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# THE RELATIONSHIP OF INFORMATION SYSTEMS, SUPPLY CHAIN MANAGEMENT WITH ORGANISATIONAL PERFORMANCE

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## **Abstract**

### **Purpose**

In today's world, Supply Chain Management (SCM) is a key strategic factor for increasing organisational effectiveness and for better realisation of organisational goals such as competitiveness, better customer care and increased profitability (Ganesh Kumar and Nambirajan, 2013). As such, research interest has focused on supply chain practices with SMEs and large organisations in terms of supply chain information systems (SCIS) and organisational performance.

### **Research Approach**

This study aims at the exploration of the statistical relationship between (SCIS) Effectiveness and Organisational Performance. The findings from a survey involving 168 IT managers show a strong correlation between SCIS and non-financial Organisational Performance across a cohort of Small Medium Enterprises (SMEs) and large organisations.

### **Findings and Originality**

These findings are further confirmed by a recent publication from Ganesh Kumar and Nambirajan, (2013). This study identified the items used by researchers for the measurement of both constructs. Exploratory Factor Analysis was employed as there was no theoretical basis to specify a priori the number and patterns of common factors (Hurley et al., 1997) especially for the extraction of factors measuring the non-financial performance of a firm.

### **Research Impact**

The analyses also revealed that companies with a high implementation degree show a better supply chain performance. Furthermore, the results show that this paper contributes to the SCM field by providing scales for financial and non-financial performance constructs, and by exploring how those are improved by the adoption of specific Supply Chain Information Systems.

### **Practical Impact**

The purpose of this study aims at the exploration of the statistical relationship between Supply Chain Information Systems' (SCIS) Effectiveness and Organisational Performance, when this is measured by financial and non-financial variables and the impacts on SMEs performance.

**Keywords:** SCM Information Systems, Organisational Performance

## **Introduction**

Supply Chain Management (SCM) has become a key strategic factor for increasing organisational effectiveness and for better realisation of organisational goals such as competitiveness, better customer care and increased profitability (Ganesh Kumar and Nambirajan, 2013). For example, Goswana, Engel and Krcmar, (2013) highlighted that organisations view their supply chains as critical determinants of efficiency and effectiveness whilst facing turbulent business environments that demand shorter product lifecycles and rapid market fluctuations. What is more, Qrunfleh and Tarardar (2014) stated that it is important for firms to adopt information systems (IS) that are aligned to its supply chain, and expedite the information about parameters that assess specific goals of its particular supply chain (SC) strategy. The authors argue that 'competition is no longer between organisations but through their individual supply chains'. As such, research interest has focused on supply chain practices, supply chain performance and organisational performance.

## **Supply Chain Information Systems (SCISs)**

One of the critical aspects in successfully SCM is the reliance on the information about key operational and performance parameters (e.g. inventory, delivery schedules and lead times) (Gunasekaran and Ngai, 2004), (Vickery et al, 2003). This information sharing across the supply chain allows members to retain the visibility that is needed to act upon changing business conditions, however the degree of visibility impacts performance gains within the supply chain (Lee, 2002), (Vickery et al 2010). This lacuna in knowledge motivated this paper addresses the gap by offering a theoretical and empirical basis for exploring the impact of SCIS *effectiveness, for smaller and larger Organisations.*

## **The SME dilemma**

Such SCIS have evolved significantly the last two decades in response to the rapid growth in web technologies (Cheng, Yang, Huang, 2002) and advancement such as the cloud computing (Wu, et al, 2013). For these reasons, SCISs need to adapt to such changes and provide the functionality to support complicated and sophisticated business requirements. A SCIS provides organisations with an infrastructure to facilitate the exchange of data among various value chain components, as well as a mechanism for coordinating and monitoring of the operations within the supply chain. With growing uptake of SCIS technologies Small and Medium-sized Enterprises (SMEs) (Goswani et al 2013), and the growing question is, what is the extent of SCIS Effectiveness and Organisational Performance? SCIS software packages are aimed towards performing a certain sets of tasks within the context of supply chain and networks (Goswani et al 2013). (Barrett and Konsynski, 1982), (Goswani et al 2013) classified SCISs into planning systems and execution systems from a process perspective. A number of scholars have identified that a high percentage of SMEs suffer the problems of non-integration, lack of consistent management information systems and unexplored e-business opportunities. There is a lack of an existing framework or model to address how SMEs can effectively implement the use ICT opportunities in order to make the most of the opportunities offered by such new technologies. The impact of how SMEs can better adopt modern technology becomes important to both researchers and practitioners, as small business

becomes a rapidly contributor We therefore develop a set of hypotheses proposing the broader aspect of the nature of the SCIS, and identifying the relevant set of applications (i.e. Operation Performance) in order to enhance the impact on supply chain effectiveness.

### **Theoretical background-research propositions**

The theoretical background of this paper draws from the Information Processing Theory (IPT) (Galbraith, 1973) which considers organisations “as information processing entities that collect, analyse, and coordinate information” in order to make operational and strategic decisions. Applying the IPT to the implementation of Supply Chain Information Systems would mean that the information produced by the system should be effective to enhance operational and strategic decision-making. Qrunfleh and Tarafdar (2014) suggested that through a number of structural means such as rules, procedures and lateral communication mechanisms or through the application of IS. They also argued that matching particular SC strategies (i.e. supply chain information processing needs) with appropriate supply chain IS strategies (i.e. supply chain information processing abilities) will enhance the benefits from those SC strategies. Furthermore, Schoenherr and Swink, (2012) applied IPT to supply chain processes, emerging research (shows that integration of external (i.e. supplier and customer facing) processes leads to improved supply chain performance and that integration of internal (i.e. intra-firm logistics, operations and supply chain management) processes positively moderates this relationship. In other words, the implementation of Information Systems should integrate the Supply Chain processes in a way that the whole supply chain is managed effectively (Chang & King; 2005; Argyropoulou et al., 2008) which in turn can have a positive impact on the organisational performance. In light of the above analysis we propose the following research questions:

*P1: Is there a difference in SCM effectiveness, for smaller and larger Organisations?*

*P2: Is there a difference in SCM effectiveness, for companies that have implemented ERP?*

*The operationalisation of constructs:* 8 items were used for the operationalisation of SCIS effectiveness (independent construct). The items are based on the Information Systems strategy for efficiency (ISSE) and flexibility (ISSF) measures developed by Sabherwal and Chan (2001) and used by Chang & King (2005) and recently tested by Qrunfleh and Monideepa (2014). For the operationalisation of Organisational Performance (dependent construct), the study used 26 items representing the four Balanced Scorecard (BSC) perspectives (Kaplan and Norton, 1992; 2005). Financial measures incorporated traditional measures like income, profit, and costs. Non-financial measures, on the other hand, meant to measure the organisational performance in relation to customers (e.g. customer satisfaction-retention), innovation and forecasting ability, organisational flexibility etc. 7-point Likert scale was adopted.

### The research design and sample characteristics

Data for this study were collected by means of a web questionnaire and a sample of 700 Greek companies of different sizes operating in various industry sectors. A web link was provided to the IT managers of the targeted companies who were considered to be the most knowledgeable respondents (Forza, 2002). This web survey started on April 2010. Two reminder letters were issued subsequently one week after the first call notifying those that had not responded of a forthcoming deadline for the closing of the questionnaire. 168 usable responses were collected from different industries and company sizes. It should be noted that we took all possible measures suggested by the literature to avoid Common, Method Variance: "identification of the most informative person, attempt to motivate key informants to co-operate with the study, minimisation of elapsed time, consideration of the impact of alternate framing of questions and finally, the use of pre-tested and structure questions" (Podsakoff et al., 2003; Reio, 2010). In addition, the Harman's single factor test, when using exploratory factor analysis, showed that no single factor accounted for the majority of the variances explained, which means that common method bias was not a major concern in our research (Podsakoff et al., 2003). Table 1 shows that the participating companies represent many different industries with nearly 60% of the companies in manufacturing, pharmaceuticals and dairy firms followed by commercial firms /retailers (25%) and services like banking, hospitals and consulting companies (15%). As it is seen in table 2 our sample comprised mainly companies employing more than 50 people which was expected as this had been determined for our targeted group as micro SMEs were unlikely to have implemented IS for our research.

*Table 1-Industry classification*

Type of industry	Number of responses	Percentages
Manufacturing and construction	99	60%
Commercial	42	25%
Services	27	15%

*Table 2-Number of employees*

No of employees	Frequency	Percent	Valid Percent	Cumulative Percent
<50	17	10.1	10.1	10.1
50 -100	53	31.5	31.5	41.7
100-250	46	27.4	27.4	69.0
250-500	27	16.1	16.1	85.1
>500	25	14.9	14.9	100.0
	168	100.0	100.0	

Table 3 presents the kind of software used by the companies in our sample. The majority of the companies are using mainly ERP Systems (ERP) either single or accompanied with one of the other enterprise systems. CRM and Order Management are also very popular, whereas the Project Management is the less frequent software used specifically by the construction firms of our sample.

*Table 3 Enterprise Systems*

Kind of software used	frequency	%
Enterprise Resource Planning (ERP)	150	89.3
Supply Chain Management (SCM)	41	24.4
Customer Relationship Management	72	42.9
Project Management (PM)	31	18.5
E-commerce	44	26.2
Order management	73	43.5

### Data analysis and findings

Before proceeding to any statistical test, the variables were tested for normality. All skewness values were much less than  $\pm 2$  and all kurtosis values were much less than  $\pm 7$ . The cut off points are: for skewness  $< \pm 2$  and kurtosis  $< \pm 7$  (Curran et al. 1996). Exploratory Factor Analysis (EFA) was followed for the reduction of the dependent variables aiming at the extraction of their respective constructs. Promax rotation techniques were employed to test the reliability of the scales and obtain the minimum number of factors. The latent root criterion, the scree test and the percentage of variance explained were used in the analysis (Hair et al, 2010). Cut off point for item loading was 0.5 and the initial 36 variables were reduced to 34. Following the Promax rotation, the pattern mix indicated 5 extracted factors: 1 factor could be attributed to the dimension of SCIS effectiveness and 4 factors were extracted for the measurement of organisational performance. Their names and reliability test results are depicted in table 4. Reliability was assessed by using Cronbach's Alpha coefficient (Cronbach, 1951), which is the most common way to estimate the reliability of such scales (Nunnally, 1994). Nunnally's (1994) threshold level of acceptable reliability being an alpha coefficient of 0.70 or greater was adopted. All scales were found to satisfy this criterion with Cronbach's a coefficient comfortably higher than the cutoff point of 0.70 (Hair et al, 2010).

*Table 4 Factors measuring SCIS effectiveness and Organisational Performance*

Constructs	Factor Name	Cronbach a
<b>Independent</b>	SCIS effectiveness	0.894
<b>Dependent</b>	Growth and development	0.962
	Dynamism and Vigilance	0.955
	Financial performance	0.940
	Marketing performance	0.942

In light of the extracted dependent factors, 4 hypotheses were formed (see table 5). For the purposes of this research, the SCIS Effectiveness factor was considered as the independent variable (IV) and the factors that measured Organisational Performance

became the dependent variables (DVs). In order to test and quantify the relationship between the IV and the DVs, multiple regression analysis was performed. Table 5 summarises the model evaluation and ANOVA results.

*Table 5 Results from the regression analysis*

SCM effectiveness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,044	1	,044	,032	,858
Within Groups	157,152	115	1,367		
Total	157,197	116			

*Comparing two groups*

- *Group 1 companies with max 100 people*
- *Group 2 companies with more than 200 people*

*A one-way between groups analysis of variance was conducted to explore the impact of size on SCM effectiveness. The Levene’s Test of Equality of Error Variances was checked first to ANOVA test the basic assumption underlying the analysis of variance. This particular test has to be greater than .05 therefore not significant because a significant result would suggest that the variance of the dependent variable (factor in our case) across the groups is not equal. The ANOVA test suggests that there is no statistically significant result to show that the size can have an impact on higher SCM effectiveness (P>.05). RQ. Is there a difference in SCM effectiveness, for smaller and larger Organisations? We used one-way ANOVA in table 6, we found that there is no statistically significant result to show that the use of ERP system alone can have an impact on higher SCM effectiveness. (P>.05). RQ. Is there a difference in SCM effectiveness, for companies that have implemented SC software? Comparing two groups*

- *Group 1 companies with ERP*
- *Group 2 companies without ERP*

*Table 6: ANOVA: SCM effectiveness*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,726	1	,726	,501	,480
Within Groups	228,897	158	1,449		
Total	229,623	159			

*We used one-way ANOVA in table 7, and we found that there is indeed a statistically significant result to show that the adoption of SC software can have an impact on higher SCM effectiveness. (P>.05). The results from the statistical tests show a positive correlation between SCIS Effectiveness for smaller and larger Organisations. To assess the statistical significance of the results we checked the ANOVA model summary which tests the hypothesis that multiple R in the population equals 0. All four models reached statistical significance (sig=.000 meaning p<.0005) and all*

hypotheses are accepted. In this exploratory research, it is found that Supply Chain Information Effectiveness has a positive impact on the financial and non-financial performance of an organisation. *Comparing two groups*

- *Group 1 companies with SC software*
- *Group 2 companies without SC software*

Table 7: ANOVA: SCM effectiveness

	Sum Squares	df	Mean Square	F	Sig.
Between Groups	16,239	1	16,239	12,024	,001
Within Groups	213,384	158	1,351		
Total	229,623	159			

### Discussion on the findings-Contribution

This paper explored how IT managers perceive SCIS effectiveness and how this, in turn, *is influenced by the size of the company*. SCIS are critical for synchronising information among members of supply chains and networks, and accordingly there is a need to better understand the similarities between *smaller and larger organisations* to be able to carry out a systematic evaluation and selection of such SCIS applications (McLaren and Vuong, 2008), (Goswna et al 2013). Our paper contributes toward this by developing the effectiveness of such SCIS in terms of performance within *SCM effectiveness, for smaller and larger Organisations*. Our results reinforce previous findings from Hendricks et al. (2007) who argued in favor of ERP and SCM integration in which can help a firm gain competitive advantage for SMEs using SCIS. In this regard, it would be logical to say that this paper contributes to the SCM field by providing scales for *SCM effectiveness, for smaller and larger organisations*.

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