

The Relationship Of Supply Management Performance With Financial Performance And Customer Service: An Empirical Analysis

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Abstract

The linkages between supply management performance, financial performance, and customer service have been the focus of interest in recent years. However, most of the financial data used in these studies are based on respondents' perceptions. This study investigates firstly the relationship of supply management performance with financial performance based on data mined from accrual statements (balance sheets, profit and loss statements) and secondly the relationship of supply management performance with customer service. The research involved the mailing of questionnaires to a large number of enterprises operating in Greece as well as the collection of financial data from accrual statements of the responding firms. Results indicate that supply management performance generally has a significant impact on profitability and short-term liquidity ratios. Moreover, one factor of supply management performance, suppliers' quality, has a positive significant impact on three of the four factors of customer service.

Keywords: Supply Chain Management, Evaluating Purchasing Performance, Finance, Survey Methods, Factor Analysis.

JEL Classification Codes: M490, M190.

Introduction

The purchasing and supply management function has been considered as a strategic resource for reaching high quality levels, fast delivery and cost savings and, thus, affecting enterprise's financial performance (Carr and Pearson 2002). Research studies state that supplier selection criteria and supplier involvement lead to improved manufacturing performance, which in turn leads to increased buyer performance (Vonderembse and Tracey 1999). Other studies indicate that supplier certification and regular assesment of facilities are positively related to return on assets, growth in market share, growth in sales, customer service, product quality, and competitive position (Tan, Handfield, and Krause 1998). The majority of recent studies in suppliers' evaluation and supply management performance indicate that buyer-supplier integration is positively related to buying enterprise's performance. (Ellram et al. 2002; Narasimhan and Kim 2002; Rosenzweig, Roth, and Dean 2003; Droge, Jayram, and Vickery 2004; Petersen, Ragatz, and Monczka 2005).

The linkages between supply management performance, financial performance and customer service have been the focus of much interest in recent years. The assertion that supply management performance impacts, through various practices, financial performance of the enterprises has been empirically tested in the past. However, most of

the financial data used in past studies are based on respondents' perceptions. The first purpose of this study is to examine any linkages between aspects of supply management performance and enterprise's profitability and liquidity through data mined from their accrual statements (balance sheets, profit and loss statements). A second purpose of this study is to examine the relationship of supply management performance with customer service.

In the following section, the relevant literature is reviewed. We then describe our research model and hypotheses. Then, the research methodology is discussed. We then present the data analyses and report the results of this study, which are followed by a discussion of the major findings in the context of the existing knowledge in the field. Finally, managerial implications are presented, and directions for future research are identified along with the limitations of the study.

Literature review

Supply management performance

Supply management could not be successful unless adequate streams of information are established between supply chain members. Sharing sales information has been viewed as a major strategy to counter the so-called "bullwhip effect" (Lee, Padmanabhan, and Wang 1997; Lee and Wang 2000). This phenomenon has been characterized as demand distortion, which can create problems for suppliers, such as inaccurate demand forecasts, low capacity utilization, excessive inventory, and poor customer service. Larson and Kulchitsky (2000) provided empirical evidence based on the positive linkage between information quality and delivery performance. Information sharing with suppliers contributes to higher supplier delivery performance, greater stability of schedules, greater flexibility and it reduces cycle time (Hult, Ketchen, and Slater 2005).

Choi and Hartley (1996) found that the capability of suppliers to make volume changes is a factor in supplier selection in the auto industry. Supply chain flexibility became a focus of interest for researchers and practitioners. Supply chain flexibility is the "flexibility to meet particular customer needs" in the chain (Gunasekaran, Patel, and Tirtiroglu 2001). The importance of supply chain flexibility has grown because of recent rise in mass customization, which calls for increased supply chain flexibility with no addition of cost (Gilmore and Pine 1997; Pine 1997; Lummus, Duclos, and Vokurka 2003; Avittathur and Swamidass 2007).

Total quality management is all about satisfying customers by managing and achieving high quality standards throughout the supply chain. Though the movement of quality was mainly focused on the inter-enterprise's processes, policies and performance variables, a swift of interest into managing quality issues throughout the supply chain has been the new agenda into total quality management.

Burt, Dobler and Starling (2003) argued that up to 75 percent of many manufacturers' quality problems can be traced back to defects in purchased materials. Thus, if a manufacturer or service provider reduces defects in incoming resources, it can improve the quality of final products, which results in more sales generated from satisfied customers and improved profit margins.

Numerous studies investigated the relationship among quality management practices and various aspects of an enterprise's performance (Ahire and O'Shaughnessy 1998; Dow, Samson, and Ford 1999; Kaynak 2003). Kaynak

and Hartley (2008) suggest that communication, collaboration, and integration among supply chain members with respect to quality are also important to enterprise's performance. Quality can increase customer satisfaction and enable an enterprise to charge higher prices or to reduce costs, leading to higher profit margins (Kaynak 2003).

Financial performance

Financial performance is based on profitability, capital structure and liquidity. Liquidity ratios are a class of financial metrics that are used to determine an enterprise's ability to pay off its short-term debt obligations. The higher the value of the ratio the larger the margin of safety to cover short-term debts. Analysts consider different assets to be relevant in calculating liquidity. Some analysts calculate only the sum of cash and equivalents divided by current liabilities, because they feel that these are the most liquid assets and would be most likely used to cover short-term debts in an emergency. An enterprise's ability to turn short-term assets into cash to cover debts is of the utmost importance when creditors are seeking payment.

Capital structure ratios indicate the way an enterprise finances its assets through some combination of equity, debt or hybrid securities. Debt comes in the form of bond issues or long-term notes payable, while equity is classified as common stock, preferred stock or retained earnings. The proportion of short and long-term debt is considered when analyzing capital structure. The most commonly used ratio is the enterprise's debt-to-equity ratio, which provides insight into how risky an enterprise is. An enterprise that is more heavily financed by debt usually poses greater risk, because it is relatively highly levered.

Profitability ratios are a class of financial metrics that are used to assess an enterprise's ability to generate earnings as compared to its expenses and other relevant costs incurred during a specific period of time. For most of these ratios, having a higher value relative to a competitor's ratio or the same ratio from a previous period is indicative that the enterprise is doing well. Some examples of profitability ratios are the profit margin, return on assets and return on equity.

Customer service

Customer service is a fundamental element in the definition of the supply management. A key objective of supply management is to improve customer service through increased stock availability and reduced order cycle time (Cooper and Ellram 1993). Mentzer et al. (2001) provide a framework similar to the value chain, encompassing all inter-function actors, such as marketing, sales, research and development, production, purchasing, logistics, information sharing, and customer service into a conceptual model. The purpose of this model is to link all processes and flows of product, information, financial resources, and demand in order to achieve greater levels of customer satisfaction, value, and profitability.

Gunasekaran, Patel and Tirtiroglu (2001) referred to customer service factors such as flexibility on customer requirements, customer query time, and post-transaction customer service. Vickery et al (2003) estimated customer service in the automotive industry based on the areas of pre-sale customer service, product support (post-sale customer service), responsiveness to customers, delivery dependability, and delivery speed. Customer service provides the single source of customer information. It becomes the key point of contact for administering the

product/service agreement. Lambert and Cooper (2000) support that customer service provides the customer with real-time information on promised shipping dates and product availability through interfaces with the organizations' production and distribution operations. Empirical findings from the retail industry underline five important customer service elements: orders are filled completely, order cycle time is short, order cycle time is reliable, accurate and timely information, and quick correction of mistakes (Ellram, LaLonde, and Weber 1999).

Reliable deliveries are considered often more important than fast deliveries. From a customer point of view, short lead times are in many cases secondary to having the product delivered on time. Although lead times may be extremely important to the manufacturer, on time delivery is more important to the customer (Beamon 1999). On time delivery is a major element on operational planning, and inconsistency on deliveries produces high level of cost and low level of customer satisfaction. Reliable deliveries have been a major competitive goal in the supply chain, due to their direct impact on customer satisfaction and on cost control. Reliable deliveries affect any attempts in cost control, which rely heavily on reliable and correct deliveries.

The level of collaboration with customers is crucial in determining the level of quality throughout the supply chain. Mass customization in industries dictates many considerations in establishing critical alliances, quality procedures, and inspection points to ensure that promised quality is not compromised throughout the supply chain.

Distribution cost is one of the most important research issues concerning logistics. The largest component of logistics cost is transportation cost, often comprising half of the total logistics cost (Thomas and Griffin 1996; Gunasekaran, Patel, and Tirtiroglu 2001). Distribution cost is related to the planning efforts and design of the distribution system. The cost related with the distribution of products entails all the inefficiencies found at the previous stages of order implementation. Issues of returned products, due to insufficient quality control, or even mistakes on invoices and other documents concerning products trafficking, can result into additional transportation and distribution cost. In this direction, distribution cost could be looked as an output cost metric concerning the efficiency of supply management on customer service.

Research model and hypotheses

Studies reveal that financial performance indicators of the buying enterprise such as sales (Rosenzweig, Roth, and Dean 2003; Tracey 2004; Petersen, Ragatz, and Monczka 2005), return on equity (Petersen, Ragatz, and Monczka 2005), total return to shareholders (Ellram et al. 2002) and net present value (Chen, Paulraj, and Lado 2004) are related to supplier's integration and evaluation.

Hendricks and Singhal (1997) provided empirical evidence that links quality practices to the long term financial performance of the enterprise by tracking the long run stock price performance of enterprises both before and after winning a quality award.

There are also other aspects of supply management that affect financial performance. Since the supply chain exists in an uncertain environment, a vital element of supply chain success is flexibility. Slack (1991) identifies two types of flexibility: range flexibility and response flexibility. Range flexibility is defined as to what extent the operation can be changed. Response flexibility is defined as the ease

(in terms of cost, time, or both) with which the operation can be changed. Although there will be a limit to the range and response flexibility of a supply chain, the chain should be designed to adapt adequately to the uncertain environment. Empirical findings from the furniture industry (Vickery, Calantone, and Droge 1999) and the automotive industry (Sanchez and Perez 2005) associate response flexibility with enterprise's profitability.

According to Terpend et al. (2008), there is relatively little research on the financial factors affected by suppliers and supply management performance indicators. Cash flow, days of credit, and enterprise's capital structure and level of leverage are a few examples of financial factors that haven't been thoroughly tested for their relationship with supply management performance.

Another critical issue of supply management performance is its direct linkage to customer service and overall satisfaction. Stanley and Wisner (2001) investigated the mediating role of internal customers into transforming supply chain activities to value activities delivered to the end-customers. They provided empirical evidence that an organization's ability to deliver service quality to external customers is related to purchasing internal service quality performance. For an effective performance measurement system in the supply chain, all measures and metrics should be linked to customer satisfaction (Lee and Billington 1992; Guanasekaran, Patel, and Tirtiroglu 2001).

In this study, we investigate the relationship of supply management performance with financial performance and customer service. The exploratory nature of the research and the fact that financial performance has not been measured before in this way precluded individual and detailed hypotheses. More specifically, in order to investigate the relationship of supply management performance with financial performance and customer service, the following null hypotheses were tested:

- *Hypothesis 1a. Supply management performance is not related to financial performance.*
- *Hypothesis 1b. Supply management performance is not related to customer service.*

Research methodology

Questionnaire design and content validity

This study incorporates two sources of data: a survey on supply management performance and customer service, and the financial ratios from the responding enterprises' accrual statements. The survey responses represent interval scale data whereas financial data represent metric data.

The survey instrument, in the form of a questionnaire, was designed based on the Malcolm Baldrige National Quality Award (MBNQA) and adjusted to the Greek supply chain activities and needs. Certain variables were selected from the MBNQA concerning aspects of suppliers' quality. The questionnaire included 11 supply management performance measures based on which respondents were asked to evaluate, on a five point scale (1 = very low, 5 = maximum), their most crucial suppliers in terms of euro (€) spent annually on purchasing materials. Moreover, the questionnaire included 11 variables in order to get an evaluation, on a five point scale (1 = very low, 5 = maximum), of the customer service processes based on the most profitable customers.

Evaluation of content validity is based on logic and theory (Nunnally and Bernstein 1994) rather than on statistical testing. Relying heavily on the literature and using experts to evaluate measures may ensure content validity (Churchill 1979). If most potential users of the test or the people in positions of responsibility agree that the measures reasonably represent the construct, it has a high degree of content validity.

The purpose of the selected scales was to represent a valid evaluation tool for a broader range of SMEs in the Greek industry both in the supply and customer service activities. Some of the scales participating in the survey were pretested scales found in the MBNQA. Nevertheless, the survey was pretested for its content validity and its use in extracting reliable performance data. Another criterion in the selection of these scales was the evaluation of processes in a tactical rather than strategic level. Hence, a pilot survey with 40 questions was distributed to 8 professionals and 4 academics in the field of purchasing and customer service. Where necessary, questions were reworded to improve validity and clarity. The pretest questionnaires were not used for subsequent analyses.

The second research instrument was formulated by financial data (balance sheets and profit and loss statements) that were collected from the responding enterprises. Financial data were mined through the enterprises' financial statements such as balance sheets and profit and loss statements for the years 2003-2006. Based on these statements, 18 financial ratios were employed for the evaluation of the enterprises' financial performance. Those ratios were grouped into two main categories: short-term liquidity ratios and profitability ratios.

Data collection

The revised survey instrument was sent to 840 enterprises identified from the Hellenic Purchasing Institute membership list. The questionnaire along with a cover letter explaining the purpose of the research was addressed to the chief purchasing officer and to the director of the logistics department, with the exception of small companies where the respondents were mostly either the enterprise's owner or the director of the economic department. A self-addressed envelope with postage was attached to facilitate the return of the completed questionnaire. Two mailings and a follow-up reminder yielded 122 usable returned surveys, giving a response rate of 14.5 percent. We should note that those 122 returned surveys include both responses from purchasing and logistics department. Responses from enterprises that either include only one of those department were not used in this research.

This relatively low response rate may be partly related to our decision that only senior managers would be selected, however, that senior managers have the least amount of free time available and are typically inundated with requests to respond to surveys (Rodrigues, Stank, and Lynch 2004). Another reason may be the confidential nature of the information requested.

Non-response bias

One potential problem with a survey methodology is non-response bias (Lambert and Harrington 1990). One test for non-response bias is to compare the answers of early versus late respondents to the survey. The idea is that late respondents are more likely to answer the questionnaire like non-respondents than are early respondents (Armstrong and Overton 1977). A multivariate T-test (the Hotelling-

Lawley Trace) was computed using the key study variables to determine whether significant differences existed between early and late respondents. The results suggest that early respondents do not display statistically significant differences from late respondents, which is an indicator of a lack of non-response bias in this study.

Respondents' profile

The demographic characteristics of the responding firms are shown in Table 1.

TABLE 1
Respondents' profile

Sample Stratification	%	Respondents' business function	%
Manufacturing	55.0	Raw material manufacturer	7.0
Commercial	33.0	Component manufacturer	5.0
Services	12.0	Final product manufacturer	43.0
	100.0	Wholesaler or retailer	33.0
		Services	12.0
			100.0
Number of employees	#	Annual gross sales	€
Median	240	Median	86 m
Minimum	17	Minimum	330,000
Maximum	12,500	Maximum	800 m

Final product manufacturers (43 percent) made up the largest portion of the respondents, and potentially had a significant impact on the survey results, since they were likely to focus on the purchasing and supply activities of supply chain management. The responding companies varied in size, employing between 17 and 12,500 employees (including part-time and temporary employees). Annual gross sales of the companies ranged from € 330,000 to € 800 million, with a median of € 86 million.

Data analyses and results

Reliability Analysis

The reliability of the scales for supply management performance measures, financial performance measures and customer service measures was evaluated using Cronbach's α (Cronbach 1951). For each scale, a value of $\alpha > 0.75$ was obtained (Table 2), suggesting that the scales were reliable (Nunnally 1988).

Table 2: Reliability analysis

Scale items	# of questions	Cronbach's α	Standardized item α
Supply management performance measures	11	0.845	0.847
Short-term liquidity ratios	13	0.764	0.766
Profitability ratios	5	0.755	0.758
Customer service	11	0.819	0.823

The standardized item α is the α value that would be obtained if all of the items were standardized to have a variance of 1. Since there was little difference between the two α s, the items on the scales have fairly comparable variances. The analysis also suggested keeping all of the questions in the four measurement scales. The supply management performance scale, which consisted of 11 questions, was the most reliable among the four measurement scales.

Factor analysis

For each of the four item scales, exploratory factor analysis was used to identify the not directly observable factors based on the variables (i.e., performance measures, customer service measures). The goal was to identify a smaller set of factors to represent the relationships among the variables parsimoniously. In this research, principal components analysis with eigenvalues greater than one was used to extract factors, and varimax rotation was used to facilitate interpretation of the factor matrix. The Bartlett Test of Sphericity (to test the null hypothesis that the correlation matrix is an identity matrix) and the Kaiser-Meyer-Olkin measure of sampling adequacy (small value of KMO indicates factor analysis is inappropriate) were used to validate the use of factor analysis. Both tests indicate that the use of factor analysis is appropriate.

The 11 supply management performance measures were reduced to three underlying factors (Table 3).

Table 3: Factor analysis - Supply management performance

Factor	% of Variance	Scale items	Factor loading
Suppliers' quality	30.24%	Suppliers' achievement of the required quality standards.	0.763
		Enterprise's satisfaction from suppliers' cooperation in quality improvements.	0.771
		The suppliers' level in the implementation of certified quality process control.	0.644
		The technical level of the suppliers.	0.771
		The level of purchasing order correctness.	0.660
		Suppliers' contribution in problem solving.	0.562
		Enterprise's satisfaction from suppliers' cooperation in cost reduction schemes.	0.475
Information sharing	17.02%	Order tracking in the various stages of implementation by the suppliers	0.866
		Information clarity to the suppliers concerning the specifications of products and services	0.637
Suppliers' response flexibility	15.43%	The number of unscheduled orders that was delivered by suppliers to the total number of delivered orders	0.833
		Purchasing order lead time	0.749

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.853.

Bartlett Test of Sphericity = 438.14, Significance = 0.000.

"Suppliers' Quality" involves the qualitative characteristics of the suppliers. This factor alone accounts for 30.24 percent of the variance in the data. "Information Sharing" includes the two practices relating to the use of information technology and sharing in supply chain management. "Suppliers' Response Flexibility" is related to flexibility of the suppliers. These three factors accounted for a total of 62.69 percent of the total variance in the data. Thus, a model with three factors was considered adequate to represent the data (Nunnally 1988). The thirteen short-term liquidity ratios were reduced to five underlying factors (Table 4).

Table 4: Factor analysis - Short-term liquidity ratios

Factor	% of Variance	Scale items (Calculation)	Factor loading
Receivables	26.70%	Operating cycle (days of receivables + days of inventory)	0.935
		Liquidity index ((receivables*receivables turnover) + (inventory * receivables to working capital)) / current assets	0.902
		Days of receivables (receivables*360) / sales	0.882
		Net trade cycle (days of receivables + days of inventory + days of credit)	0.765
		Accounts receivable turnover (sales / receivables)	-0.573
General liquidity	16.69%	Acid test ratio (current assets - inventory) / current liabilities	0.981
		Current ratio (current assets / current liabilities)	0.965
Cash	14.77%	Cash to current assets (cash / current assets)	0.938
		Cash ratio (cash / current liabilities)	0.889
Working capital	13.49%	Receivables to working capital (receivables / working capital)	0.934
		Suppliers to working capital (suppliers / working capital)	0.921
Payables	13.03%	Days of credit [suppliers / ((cost of goods sold - depreciation + ending inventory - starting inventory) / 360)]	-0.908
		Accounts payable turnover (cost of goods sold - depreciation + ending inventory - starting inventory) / suppliers	0.672

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.507.

Bartlett Test of Sphericity = 1564.95, Significance = 0.000.

The first factor, "Receivables," accounted for 26.70 percent of the variance in the data. It is comprised of five items that address the amount of cash, goods or services owed to a business by a client or customer. "General Liquidity" consists of two items concerning the conversion of an asset into cash. The third factor, "Cash," relates to the cash flows and is accounted for 14.77 percent of the variance in the data. "Working Capital" includes two items relating to the ability of the enterprise to satisfy both maturing short-term debt and upcoming operational expenses. The last short-term liquidity factor "Payables" is related to debts that must be paid off within a given period of time in order to avoid default. The five factors accounted for 84.67 percent of the total variance in the data, indicating that a model with five factors was sufficient to represent the data.

The five profitability ratios were reduced to three underlying factors (Table 5).

TABLE 5: Factor analysis - Profitability ratios

Factor	% of Variance	Scale items (Calculation)	Factor loading
Operating margin	37.10%	Operating margin (earnings before interest and taxes / sales)	0.961
		Return on assets before tax (earnings before interest and taxes / total assets)	0.964
Asset turnover	34.32%	Asset efficiency (sales / total assets)	0.926
		Current liabilities turnover (sales / current liabilities)	0.925
Gross profit margin	20.43%	Gross profit margin (gross profit / sales)	0.998

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.430.

Bartlett Test of Sphericity = 256.90, Significance = 0.000.

The first factor, "Operating Margin," accounted for 37.10 percent of the variance in the data. It is comprised of two items used to measure a company's pricing strategy and operating efficiency. "Asset Turnover" consists of two items concerning a firm's efficiency at using its assets in generating sales or revenue. The third factor, "Gross Profit Margin," accounted for 20.43 percent of the variance in the data. It assesses a firm's financial health by revealing the proportion of money left over from revenues after accounting for the cost of goods sold. The three factors accounted for 91.85 percent of the total variance in the data, indicating that a model with three factors was sufficient to represent the data.

The 11 customer service measures were reduced to four underlying factors (Table 6).

TABLE 6: Factor analysis - customer service

Factor	% of Variance	Scale items	Factor loading
Consistency on deliveries	22.87%	On-time delivery of products/services to the customers	0.796
		Delay in the delivery of products/services to the customers	0.720
		Correct documents associated with the delivery of products /services	0.632
		Flexibility of the distribution system to respond to unscheduled orders	0.625
Collaboration with customers	15.85%	Collaboration for the configuration of the most important characteristics of products/services	0.729
		Efficiency of the company's performance system on customer service	0.705
		Customers' satisfaction in terms of on-time delivery and product/service quality	0.561
Communication with customers	15.03%	Communication regarding quality characteristics	0.773
		Information exchange with customers regarding their future requirements	0.705
		Convenience with which customers place their orders	0.641
Distribution cost	9.83%	Distribution cost as a percentage of sales	0.925

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.772.

Bartlett Test of Sphericity = 258.81, Significance = 0.000.

"Consistency on Deliveries" includes four items and is accounted for 22.87 percent of the variance in the data. "Collaboration with Customers" is referred to areas of cooperation between firm and the customers. "Communication with Customers" includes three items and is accounted for 15.03 percent of the variance in the data. The last factor "Distribution Cost" is referred to the distribution cost as a percentage of sales. These four factors accounted for a total of 63.59 percent of the total variance in the data. Thus, a model with four factors was considered adequate to represent the data.

Correlation Analysis

In order to investigate the relationship of supply management performance with financial performance and customer service and, therefore, test the research hypotheses of the study, a bivariate correlation analysis was used.

The results of this analysis (Tables 7 and 8) indicate that there is a relationship of supply management performance with financial performance. Therefore, the null hypothesis H1a is rejected.

Table 7: Correlation of supply management performance vs. short-term liquidity ratios

Factor	Suppliers' quality	Information sharing	Suppliers' response flexibility
Receivables	-0.135	-0.030	-0.012
General liquidity	0.099	-0.021	0.150
Cash	-0.083	0.002	0.086
Working capital	0.012	-0.225*	-0.041
Payables	0.016	-0.033	-0.218*

*Significant at $\alpha = 5\%$.

Table 8: Correlation of supply management performance vs. profitability ratios

Factor	Suppliers' quality	Information sharing	Suppliers' response flexibility
Operating margin	0.191*	0.171	0.125
Asset turnover	0.093	-0.012	0.105
Gross profit margin	-0.011	0.129	0.241 [†]

*Significant at $\alpha = 5\%$.

[†]Significant at $\alpha = 1\%$.

More specifically, information sharing was found to have a significant negative impact on working capital ratios, which indicates that sharing information with the suppliers improves cash flow and short-term liquidity in general. Suppliers' response flexibility has a negative impact on credit. Based on the aforementioned analysis, the most crucial factor that influences enterprise liquidity is information sharing with suppliers.

Suppliers' quality was found to be positively associated with operating margins, whereas suppliers' response flexibility was found to be positively associated with gross profit margin.

Bivariate correlation analysis shows that there is a strong association between supply management performance and customer service (Table 9). Therefore, the null hypothesis H1b is rejected.

Table 9: Correlation of supply management performance vs. customer service

Factor	Suppliers' quality	Information sharing	Suppliers' response flexibility
Consistency on deliveries	0.260 [†]	-0.080	0.110
Collaboration with customers	0.190*	0.050	0.150
Communication with customers	0.000	0.110	0.090
Distribution cost	0.220*	0.080	0.050

*Significant at $\alpha = 5\%$.

[†]Significant at $\alpha = 1\%$.

Suppliers' quality was found to have a positive relationship with factors of customer service such as consistency on deliveries, collaboration with customers and distribution cost savings. However, there were no statistically significant correlations between information sharing, suppliers' response flexibility and factors of customer service. These relationships raise the importance of suppliers' quality on the total performance of the supply chain.

Discussion

Another view of the relationship of supply management performance with financial performance and customer service performance is presented on Figure 1.

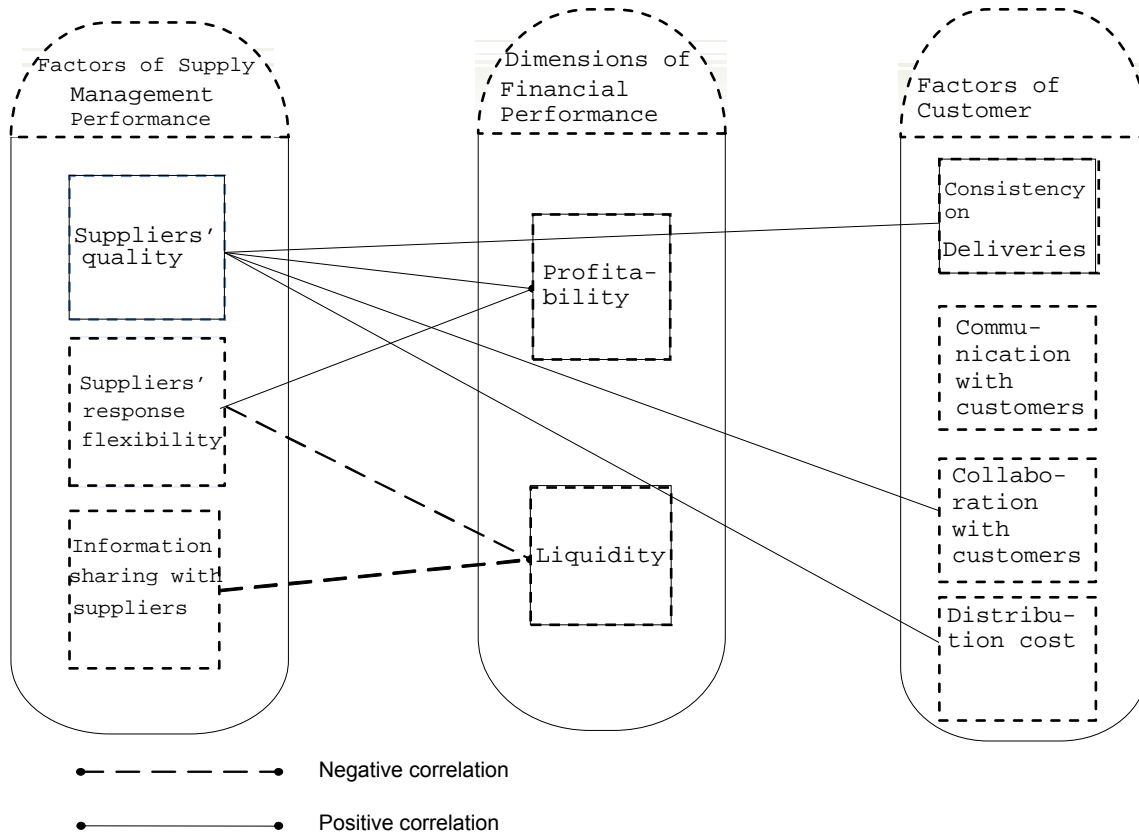
Suppliers' quality was found to be the dominant factor, among the variables examined, that influences financial performance and customer service. The positive association of suppliers' quality with operating margin is in accordance to the literature regarding the effect of suppliers' quality on enterprise financial performance.

Suppliers' quality is positively related to aspects of customer service such as consistency of deliveries, collaboration with customers and distribution cost savings. Buying quality improves process planning and enhances enterprises' efforts in achieving high levels of consistency on deliveries. Furthermore, quality of incoming materials is a very important component of the quality of the final products. This fact reduces refunding on recalled products that can seriously aggravate customer service performance and distribution cost. Moreover, quality products are the basic element of collaboration with customers, without which relationships are limited to transactional issues.

Suppliers' response flexibility was found to be correlated with short-term liquidity and profitability ratios. Response flexibility affects level of inventory, planning, sales and gross profit margins. The linkage found between gross profit margin and response flexibility

supports the importance of this aspect to the level of sales or cost of sales.

FIGURE 1
Correlations of Supply Management Performance with Financial Performance and Customer Service



The negative relationship between suppliers' response flexibility and credit can be attributed to the fact that enterprises with high suppliers' response flexibility are working on lower levels of credit in order to offset suppliers' effort in delivering unscheduled orders at the prerequisite time.

Furthermore, suppliers' response flexibility has a positive impact on gross profit margin. Response flexibility enables enterprises to respond to demand changes and at the same time keep inventories low. Moreover, efficient response to uncertain demand underlines the ability to change or react with few penalties in time, effort, cost or performance. Unpredicted fluctuation of demand can be accommodated by excess or less inventories during peak production. Thus, suppliers' response flexibility enables enterprises, in cases of fluctuating demand, to increase profits by delivering efficiently end products to the customers and at the same time work with lower cost.

Working capital ratios were found to be negatively related to information sharing with suppliers. Working capital finances the cash conversion cycle or, in other words, the time required to convert raw materials into finished goods, finished goods into sales, and accounts receivables into cash. The relationship between working capital ratios and information sharing with the suppliers indicates that information sharing has a significant impact on the dependence of working capital on receivables and payable accounts. Lower levels of this factor show

that working capital is based more on elements of cash and inventory rather than on accounts receivables and debt owed to suppliers. Information sharing with suppliers contributes to higher supplier delivery performance, greater stability of schedules and greater flexibility. Supplier delivery performance and stability of delivery schedules improve cash flows by reducing creditors' and debtors' levels and, thus, enhancing working capital turnover (Groves and Valsamakis 1998). Furthermore, empirical findings support that information exchange between members of a supply chain promotes cycle time reduction (Hult, Ketchen, and Slater 2005).

The factors of customer service performance are positively affected by suppliers quality. This lead to the conclusion that problems that enterprises face in customer service can be traced back to suppliers' quality. Factors such as consistency on deliveries of end products to customers, collaboration with customers and distribution cost can be improved by increasing suppliers' quality. High levels of suppliers quality secure low levels of returned products, reworked materials, customer complains and an effective distribution planning.

Managerial implications

Nowadays more SMEs are turning into financial figures as a measure of their performance. Market restrictions on cash flow and profitability force management to re-evaluate many of their supply management practices, including those affecting suppliers' relationships. Findings of this study support that SMEs with high profitability for the period 2003-2006 have sufficient performance on the levels of suppliers' quality, suppliers' response flexibility and information sharing with the suppliers. Thus, management should work on these aspects of supply management performance in order to maintain and develop profitability and liquidity.

Furthermore, this study provides evidence that accrual statements can be affected by several aspects of supply management performance. The findings support other empirical or conceptual researches relating suppliers' quality and response flexibility to profitability by examining the financial position through ratio analysis. Thus, this study provides new ground for the use of financial ratios as a research or management tool on supply management.

Moreover, this study provides evidence of the impact of those aspects to enterprises' liquidity. Liquidity ratios have never been examined before regarding their relationships on supply management performance practices. Response flexibility was found to have a negative linkage to the levels of credit. This provides evidence to the assertion that credit on payments is used as a motive for achieving higher levels of suppliers' response flexibility. Additionally, information sharing with suppliers is associated to cash flow position. Its relation to working capital ratios indicates the "information" effect on two major elements of cash flow: receivables and payables. High levels of information flow between enterprise and suppliers provide better levels of cash flow turnover with little dependency on receivables and payables.

Suppliers' quality was found as the only aspect of supply management performance that affects customer service. Its significant relationships with factors of customer service indicate the range of suppliers' quality impact not only on financial level but on customer service as well. This association can also explain the impact of suppliers' quality to the enterprises' financial performance and its position as the most important aspect of performance examined.

Limitations and directions for future research

This study was based on the financial performance and the performance aspects of supply management activities of the buying enterprise. The financial performance of the most important suppliers and customers was not examined. This limits the breadth of the findings of this study to the buying enterprise. In spite of the fact that a number of subsidiaries of international companies participated in this study, our sample includes many local companies of medium to small size. Therefore, we consider our findings as preliminary and restricted by conditions prevailing in the Greek environment.

However, the study proposes new areas of research for supply management performance. The use of ratios and the identification of correlations between supply management practices and ratios of cash flow and debt evaluation can bring new knowledge to the study of supply chain management. Hence, it will be very interesting to elaborate on the results of future research based on ratio analysis. Toward this direction, the study proposes the examination of supply management performance factors in both upstream and downstream supply chain relationships, including ratio analysis for all the participating members.

References

- Ahire, L.S. and K.C. O'Shaughnessy, 1998, "The Role of Top Management Commitment in Quality Management: An Empirical Analysis of the Auto Parts Industry," *International Journal of Quality Science*, 3(1), 5-37.
- Armstrong, J.S. and T.S. Overton, 1977, "Estimating Non-Response Bias in Mail Surveys," *Journal of Marketing Research*, 14(3), 1977, 396-402.
- Avittathur, B. and P. Swamidass, 2007, "Matching Plant Flexibility and Supplier Flexibility: Lessons from Small Suppliers of U.S. Manufacturing Plants in India," *Journal of Operations Management*, 25(3), 717-735.
- Beamon B, 1999, "Measuring Supply Chain Performance" *International Journal of Operations and Production Management* 19(3), 275-292.
- Burt, D.N., D.W. Dobler and L.S. Starling, 2003, "World Class Supply Management: The Key to Supply Chain Management", McGraw-Hill, Irwin.
- Carr, A.S and J.N. Pearson, 2002, "The Impact of Purchasing and Supplier Involvement on Strategic Purchasing and its Impact on Enterprise's Performance," *International Journal of Operations and Production Management*, 22(9), 1032-1053.
- Chen, I.J., A. Paulraj and A.A. Lado, 2004, "Strategic Purchasing, Supply Management and Firm Performance," *Journal of Operations Management*, 22(5), 505-523.
- Choi, T.Y. and J.L. Hartley, 1996, "An Exploration of Supplier Selection Practices across the Supply Chain," *Journal of Operations Management*, 14(4), 333-343.
- Churchill, G.A.. Jr., 1979, "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research*, 16(1), 64-73.
- Cooper, M.C and L.M. Ellram, 1993, "Characteristics of Supply Chain Management and the Implication for Purchasing and Logistics Strategy," *The International Journal of Logistics Management*, 4(2), 13-24.
- Cronbach, L.J, 1951, "Coefficient Alpha and the Internal Structure of Tests," *Psychometrika*, 16, 297-334.
- Dow, D., D. Samson and S. Ford, 1999, "Exploding the Myth: Do All Quality Management Practices Contribute to Superior Quality Performance?," *Production and Operations Management*, 8, 1-27.

- Droge, C., J. Jayram and S.K.Vickery. "The Effects of Internal Versus External Integration Practices on Time-Based Performance and Overall Enterprise Performance," *Journal of Operations Management*, (22:6), 2004, pp. 557-573.
- Ellram, L.M., B.J. LaLonde and M.M. Weber, 1999, "Retail Logistics," *International Journal of Distribution and Materials Management*, 19(12), 29-39.
- Ellram, L.M., G.A. Zsidisin, S.P. Siferd and M.J. Stanly, 2002, "The Impact of Purchasing and Supply Chain Management Activities on Corporate Success," *Journal of Supply Chain Management*, 38(1),4-17.
- Gilmore, J.H. and B.J. Pine, 1997,"The Four Faces of Mass Customization," *Harvard Business Review*, 75(1), 91-101.
- Groves, G. and V. Valsamakis, 1998, "Supplier-Customer Relationships and Company Performance," *The International Journal of Logistics Management*, 9(2), 51-64.
- Gunasekaran, A., C. Patel and E.Tirtiroglu, 2001, "Performance Measures and Metrics in a Supply Chain Environment" *International Journal of Operations and Production Management*, 21(1/2), 71-87.
- Hendricks, K.B. and V.R. Singhal, 1997,"Does Implementing an Effective TQM Program Actually Improve Operating Performance? Empirical Evidence from Enterprises that have Won Quality Awards," *Management Science*, 43(9), 1258-1274.
- Hult, G.T.M., D.J. Ketchen and S.F. Slater. "Market Orientation and Performance: An Integration of Disparate Approaches," *Strategic Management Journal*, 26(12), 1173-1181.
- Kaynak, H, 2003, "The Relationship between Total Quality Management Practices and their Effects on Enterprise Performance," *Journal of Operations Management*, 21(4), 405-435.
- Kaynak, H. and J.L. Hartley, 2008, "A Replication and Extension of Quality Management into the Supply Chain," *Journal of Operations Management*, 26(4), 468-489.
- Lambert, D.M. and T.C. Harrington, 1990,"Measuring Non-Response Bias in Customer Service Mail Surveys," *Journal of Business Logistics*, (11:2), 5-25.
- Lambert, D.M. and M.C. Cooper, 2000, "Issues in Supply Chain Management," *Industrial Marketing Management*, 29(1), 65-83.
- Larson, P. D. and J.D. Kulchitsky, 2000, "The Use and Impact of Communication Media in Purchasing and Supply Management," *Journal of Supply Chain Management*, 36(3), 29-39.
- Lee, H.L. and C. Billington, 1992,"Managing Supply Chain Inventory: Pitfalls and Opportunities," *Sloan Management Review*, 33(3),65-73.
- Lee, H.L, V. Padmanabhan and S.Wang, 1997, "The Bullwhip Effect in Supply Chains," *Sloan Management Review*, 38(1), 93-102.
- Lee, H.L. and S. Wang, 2000, "Information Sharing in a Supply Chain," *International Journal of Manufacturing Technology and Management*, 1(1),79-93.
- Lumms, R.R., L.K. Duclos and R.J.Vokurka, 2003, "Supply Chain Flexibility: Building a New Model," *Global Journal of Flexible Systems Management*, 4(4), 1-13.
- Mentzer, J.T., W. de Witt, J.S. Keebler, S. Min, N.W. Nix, C.D. Smith and Z.G. Zacharia, 2001, "Defining Supply Chain Management," *Journal of Business Logistics*, 22(2),1-25.
- Narasimhan, R. and S.W. Kim, 2002, "Effect of Supply Chain Integration on the Relationship Between Diversification and Performance: Evidence from Japanese and Korean Firms," *Journal of Operations Management*, 20(3),303-323.
- Nunnally, J.C, 1988, *Psychometric Theory*, McGraw-Hill, Englewood Cliffs, NJ.
- Nunnally, J.C. and I.H.Bernstein, 1994, *Psychometric Theory*, McGraw-Hill, New York.

- Petersen, K.J., G.L. Ragatz and R.M. Monczka, 2005, "An Examination of Collaborative Planning Effectiveness and Supply Chain Performance," *Journal of Supply Chain Management*, 41(2),14-25.
- Pine J.B, 1997, *Mass Customization: The New Frontier in Business Competition*, Business School Press, Cambridge, MA.
- Rodrigues, A.M., T. Stank and D.F. Lynch, 2004, "Linking Strategy, Structure, Process and Performance in Integrated Logistics," *Journal of Business Logistics*, 25(2), 65-94.
- Rosenzweig, E.D, A.V. Roth and J.W. Dean, 2003, "The Influence of an Integration Strategy on Competitive Capabilities and Business Performance: An Exploratory Study of Consumer Products Manufacturers," *Journal of Operations Management*, 21(4), 437-456.
- Sanchez, A.M. and M.P. Perez, 2005, "Supply Chain Flexibility and Firm Performance: A Conceptual Model and Empirical Study in the Automotive Industry," *International Journal of Operations and Production Management*, 25(7), 681-700.
- Slack, N. *The Manufacturing Advantage: Achieving Competitive Manufacturing Operations*, Mercury Books, London, 1991.
- Stanley, L.L. and J.D. Wisner, 2001, "Service Quality along the Supply Chain: Implications for Purchasing," *Journal of Operations Management*, 19(3), 287-306.
- Tan, K.C., R.B. Handfield and D.R. Krause, 1998, "Enhancing the Enterprise's Performance through Quality and Supply Base Management: An Empirical Study," *International Journal of Production Research*, 36(10),2813-2837.
- Terpend R., B.B. Tyler, R.D. Krause and B.R. Handfield, 2008, "Buyer-Supplier Relationships:Derived Value over Two Decades," *Journal of Supply Chain Management*, 44(2), 28-55.
- Thomas, D.J. and P.M. Griffin, 1996, "Co-ordinated Supply Chain Management," *European Journal of Operational Research*, 94(1), 1-15.
- Tracey M, 2004, "A Holistic Approach to New Product Development," *Journal of Supply Chain Management*, 40(4), 37-55.
- Vickery, S., R. Calantone and C. Droge, 1999, "Supply Chain Flexibility: An Empirical Study," *The Journal of Supply Chain Management*, 3593, 16-24.
- Vickery, S., J. Jayaram, C. Droge and R. Calantone, 2003, "The Effects of an Integrative Supply Chain Strategy on Customer Service and Financial Performance: An Analysis of Direct versus Indirect Relationships," *Journal of Operations Management*, 21(5),523-539.
- Vonderembse, M.A. and M.Tracey, 1999, "The Impact of Supplier Selection Criteria and Supplier Involvement on Manufacturing Performance," *The Journal of Supply Chain Management*, 35(3), 33-39.

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