

# Effects of Information, Material and Financial Flows on Supply Chain Performance: A Study of Manufacturing Companies in Malaysia

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*In a challenging business environment, organizations not only need to improve their performances to meet customers' requirements but ultimately they need to achieve customers' satisfaction. This study aims to study the impact of three difference kind of flows on supply chain performance; information, materials and financial flows. This study is focused on manufacturing companies in the northern region of Malaysia. Data has been collected by using questionnaires that have been to 202 manufacturing companies in the northern region of Malaysia. Results from the analyses show that information flow and material flow do not have significant impacts on the performance of supply chain management, while financial flow has a significant impact on the performance of supply chain management. The implications of the findings for the effective management of the supply chain in manufacturing firms are discussed.*

## Introduction

The business environment has evolved rapidly and is constantly changing. In the rapidly changing environment, organizations face intense pressure to compete and gain a leading edge over their rivals. According to Sundaram and Mehta (2002), economic globalization over the past two decades has led to fierce competition as organizations can operate boundary-less. Apart from ensuring quality, organizations also need to ensure speedy and inexpensive products and are continuously improving their internal operations and at the same time focusing on external operations which led to the concept of supply chain management (SCM).

Robertson, Fagerhaug, Randmoel, Schuldmaier and Prenninger (2002) claim that SCM is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. Supply chain management involves coordinating and integrating these flows both within and among companies. The product flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. Today, goods' movements or material flows require a complex network of many providers to ensure capacity coverage. Businesses need to think about and plan much more carefully, how they are going to move products, since moving products makes up about 60 percent of logistics costs in the U.S. market (Lofgren et al., 2005). The information flow involves transmitting orders and updating the status of delivery. Lofgren et al. describe how information flow is a key component of today's supply chain; it is the mechanism that brings trading partners together. In the past, they say, businesses looked only inside their four walls for ways to reduce waste.

Today, businesses have to look outside for ways to become more efficient, and many companies are turning to partnerships. “The information flow provides the opportunity to really get at the inefficiencies”.

The financial flow consists of credit terms, payment schedules and consignment as well as title ownership, Lofgren et al. (2005). They explain how the funds or financial flow drives the need to efficiently move money. Fundamentally, all of the partners who come together are in business to make money and yet, how those dollars flow is not often thought about. The efficiencies of cash flows, however, can be increased. “The ability to organize and extract important information on how a product flows is critical in managing this flow, and effectiveness in this area leads to healthy cash flows.” Hence, today the supply chain strategy has evolved and the integration of supply chain is the main focus so that the flows of information, materials and financial are efficient.

There are several schools of thoughts concerning the evolution of the integrated process of supply chain, as described by Cigolini, Cozzi and Perona (2004). The “traditional logistics” school (authors Scott and Westbrook, 1991) began their research on how to reduce the fluctuations in material flows among channel partners, particularly in the areas of logistics and transportation with the objective of improving supply chain efficiency by reducing inventory levels. Subsequently, logistics became an integral part of SCM. On the other hand, the “modern logistics” school (Lee and Billington, 1992, 1993; Christopher, 1992b) focused on the importance of system-wide co-ordination of both physical and information flows. Authors of this school of thought maintain that there are various forms of organizations in supply chain relationships but alliances should be developed only among strategic partners. However, firms face complex decisions whether the flows of materials, information and financial are important in improving the performance of supply chain management. Therefore, the impact of materials, information and finance flows is an interesting topic to study. The purpose of this research is to explore the impact of impact of three difference kind of flows on supply chain performance; information, materials and financial flows.

### **Information Flow**

Stevenson and Spring (2007) have stated that accurate and real-time information flow in the supply chain is considered as important as material flow by most organizations. “An information-enriched supply chain would have a single customer entity connected to every scheduling process, showing order information flowing to all links. For a non-enriched supply chain, the customer entity might connect only to the final scheduling link, leaving the remainder of the supply chain hidden from the customer” (Hull, 2002).

Information sharing is an important element that reflects cooperation in supply chain management, according to Li, Yan, Wang and Xia (2005). According to Simatupang and Sridharan (2002b), information sharing is “the ability to see private data in a partner’s systems and monitor the progress of products as they pass through each process in the supply chain. This activity includes monitoring (data capturing), processing, and dissemination of customer data, end-to-end inventory status and locations, order status,

costs-related data, and performance status". These authors have argued that information sharing ensures that partners in the supply chain are able to fulfill demand within shorter order cycle times based on the shared information. Information sharing among supply chain partners creates information flow within supply chain management and this enables supply chain partners to make decision effectively. As noted in the paper by Li et al., (2005), information flow can be categorized according to operational areas such as inventory, sales, demand forecasting, order state and production plan (Lee and Whang, 1999). Also noted in the paper by Koh, Saad and Arunachalam (2006), managing supply chain includes activities such as material sourcing, production scheduling and physical distribution system, but all these are supported by information flow which is necessary (Bovet and Martha, 2003).

### **Material Flow**

Many practitioners of supply chain management have recognized the importance of managing material flows across the supply chain as an important strategic success factor (Rao Tummala, et al., 2006; Chin et al., 2004). Based on the paper by Chin, Rao Tummala, Leung and Tang (2004), they have cited the control of smooth material flow as the centre of the best SCM design and practices and that supply chain performance can be improved by re-engineering material flows (Towill, Childerhouse & Disney, 2000). Furthermore, efficient material flow ensures on-time delivery of products to customers. Chin et al. have also cited that this means raw materials, work-in-process and finished goods inventory will be kept at the minimum level and at the same time cut inventory holding costs tremendously (Fredenhall and Hill, 2001). Sadler and Gough (2005) have noted that supply chain management is able to achieve superior value for the supply chain members as well a customers through well coordinated material flows which begins from the front end of the chain, that is the source all the way to manufacturing and subsequently finished products till end customers (Harrison & van Hoek, 2002).

### **Financial Flow**

According to M. Udin, K. Khan and Zairi (2006), financial information and financial movement in organizations are essential in supply chain management. Financial performance is important as it reflects the current financial position of organizations whereby through this information, top management makes decisions whether or not to proceed with their plans. These researchers have also explained that organizations use financial flow or financial position information to evaluate suppliers and customers in order to ensure that they have the capability to make the supply chain management work smoothly. Further explanation provided is that inadequate financial strength would only deliver a burden and risk to other parties in the supply chain collaboration.

Fairchild (2005) has raised the concern that there are limited literatures on financial information aspects of supply chain as well as limited information between financial institutions that goes with supply chain transactions. This author has said that despite supply chains are now becoming more automated, more transparent and more visibility in the processes, supply chain literatures are still mainly focused on operational and

logistic perspectives between suppliers, buyer and intermediaries, and financial activities have not been paid attention to. In the author's earlier publication (Fairchild, 2003), it has been mentioned that the literatures that are available on financial value chain are basically on the front-end aspects of financing which is on electronic payment or back-end process such as the financial electronic data interchange (EDI). This author views these as providing only a limited solution and only large organizations have the privilege of using these methods due to the high cost involved.

### **Supply Chain Management Performance**

According to Attaran and Attaran (2007), organizations have always been focusing on building efficient supply chains and this area has been the major focus for organizations. They claimed that collaborative supply chain management practices are beginning to be firmly established as the way to achieve successful and sustainable business operations. These authors say that the need to have the right product and better service are on the rise and the continuous rising supply chain costs are affecting all supply chain partners bottom-line. They have cited a survey by Kurt Salmon and Associates (Kurt Salmon and Associates, 2002) which found that 41 percent of manufacturers, 50 percent of retailers and 38 percent of distributors have identified the need to reduce supply chain as a top issue that needs to be addressed in the coming three to five years. The researchers have also stressed that insufficient collaborative planning has great impact on supply chain performance. Therefore, in order to build efficient and sustainable supply chains, they have suggested the need for collaborative planning as it has a significant impact on supply chain performance. This leads to the collaborative planning, forecasting, and replenishment (CPFR) business process which is essential to improve the effectiveness of supply chain management (Tuominen, 2004; Cassivi, 2006; Stank, Daugherty and Autry, 1999).

According to Hsu (2005), supply chain management has been proven to improve an organization's competitiveness and the benefits have been widely recognized. Among the benefits of implementing supply chain management that the researcher has identified are the reduction of production, delivery and distribution costs, lower inventory, improves manufacturing flexibility and higher productivity. Shepherd and Gunter (2006) have cited some benefits of effective supply chain management which includes reduced costs, increased market share and sales and solid customer relations (Ferguson, 2000). According to Simatupang and Sridharan (2004), flexibility is one of four performance metrics which is a key to supply chain excellence. All of the benefits are the outcome of effective supply chain management. From the study by Hsu (2005), two types of benefits of implementing supply chain management system have been identified, which are the "perceived" and "realized" benefits (Alam, 1996). These two types of benefits consist of the tangible and intangible benefits. The tangible benefits include improved on-time delivery, costs and inventory reduction as well as improved inventory management, shorter product development life cycle and improved quality. As for the intangible benefits, they include improved in service quality, short response time to customer needs, sharing and exchanging information, accurate, timely and consistent information.

### Theoretical Framework

The theoretical framework is deduced from Porter Value Chain Model as well as from previous researches and literatures. Previous researches have also shown that material flow is a strategic success factor (Chin et al., 2004; Towill et al., 2000; Rao Tummala et al., 2006) as well as the importance of information and financial flow (Udin et al., 2006; Fairchild, 2005). Thus, the theoretical framework that is developed for this study is as follows:

#### Development of Hypotheses

Yu, Yan and Cheng (2001) in their research have explained that uncertainties in the supply chain are due to the inability to get perfect information. According to them, uncertainties arise when individual supply chain member has the needed information about themselves while lacking the information of other members in the supply chain. They have also stressed that all the members along the supply chain need to share information and this flow of information among members would improve the supply chain performance. Thus, the first hypothesis that has been developed is as follows:

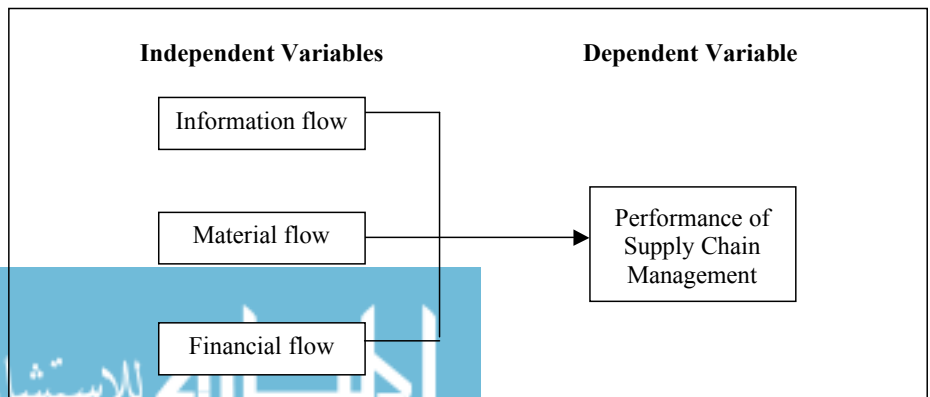
H1: Information flow has positive impact on the performance of supply chain management.

According to De Souza, Song and Liu (2000), reducing material delay could improve system performance. Towill, Childerhouse and Disney (2000) have described the control of smooth material flow as an important factor in supply chain and that supply chain performance can be improved by re-engineering material flows. Hence, the following second hypothesis has been developed.

H2: Material flow has positive impact on the performance of supply chain management.

As explained by several researchers such as Lofgren, Lillrank and Fearon (2005), Fairchild (2005) and Udin, Khan and Zairi (2006), information flow plays an important role

Figure 2: Theoretical Framework



in supply chain performance and will impact the supply chain performance. Hence, the third hypothesis that has been developed is:

H3: Financial flow has positive impact on the performance of supply chain management.

### Research design

The dependent variable in this study is the performance of supply chain management. It is measured by cost reduction (includes production, inventory and labor costs), improved delivery (includes on-time delivery, short response time, right kind of products, speed of delivery) and improved reliability (product, design, capacity, volume change). Aramyan, Oude Lansink, van der Vorst and van Kooten (2007) have identified the following indicators on supply chain performance in their research, such as efficiency (costs, profit, return on investment and inventory), flexibility (customer satisfaction, volume flexibility and delivery flexibility), responsiveness (fill rate, product lateness, customer response time, lead time, shipping errors and customer complaints) and quality (product quality and process quality). The independent variables for this study are information flow, material flow and financial flow.

- i) *Information Flow*. Information flow is measured by considering infrastructure for information exchange, adequacy of information shared, visibility of information, availability of information and criteria for information flow.
- ii) *Material Flow*. Material flow is measured by considering the coordination of material flows (from supplier and to customer), technological aspect in managing material flow, replenishment responsibility, improvement in turnaround time, lean manufacturing and assurance of supply.
- iii) *Financial Flow*. Financial flow is measured by considering how it reflects the financial position of organizations, means to evaluate suppliers and customers, how inadequacy affects supply chain partners, use in decision making, appropriate accounting system, and control over transactions.

The survey sample is based on manufacturing companies in the northern region of Malaysia, comprising Penang, Prai and Kulim. These areas have been selected as they are industrial zones which consist of manufacturing companies like multinational companies as well as small and medium companies. Only manufacturing companies have been chosen for this study as supply chain management is mainly practiced in manufacturing companies compared to other organizations such as service organizations. Samples for this study are manufacturing companies that are members of the Federation of Malaysian Manufacturers (FMM) and the sample size used is 202. The unit of analysis for this study is the organization; hence one representative from the organization is required to respond to the survey. The targeted survey subjects are managers or employees in the manufacturing companies who is most responsible for the supply chain management in the organization and it covers areas such as planning, procurement, order fulfillment, order management, etc.

Stratified random sampling was used in this study. Data for this study has been collected via questionnaires. The questionnaires have been sent via email to 202 manufacturing companies that have been identified from the Federation of Malaysian Manufacturers member directory. Completed questionnaires have been received from 82 companies, which represent a response rate of 40.6%. Two questionnaires are found to be incomplete therefore they have been excluded from the analysis. Respondents have been asked to rate on a 5-point Likert scale from “Strongly disagree” to “Strongly agree” the extent of information flow, material flow and financial that are currently being practiced in their organizations. Respondents have also been asked to rate on a 5-point Likert scale from “Not improved at all” to “Highly improved” on how effective the factors of cost reduction, improved delivery and improved flexibility are being realized in their organizations as measures of the performance of supply chain management.

**Profile of Respondents**

Data that has been collected from the respondents in manufacturing companies in the northern region has been analyzed. Out of a total of 202 questionnaires have been distributed and 84 respondents have responded. However, 2 questionnaires are incomplete and have been excluded from the analysis. Therefore, only 82 questionnaires are usable. The demographic profile of the respondents is summarized in Table 1.1.

Table 1.2 has summarized the job positions of the respondents. There is a wide range of positions held by the respondents in this study, ranging from Planners/Buyers, Officers, Analysts to Executives, Managers to top management in the organizations.

This study also seeks respondents’ feedback on their satisfaction level towards their organizations’ supply chain management. Table 1.3 summarizes the satisfaction data.

**Table 1.1: Demographic Profile of Companies Surveyed**

Variables	Categories	Frequency	Percent
Primary Business	Electrical & Electronic	49	59.8
	Industrial & Engineering	16	19.5
	Chemical	2	2.4
	Plastic	1	1.2
	Textile	2	2.4
	Others	12	14.6
Number of employees in organization	< 100	2	2.4
	100 – 250	2	2.4
	251 – 500	6	7.3
	501 – 1000	18	22.0
	> 1000	54	65.9
Year of organization in Business	5 years or less	5	6.1
	6 – 10 years	9	11.0
	11 – 15 years	6	7.3
	> 15 years	62	75.6



Most of the respondents (73.2%) are satisfied with their organizations' supply chain performance whereas 23.2% of the respondents find that they are moderately satisfied with their organizations supply chain performance. There are also respondents who are extremely satisfied with their organizations' supply chain management, but the rate is low, only about 1.2%. Some respondents are dissatisfied with their organizations' supply chain management (1.2%), while a handful of the respondents (also 1.2%) find that their organizations' supply chain management is at a very dissatisfactory level.

Table 1.4 has summarized the reasons for practicing supply chain management in organizations based on respondents' feedback. 92.7% of the respondents feel that their organizations practice supply chain management to improve customer satisfaction. This reason has the highest percentage. Secondly, respondents feel that their organizations practice supply chain management to achieve greater cost savings (84.1%). This is followed by the reason to improve delivery/response time at 82.9%. The remaining reasons based on order of percentage are to improve reliability of operations (62.2%), to foster closer relationships that create more opportunities for improvement (62.2%), to gain internal integration of activities (61.0%), to coordinate business processes based on joint objective (59.8%), to improve decision making (54.9%), to achieve greater product/process innovations (43.9%) and to share manufacturing capacity (42.7%).

**Goodness of Measures**

In this study, factor analysis has used to validate whether the items in each section are loaded into the expected categories. In addition, Cronbach's alpha has also been used to assess the internal consistency or homogeneity among the items.

**Table 1.2: Job Position of Respondents**

Variable	Categories	Frequency	Percent
Job Position	Top Management	3	3.7
	Managers	24	29.3
	Executives	16	19.5
	Officers	10	12.2
	Analysts	5	6.1
	Planners/Buyers	21	25.6
	(Blank)	3	3.7
Total		100	100.0

**Table 1.3: Supply Chain Management Satisfaction**

Variable	Categories	Frequency	Percent
How satisfied are you with your company's supply chain management	Very dissatisfied	1	1.2
	Dissatisfied	1	1.2
	Moderate	19	23.2
	Satisfied	60	73.2
	Very Satisfied	1	1.2



### Factor Analysis

Factor analysis is performed on the independent and dependent variables. There are three independent variables namely, information flow, material flow and financial flow. The varimax rotation method is used to determine any underlying components for each variable. Based on the results, a factor analysis with varimax rotation has been done to validate whether the respondents perceived the three constructs to be distinct independent variables. The results have shown three solutions with eigenvalues greater than 1.0 and the total variance explained was 73.85% of the total variance. KMO measure of sampling adequacy was 0.80 indicating sufficient intercorrelations while the Bartlett's Test of Sphericity is significant (Chi square=1423.202,  $p < 0.01$ ). The criteria used by Igbaria et al., (1995) to identify and interpret factors are: each item should load 0.50 or greater on one factor and 0.35 or lower on the other factor. Table 4.10 shows the results of factor analysis. These results confirm that each of these constructs is unidimensional and factorially distinct and that all items used to measure a particular construct are loaded on a single factor.

**Table 1.4: Reasons for Practicing Supply Chain Management in Organizations**

Variable	Categories	Frequency	Percent
To Improve Customer Satisfaction	Yes	76	92.7
	No	6	7.3
To Achieve Greater Cost Savings	Yes	69	84.1
	No	13	15.9
To Achieve Greater Product/ Process Innovations	Yes	36	43.9
	No	46	56.1
To Gain Internal Integration of Activities	Yes	50	61.0
	No	32	39.0
To Coordinate Business Processes Based on Joint Objective	Yes	49	59.8
	No	33	40.2
To Improve Reliability of Operations	Yes	51	62.2
	No	31	37.8
To Improve Delivery/ response Time	Yes	68	82.9
	No	14	17.1
To Improve Decision making	Yes	45	54.9
	No	37	45.1
To Share manufacturing Capacity	Yes	35	42.7
	No	47	57.3
To Foster Closer Relationships That Create More Opportunities for Improvement	Yes	51	62.2
	No	31	37.8

**Table 1.5: Rotated Component Matrix for Information, Material and Financial Flow**

Item	F1	F2	F3
<u>Information Flow (F1)*</u>			
(3) Supply chain partners have visibility on information related to material demand and supply for decision making	<u>.948</u>	.159	.051
(1) Information is exchanged between supply chain partners using integrated information system	<u>.895</u>	.075	.092
(2) Adequate information is shared on a timely manner between supply chain partners	<u>.891</u>	.083	-.063
(5) Information flows seamlessly in the supply chain network for all partners to use in making decisions	<u>.871</u>	.241	.108
(6) Information flow depends on trust and commitment among the supply chain partners	<u>.857</u>	.056	.056
(4) The infrastructure required for information flow is sufficient and available	<u>.775</u>	.024	.179
<u>Material Flow (F2)</u>			
(1) Supply chain Management can enhance value for customers and supply chain partners through design and coordination of materials flow from supplier to manufacturer and finished products onwards to the ultimate customer	.047	<u>.899</u>	.151
(5) Direct material flow improves the process turnaround time as it reduces the number of stocking points	.088	<u>.888</u>	.075
(6) material flow forms the basis for lean manufacturing	.123	<u>.872</u>	.102
(2) material flow is important to ensure that the supply chain is managed effectively and products are delivered to customers on timely manner	.079	<u>.868</u>	.046
(4) Responsibility for replenishment is handed over to the supplier based on trust	.060	<u>.853</u>	.059
(3) Technology helps in managing inventory flow and supply within a given supply channel	.207	<u>.811</u>	.035
<u>Financial Flow (F3)</u>			
(4) Financial flow needs to be considered in decision making as the cost in one area affects the cost in other areas (e.g. logistic cuts across functional boundaries)	.097	.107	<u>.925</u>
(1) Financial performance is important as it reflects the current financial position of organizations whereby through this information, top management makes decision whether or not to proceed with their plans	-.059	-.069	<u>.901</u>
(6) My organization is in control concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained	.088	-.083	<u>.881</u>
(2) My organization uses financial flow or financial position information to evaluate suppliers and customers in order to ensure that they have the capability to make the supply chain management work smoothly	.137	.078	<u>.859</u>
(3) Inadequate financial strength would only deliver a burden an risk to other parties in the supply chain collaboration	.133	.120	<u>.808</u>
(5) My organization has an accounting system that allows for the proper recording of project financial transaction, including the allocation of expenditures in accordance with the respective components, disbursement categories, and sources of funds	.039	.171	<u>.592</u>
(7) Financial flow information provides significant insights about the financial health of the supply chain	.012	.106	<u>.578</u>
Eigenvalue	4.723	4.678	4.632
Percentage Variance (73.85%)	24.856	24.622	24.378

Note: \*Information flow 7 will not be used in further analysis due to low loading and high cross loading. Underlined loadings indicate the inclusion of that item in the factor

Factor analysis has also been performed on the dependent variable which is the performance of supply chain management. From the table, the analysis shows that KMO is 0.821 and Barlett's test of sphericity shows significant level (Chi square=1012.874,  $p < 0.01$ ). All the anti-image correlation metric display a value of 0.50 above. There are 3 factors extracted and total variance explained by this factor is 74.85%. From Table 1.6, the dependent variable falls into 3 components. However, previous studies (Hsu, 2005; Alam, 1996; Aramyan, Oude Lansink, van der Vorst and van Kooten, 2007) have identified all the 3 components as one factor measuring supply chain management performance. This study will thus treat the supply chain management performance as one factor. Table 1.6 shows the results of factor analysis.

### Reliability Analysis

The range between 0 and 1 for Cronbach's Alpha coefficient shows reliability of the data. If the value is lower than 0.5, one of the items must be deleted to get a value that is more than zero. The result in Table 4.12 shows that all the variables have Cronbach's Alpha value greater than 0.7, thus it can be considered that all the variables are reliable and acceptable. The values obtained for all variables are above 0.8, which is considered good. Information flow has the highest reliability at 0.94 while supply chain performance has the lowest reliability at 0.88.

**Table 1.6: Rotated Component Matrix for Supply Chain Management Performance**

Item	F1	F2	F3
<u>Improved Flexibility (F1)*</u>			
(2) Improve product variety	<u>.899</u>	.107	.052
(5) Improve the adjustment of the capacity	<u>.890</u>	.039	-.018
(6) Improve the volume changes	<u>.883</u>	.123	.125
(1) Improve product features	<u>.874</u>	.081	.007
(3) Improve product mix	<u>.798</u>	.085	.272
(4) Improve the rapid design changes	<u>.728</u>	-.001	.297
<u>Improved Delivery (F2)</u>			
(3) Improve the response time to demand changes	.139	<u>.957</u>	.178
(4) Deliver the kind of products needed	.051	<u>.933</u>	.093
(5) Improve speed of delivery relative to competitors	.071	<u>.903</u>	.178
(2) Improve the accuracy of the predictability of delivery dates	.095	<u>.884</u>	.244
<u>Cost Reduction (F3)</u>			
(5) Reduce unit cost of product over life cycle	.076	.069	<u>.858</u>
(1) Reduce the production cost per unit	.218	.127	<u>.761</u>
(2) Reduce inventory cost	-.113	.232	<u>.758</u>
(4) Improve labor productivity	.149	.095	<u>.716</u>
(3) Improve capacity utilization	.213	.214	<u>.692</u>
Eigenvalue	4.479	3.554	3.195
Percentage Variance (74.85)	29.858	23.693	21.302

Note: \*Improve Delivery 1 will not be used in further analysis due to low loading and high cross loading. Underlined loadings indicate the inclusion of that item in the factor

### Correlation Analysis

Pearson correlation coefficient describes the relationship between two continuous variables. The result of the inter-correlations among the variables is shown in Table 1.8. The correlations which represent the concept of association between the independent and dependent variables are fundamental to regression analysis, a prerequisite that should be fulfilled before any simple or multiple regression could be done on the variables under investigations. From Table 4.15, it shows that material flow has significant correlation with information flow ( $p < 0.05$ ) and supply chain performance has highest significant correlation ( $p < 0.01$ ) with financial flow.

### Regression Analysis

Before the regression results can be correctly interpreted, some assumptions of multiple regressions should be met such as the linearity of the relationship between the independent and the dependent variables, the data and the error terms are normally distributed, the error variances are homoscedastic, and the existence of autocorrelation and multicollinearity are within the acceptable range. Outlier analysis has been done to see whether any outlier exists that could influence the regression equation. However, in this study the outliers do not exist. An inspection on all the assumptions has revealed that the independent and dependent variables are linearly related. The data and the error terms are approximately normal with constant variance. The existence of autocorrelation and multicollenarity are within the acceptable ranges.

### Hypotheses Testing

The results of multiple regression analysis are summarized in Table 1.9. From the summary, the regression model is significant ( $F = 4.351$ ,  $p < .001$ ). The predictor effects in this study such as information flow, material flow and financial flow can explain 14% ( $R^2 = 0.14$ ) of the variance in supply chain management performance in the northern

**Table 1.7: Results of the Reliability Test**

Variable	No of Item	Item Dropped	Cronbach's Alpha
Information flow	7	1	.94
Material flow	6	-	.93
Financial flow	7	-	.90
SCM Performance	16	1	.88

**Table 1.8: Intercorrelations of Major Variables**

Major Variable	Information flow	Material flow	Financial flow	SCM Performance
Information Flow	1.00			
Material Flow	.241*	1.00		
Financial Flow	.174	.166	1.00	
SCM Performance	.123	.025	.370**	1.00

Note, \*  $p < 0.05$ ; \*\*  $p < 0.01$

region of Malaysia. 86% of the variance could be due to error or by other factor that are not included in this study. However, information flow ( $\beta = .072, p>0.05$ ) is found not to be statistically significant with supply chain performance. As a result, H1 is not supported. The result is similar for material flow ( $\beta = -.053, p>0.05$ ) which is found not to be statistically significant with the performance of supply chain management in the northern region of Malaysia. Thus, H2 is also not supported. In other words, both H1 and H2 are rejected.

Lastly, financial flow is found to be a critical factor influencing the supply chain performance in this study. It is found to be positively and significantly correlated with supply chain management performance ( $\beta = .367, p<0.001$ ). The beta value of 0.36 indicates that financial flow has positive effect on supply chain management performance. Based on this finding, H3 is supported and is accepted.

### Discussion

From the findings of the analysis as discussed in Chapter 4, information flow and material flow are found to be not statistically significant with supply chain management performance. This is contrary with findings by most of the researchers such as Rudberg et al. (2002), Li et al. (2005), Smaros et al. (2003), Chandra and Kumar (2000), Davenport

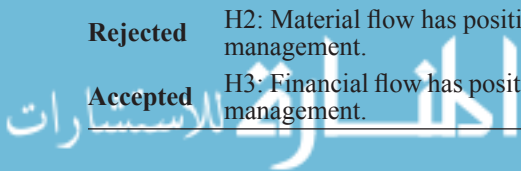
**Table 1.9: Regression Results for Supply Chain Management Performance**

Variable	Std Beta
Predictor Variable	
Information Flow	.072
Material Flow	-.053
Financial Flow	.367***
F	4.351
R <sup>2</sup>	.143
Adjusted R <sup>2</sup>	.110
F <sup>2</sup> Change	4.351
R <sup>2</sup> Change	.143

Note: \* $p<0.05$ , \*\* $p<0.01$ , \*\*\* $p<0.001$

**Table 1.10: Result of All the Hypotheses Testing**

Results	Hypotheses
Rejected	H1: Information flow has positive impact on the performance of supply chain management.
Rejected	H2: Material flow has positive impact on the performance of supply chain management.
Accepted	H3: Financial flow has positive impact on the performance of supply chain management.



and Brooks (2004), Cigolini et al. (2004), Zailani and Rajagopal (2005), McCarthy and Golicic (2002), Simatupang and Sridharan (2004), Chin et al. (2004), etc. who have found that information and material flow are important factors in the performance of supply chain management.

This finding which is contrary with previous researches' findings could be due to several reasons. Today, most organizations, regardless of whether they are large multinational organizations or medium sized local companies are beginning to expand globally. Sridharan and Caines (2005) have cited that many large organizations today are conglomerations of business units and acquisitions globally (Spiegel, 2001). Most organizations are expanding across regional boundaries at various geographical locations. Sub-companies of these organizations that are located in different countries might be influenced by the different cultures in the countries that they are located in. These sub-companies will have their own way of managing their processes, work structures, resources, information, material, so on and so forth. As suggested by Spiegel (2001), it is necessary to understand the way people work together and also the type of information exchange to enable these globally large organizations to identify the technologies that could support these exchanges and to connect them.

With organizations operating at different locations with different ways of managing work, there is possibility that some factors such as management commitment, technology, infrastructure, culture, etc could impact supply chain performance. Chin, Rao Tummula, Leung and Tang (2004) have found that management involvement and commitment are essential to establish relationships with customers and suppliers. They have also brought up the fact that the change of corporate culture is the single most important factor for successful supply chain management. Besides that, they have also cited that change in corporate culture is needed as traditional culture focused only on short-term organizational performance whereas SCM purpose is to improve performance and profitability that benefits all the supply chain partners (Tan, Kannan & Handfield, 1998).

The findings of this study could also be due to respondents not fully understanding the questions or do not have sufficient knowledge about the questions asked. Looking at the demographic profile, a majority of the respondents are within 26-35 years of age (58.6%). This leads us to believe that some respondents might not have adequate experience and thus might not have sufficient knowledge about the questions asked. It could also be due to the range of positions held by the respondents in this study being too wide, ranging from Buyers, Planners, Officers, and Analysts to Executives, Managers or even top management such as the Director of the organization. Another possible reason could be the channel of communication which organizations might view as important. There needs to be effective communication channels before information flow is considered as an importance factor that impacts the performance of supply chain management. Chin, Rao Tummula, Leung and Tang (2004) have cited that communication channels need to be well established to enhance interactions and communications within and across organizations (Cooper & Ellram, 1993). Chin et al. have further added that communication channels enable the entire supply chain to response faster and have the

flexibility to meet the ever-changing needs of the marketplace. They have also explained that feedback for continuous improvements within the organization and information flow to customers and from suppliers for decision making are required. This explains why communication among individuals, groups and organizational interactions are critical along the supply chain.

Apart from that, today, outsourcing activities are gaining momentum and have gained footsteps in the business environment. More and more organizations are engaged in outsourcing their non-core competent activities to reduce costs. With outsourcing activities, organizations need not have to worry too much about having to stock up inventory to ensure smooth production and delivery. Contract manufacturers are taking over most of organizations production and have been handed the responsibility to produce and ensure assurance of supply to organizations. With the trust provided to contract manufacturers, organizations might deem information and material flow within the supply chain management in the organizations as not as essential as other factors. In fact, as Rao Tummala, Phillips and Johnson (2006) have explained that technology will help in managing inventory flow and supply within a given supply channel and is a key in evaluating and in reducing resource consuming processes. This leads to another possible reason which organizations nowadays might deem it as more important to improve supply chain management performance than information and material flow as majority of the organizations being sampled are from electrical & electronics and industrial & engineering industries which are normally advanced in technology. The study however shows that financial flow has significant positive impact on supply chain performance, in line with the view of M. Udin, K. Khan and Zairi (2006) who support the fact that information flow is essential in supply chain. This is a relatively a new factor that has been identified to have influential power on supply chain management as most of the previous researches focused mostly on the importance of information and material flow. This is a new supported finding and it is hoped that this finding could contribute to future researches on supply chain management. The analysis and findings have answered the four research questions that were developed for this study, which includes the study on the relationship between the independent variables and the dependent variable as well as determining the factor that has the most significant impact on the performance of supply chain management.

### **Implications**

This study provides useful insights on factors that could affect supply chain performance. The findings might not be similar to findings from past studies that stress the influence of information and material flow on the performance of supply chain management as there are other influential factors that need to be considered. However, with the finding of a new potential factor in financial flow, organizations may need to consider this in managing their supply chain. Financial flow also plays a role in decisions made in an organization which in turn will affect the performance of supply chain management as it affects cost and the flow of materials as well. Financial flow information provides significant insights about the financial health of the supply chain. As supply chain

involves a network of supply chain partners, organizations need to ensure that financial flow is managed effectively as financial flow information provides significant insights about the financial health of the supply chain. Financial flow needs to be considered in decision making as well, as the cost in one area affects the cost in other areas and this would hinder organization's supply chain performance.

### Limitations

Firstly, some of the measurements in this study, for example the use of "Moderate" level in the questionnaire when seeking respondents feedback on their satisfaction level towards the supply chain management in their organizations might not be a good measure as it reflects a possible "neutral" answer. Also, the 5-Likert scale used in the questionnaire ranging from "Least important" to "To great extent" and "Not improved at all" to "Highly improved" in some of the questions might not fully suit the questions asked. As explained by Beamon (1999), the usage of qualitative evaluations such as "good", "fair", "adequate" and "poor" to measure supply chain performance are vague and difficult to use in meaningful way. Therefore, he advises that quantitative performance measures are better evaluation tool compared to qualitative evaluations. However, he has also raised a concern that quantitative or numerical performance measure might not adequately describe the supply chain performance and thus would also be vague and difficult to use.

This study consists of manufacturing companies of different sizes which include multinational companies as well as local small and medium manufacturing companies (companies with 250 or less employees would be categorized as small and medium companies). Judging from previous findings, this seems to be a limitation in this study. There are differences in supply chain management performance among small and medium enterprises (SMEs) and large enterprises (LEs), as have already been claimed by some researchers and there are several possible reasons for these differences. Vaaland (2007) has cited in his paper that SMEs and LEs implement supply chain management differently and apparently the difference is associated with SME performance (Arend & Wisner, 2005). Arend & Wisner have also claimed that SMEs are generally not able to implement supply chain management to its full extent, primarily because they are managed by larger customers and need to abide by the rules and conditions set forth by their customers. They have also suggested that larger organizations consider SMEs as easily replaceable; hence buyers are rather reluctant to form partnerships with SMEs. Also cited in Vaaland is a study of 288 UK SMEs (Quayle, 2003) which leads to evidence of differences in supply chain management implementation due to lack of effective adoption of supply chain management techniques. Quayle has found that there is significant gap between LEs and SMEs in implementing various supply chain management tools and ideas and some of the important tools and concepts that lead to improved supply chain competitiveness might not gain the attention among SMEs. These findings are supported by Wagner, Fillis and Johansson (2003) who have found considerable diversity in SMEs supply chain management implementation due to differences in technological adoption, such as the adoption of electronics interfaces among supply chain partners. Wagner et



al. have explained that whereas LEs have the resources and budgets to adopt advance technological strategies and tools, SMEs are challenged by resource limitations. These researchers have found that the implementation of supply chain management in SMEs is not as deep as the implementation in LEs, thus SMEs do not gain as much advantages as LEs. According to Vaaland (2007), the lack of supply chain management implementation could be related to supply chain structures, which includes resource structures and how the various assets are linked and shared among supply chain partners.

For future research, it is suggested that more factors must be included in the study. Among the factors to be considered could be elements such as trust, commitment, cooperation, buyer-supplier relationship, etc. Also to be considered is the inclusion of moderator in the relationship. According to R. Kannan and Tan (2006), organizations are under pressure to improve quality, delivery, performance, responsiveness and reducing costs as the market situation becomes increasingly competitive. In response to the competitive forces, organizations are looking into ways to leverage their supply chains and evaluating the roles of suppliers. R. Kannan and Tan (2006) have cited that as a result, non-core competencies activities are being outsourced and this activity has been on an increasing trend (Pralhad & Hamel, 1990). Also, Kim, Park and Kim (1999) have cited that outsourcing is a viable option for organizations that aim to build up strong core competency (Deavers, 1997). According to R. Kannan and Tan, outsourcing enables organizations to better utilize their resources and provide organizations more flexibility to respond to changing needs. However, a point to note is that organizations might need to manage their supplier base as outsourcing activities increased in order to ensure that the organizations' requirements and quality of products are met. Looking at this, future research could probably study about the impact of outsourcing on supply chain management.

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