assessing the contribution of each financial performance driver. Finally, the appropriate SC strategy is formulated (managing SC costs, increasing SC agility, improving SC reliability, increasing SC responsiveness or managing SC assets) based on the standard performance metrics of the SCOR model.

The proposed approach allows companies to control and have visibility of their entire set of operations through linking SC operations' performance with financial performance results. According to this approach, companies can formulate the appropriate SCM strategy by considering the targeted financial outcome and proposing the subsequent plans of action to enhance and control the performance of the relevant SC operations.

A case study of a manufacturing company was conducted. First, the company's financial performance results were analysed using Du Pont ratio analysis in order to determine the relevant scenario. Then, the corresponding SC performance measures were identified and the appropriate SC strategy was formulated based on the standard performance metrics of the SCOR model. Finally, the company's financial performance results were analysed again after implementing the formulated SC strategy in order to evaluate its significant impact on achieving the company's targeted financial outcome.

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