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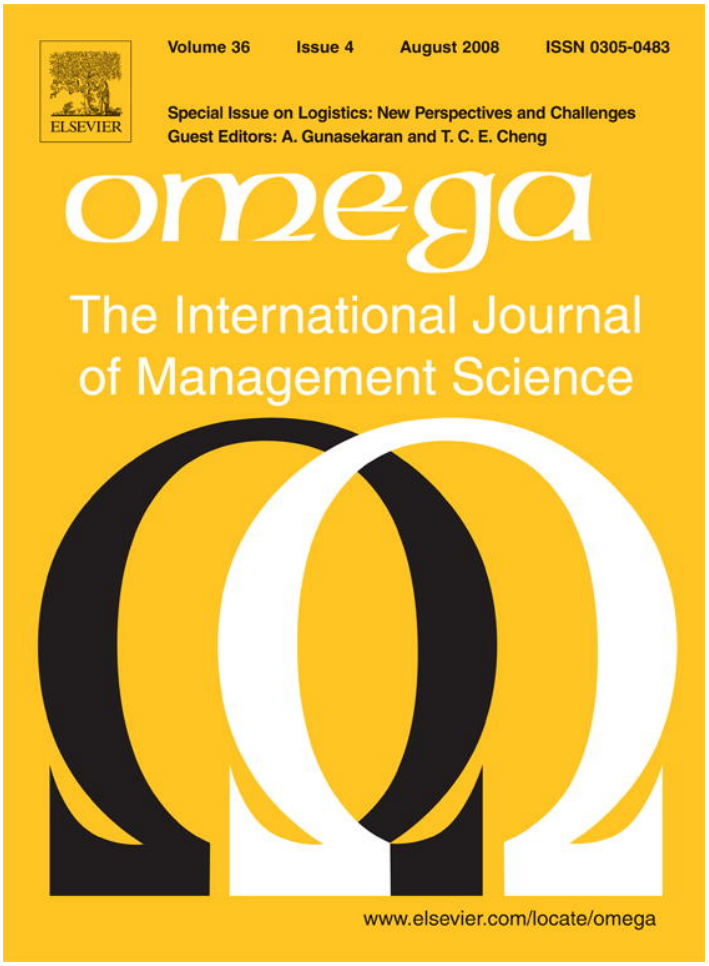

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The use of information systems for logistics and supply chain management in South East Europe: Current status and future direction☆

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Abstract

This research aims to investigate the current status and future direction of the use of information systems for logistics and supply chain management (LSCM) in South East Europe. The objectives are threefold: (1) to identify major challenges and developments on the use of information systems for LSCM by enterprises, (2) to examine the actual level of satisfaction of current policy on LSCM, and (3) to reveal the actual need of enterprises in South East Europe on effective use of information systems for LSCM. Mixed methodology of literature review and questionnaire survey is adopted in this research. Data collected from 79 enterprises are analysed using descriptive analysis in SPSS. The findings suggest that enterprises in Albania, Bulgaria, Greece, Former Yugoslav Republic of Macedonia (FYROM), Romania, and Serbia and Montenegro, face similar challenges but all are in different stages of developments of LSCM. Their use of information systems explains their heavy focus on supply chain partnership and weakness in demand chain partnership. Major findings suggest that companies and governments alike in that region do not seem to be ready for playing a significant and demanding role in global supply chains. Current deficiencies, including limited abilities in building valuable forward relations, weak strategic planning and organisation, and infrastructural problems, are major obstacles for fast development in LSCM. At the same time though, traces of changing mentalities do exist, setting the ground for improved performance and ultimately for a better position in global business.

Keywords: Supply chain management; Information systems; Logistics; South East Europe; Policy making

1. Introduction

The globalisation market has stimulated the demand on the use of concepts, techniques, tools, systems, technologies, models and frameworks in enterprises for logistics and supply chain management (LSCM). This phenomenon is not surprising given that supply chain now has to compete with other supply chains [1]. The chain–chain competition has started to take over

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the enterprise–enterprise competition, although many enterprise–enterprise competitions do exist particularly in the less developed economies. The forward-looking enterprises today are dynamic; they collaborate with suppliers, customers and even with competitors, share information and knowledge aiming to create a collaborative supply chain that is capable of competing if not leading the particular industry. Hence, gaining competitiveness under such a cut-throat environment becomes increasingly difficult, but not impossible.

Managing a supply chain includes activities such as material sourcing, production scheduling, and the physical distribution system, supported by the necessary information flows. While there has been a plethora of literature on the adoption of material requirements planning (MRP) (e.g. [2]), manufacturing resource planning (MRPII) (e.g. [3]), enterprise resource planning (ERP) (e.g. [4]), supplier relationships management (SRM) (e.g. [5]), customer relationships management (CRM) (e.g. [6]) and other information systems to improve LSCM, mixed performances could still be identified. Advanced technologies such as radio frequency identification (RFID), global positioning satellite (GPS), and wireless and mobile technology have recently been applied in the manufacturing [7], service [8], logistics and distributions [9], and retail [10] sectors, but they have also resulted in mixed performances in a supply chain. Although cases of better tracking of product logistics, improved efficiency in information processing, improved security, reduced counterfeit, fast-tracked quotation and ordering, improved customer relationships, better control of supplies have been reported (examples are cases in Frankfurt Airport in Germany and Wal-Mart in USA), these cases often are a representation from more developed countries where appropriate infrastructure is in place.

The European Commission has funded many research and development projects collectively aiming to improve the competitiveness of European enterprises. Although many reported successes can be identified, the actual benefits translated to the enterprises are yet to be revealed. This does not imply that the previous projects were a failure, but it indicates that further work is required to show the actual challenges, developments and performances in the enterprises. This research is formulated primarily to provide such feedback to policy makers in order to review their current policy for a more strategic and 'direct-hit' future funding investment. This notion was also applied in Hughes and Love's [11] research on information and communication technology (ICT) policy formulation for the Australian government.

South East European countries (Albania, Bulgaria, FYROM, Serbia, Montenegro, Bulgaria and Romania) will have to increase their competitive capability. Although Greece has been a member of the European Union since the beginning of the 1980s, its geographical location invokes a strong strategic link with the other South East European countries in order to collaboratively increase their regional competitiveness, and thus is also included in this study.

Lack of information could have a negative impact on profit maximisation [12]. Various information systems and technologies could be used to manage a supply chain and logistical operations. It has been identified that the use of appropriate systems could lead to the creation of differential business value [13]. Unfortunately, little inter-country research could be identified that examines the adoption of these information systems and advanced technologies for supply chain and logistics management in South East Europe, and one that could lead to future policy making and strategic investment in the region. To this end, the study adopts the following aim and objectives.

2. Aim and objectives

This research aims to investigate the current status and future direction of the use of information systems for LSCM in South East Europe. The objectives are threefold: (1) to identify major challenges and developments on the use of information systems for LSCM by enterprises, (2) to examine the actual level of satisfaction of current policy on LSCM, and (3) to reveal the actual need of enterprises in South East Europe on effective use of information systems for LSCM.

3. Literature review

The supply chain concept is based on the formation of a value-chain network consisting of individual functional entities committed to providing resources and information to achieve the objectives of efficient management of suppliers as well as the flow of parts [14]. In the business-to-business (B2B) market, many suppliers have to be able to provide a level of delivery performance that is compatible with their corporate customers. Those suppliers that can provide such delivery performance could win the supply contract. The desired delivery performance can be achieved with effective and efficient use of an ERP system [15,16], which could provide better information flow in a supply chain under the conditions of skilled workforce [17] and integration

with SCM [18]. This benefit could also be propagated to the demand chain in meeting customer delivery performance in the business-to-consumer (B2C) markets. Under resource constraints, such service could also be outsourced to a logistics service provider [19].

An ERP system is an integrated application program for enterprise business organisation, management and supervision [20]. ERP technologies have been designed to address the fragmentation of information across an enterprise's business, to integrate with intra- and inter-enterprise information [21]. When considering ERP integration between enterprises for a seamless supply chain performance, the differences on the types of ERP adopted by suppliers and customers in the supply chain could create incompatibility issues. To this end, the concept of extended enterprises was purported to study the role of ERPII, which could be operationalised by extended enterprise application (EEA) and/or enterprise application integration (EAI) to create links between different ERP systems to be integrated in a supply chain [22].

An enterprise must not rely only on ERP for managing a supply chain [1]. Due to its rigid system design and incapability to deal with uncertainty [23], other systems and/or technologies such as RFID, mobile technology, wireless technology, etc., would help to improve order, part and product traceability in a supply chain [24]. In turn, this may reduce the problems of uncertainty since a more accurate progress update of the flows of order, part and product could be achieved. Following this logic, an intelligent agent-based knowledge management system used in conjunction with the advanced technology was proposed to help reduce the problems of uncertainty in a manufacturing supply chain [24].

Not every enterprise could afford an ERP system. A large scale ERP system implementation, e.g. SAP, could cost up to £4million. A mid-range ERP system implementation, e.g. Sage, could cost around £25,000. Such price ranges show that medium and large enterprises are the likely users of large scale ERP system, whilst smaller enterprises could only afford the mid-range ERP systems. However, its predecessors, MRP and manufacturing resource planning (MRPII), are still very popular, particularly amongst the manufacturing small and medium sized enterprises—SMEs [4]. MRP and MRPII are mainly used for production planning in manufacturing enterprises, whilst warehouse management systems (WMS) is used for inventory control. To integrate with the suppliers and customers in the supply chain, SRM and CRM have been adopted. Enterprises do combine these systems in order to provide the best performance in LSCM.

Electronic data interchange (EDI) has been used widely to transfer information between suppliers and customers in a supply chain. Bar coding is still widely used to ensure part and product tracing. These long-established technologies are not expensive compared to RFID when considering their robust implementations at all micro–macro and backward–forward levels in a supply chain. Although the cost of RFID tag is decreasing rapidly [25], the reader standard and compatibility with suppliers persist to be a constraint for its integrated application in a supply chain. Smith [25] argued that RFID should be viewed as a transformational event rather than a technological innovation. It was found that Wal-Mart and other cost-sensitive and value-chain progressive enterprises' usage of RFID-based technology should revolutionise the method that enterprises track their inventory. From the security perspective, it was identified that RFID technology provides enormous economic benefits for both business and consumers, while simultaneously, potentially constituting one of the most invasive surveillance technologies threatening consumer privacy [26]. Nonetheless, it was argued that RFID smart technology on counteracting theft outweighs consumer privacy invasion [25].

These issues are of immense importance for studying LSCM. However, when moving to the specific region under investigation, information becomes scarce. There is small number of studies touching upon SCM, logistics and IS in South East Europe but they are country-focused, or following what can be called a micro-approach, rather than region-focused, or following what can be called a macro-approach. For example, Kotsifaki et al. [27] investigated the level of logistics strategic planning in Greece, while Bloomen and Petrov [28] examined the status of logistics development in Bulgaria at the beginning of the 1990s. Although this micro-approach that has predominantly implemented up to now is crucial for understanding LSCM in separate countries, it is of limited value for assessing the region as a whole. This study uniquely provides both academics and practitioners with an overall view of the current status of SCM and IS in the specific region. Based on the belief that South East Europe, as a region and not as individual countries, can benefit hugely from EU regional policies and from its increased competitiveness in global supply chains, a macro-approach seems evident.

4. Research methodology

A mixed methodology was deployed in this research [29]—comprising literature review and questionnaire

survey. Review of the literature on information systems use for LSCM led to the development of a questionnaire to collect actual data from enterprises on issues related to challenges, benefits, and development on the use of information systems for LSCM in South East Europe. A question on satisfaction level of policy related to LSCM was also included in order to reveal what enterprises really think of it. A specific question was also designed to identify what enterprises really need for future measures in supporting LSCM. It was envisaged that results from the questionnaire survey would provide an overview of the use of information systems for LSCM in South East Europe at large, and a basis for future direction for South East European enterprises and policy makers to improve performances on LSCM.

There are three key themes in the questionnaire: (1) LSCM practices, (2) use of information systems to support LSCM, and (3) policy effect. It was deemed important to explore theme 1 prior to detailed investigation of themes 2 and 3 because results from theme 1 would provide the general current status of LSCM. Questions in theme 1 were on the topics of strategic planning for SCM and logistics, the existence of a clear logistics plan and of a separate logistic department, and on close relations with suppliers, customers and 3PL partners. Questions in theme 2 focused on the current and future implementation of systems, on benefits deriving from the use of systems, and on problems associated with their implementation. Questions in theme 3 included satisfaction levels from current policies regarding SCM and logistics, and suggestions for important future directions in policy making for SCM and logistics.

It only took about 25 min to answer these questions. Structured, on-line-administered questionnaires, utilising closed questions based on the literature review, were emailed to 300 manufacturing and trading enterprises in six South East European countries, namely Albania, Bulgaria, FYROM, Greece, Romania, and Serbia and Montenegro.

Manufacturing and trading enterprises were the target groups because they tend to adopt such information systems and it was envisaged that interesting results could be obtained. However, it was not within the remit of this research to cover the entire population of manufacturing and trading enterprises in these countries, given that enterprises record in official databases and directories are usually outdated in these countries [17]. "Self-selected" sampling of a heterogeneous sample of manufacturing and trading enterprises was adopted in order to stimulate responses [30]. Hence, a small sample size was initiated using personal and professional contacts of the researchers. Seventy-nine completed questionnaires were returned giving a satisfactory response rate of 26.3%, without any follow-up. The data were analysed using SPSS. Descriptive analysis was applied owing to the small sample size for large countries coverage.

5. Results, analysis and discussions

Primary data analysis reveals interesting results in five significant issues related to the aim and objectives of this study. These issues include: the need for improving strategic planning, forward vs. backward supply chain relations, the overall satisfaction of information systems currently in use, and specific policy recommendations. Table 1 summarises the empirical results of these issues and Table 2 shows the systems currently in use and its future implementation.

5.1. Strategic planning

Table 1 shows that almost half of the companies in the sample ($n=38$, 48%) believe that they need to improve their strategic planning concerning LSCM. Only one fourth of these companies seem to be satisfied with their strategic planning ($n=21$, 27%) while 15% claim that they have just started to implement some sort of strategic planning for LSCM. An interesting finding is the fact that 10% stated that they find strategic planning not appropriate. This study also found that the majority of companies ($n=41$, 52%) do not have a clear logistics plan, and 55 of them (70%), do not have a separate logistics department.

Since the sample included exclusively trading and manufacturing companies, where LSCM functions are of increased importance, these results signify a certain shortcoming of such companies in South East Europe. This shortcoming, namely the lack of strategically planned and organised LSCM operations, could prove fatal for companies in the region taking into account the fierce global competition they face. Cultural background, which is widely related to somewhat chaotic and mainly spontaneous behaviour, and the developing transition stage of most of the national economies in South East Europe, from communism to a modern market-driven reality, can serve as the underlying reasons for such a shortcoming. Still, companies illustrate a satisfactory understanding of the significance of strategic planning for increasing competitiveness since only eight companies (10%) found it as not appropriate. For these few companies though further research is needed for identifying the causes of this surprisingly different attitude towards strategic planning.

Table 1
Supplier and customer relationships in LSCM settings

	Improve	Start implementing	Satisfied already	Not appropriate
Plan strategically for LSCM	38 (48%)	12 (15%)	21 (27%)	8 (10%)
Close partnership with suppliers	30 (38%)	1 (1%)	41 (52%)	7 (9%)
Close partnership with customers	38 (48%)	1 (1%)	28 (36%)	12 (15%)
Cooperation with 3PL partners	1 (1%)	6 (8%)	3 (4%)	69 (87%)

Table 2
Current systems in use and future implementation

	Systems currently in use	Future implementation of systems
MRP	35 (44%)	19 (24%)
MRPII	25 (32%)	20 (25%)
ERP	21 (27%)	17 (22%)
WMS	35 (44%)	19 (24%)
SCM	18 (23%)	15 (19%)
CRM	21 (27%)	30 (38%)
SRM	22 (28%)	14 (18%)
APS	14 (18%)	13 (16%)
JIT	18 (23%)	13 (16%)
TOC	5 (6%)	4 (5%)
E-commerce	9 (11%)	21 (27%)
E-business	16 (20%)	21 (27%)
Decision support	10 (13%)	12 (15%)
RFID	4 (5%)	4 (5%)
EDI	22 (28%)	14 (18%)
Bar coding	32 (41%)	14 (18%)
Other	0 (0%)	2 (3%)

5.2. Supply and demand chain partnerships

Table 1 also exhibits the status of partnerships between the companies in the sample with both their suppliers and customers. Concerning suppliers, 41 companies (52%) deem their partnerships as satisfactory already, whilst 30 companies (38%) believe that this partnership needs improvement. None of them concerned about determining optimal number of suppliers [31] although they are not totally satisfied with their performance. Concerning customers the situation is nearly reversed. Only 28 companies (36%) are satisfied with their partnerships with their customers whilst 38 companies (48%) state that it needs improvement. A staggering 15% of the companies characterise partnerships with customers as not appropriate whilst for suppliers the number is considerably less (9%).

An integral element of both LSCM is close collaboration between partners throughout the length of the supply and demand chains, aiming to streamline the process and deliver higher value to final consumers by minimising cost and time wastage [32]. To this end, a close working relationship between suppliers and customers is imperative. However, companies in South East Europe participating in this study demonstrate a stronger focus on dealing with suppliers than with customers. Thus, it can be said that backward relationships (with suppliers) have been more valued in the supply chain, up to now at least, than forward relationships (with customers). This unbalanced mentality can be characterised as production-oriented in contrast to a customer-oriented one. It is reasonable that companies focusing in production would cherish supply relations above all other relations and upgrade the importance of suppliers in their continuous attempt to minimise costs, improve production processes and squeeze more profits out of customers. This attitude can again be attributed to social and economic factors in the region. Communist regimes in most of the South East European countries that were by nature supply/production-oriented have galvanised generations and formulated specific attitudes in favour of opportunism and distrust which are hard to change. Consequently, suppliers become more important than customers. However, a promising prospect is that many companies realise the fact that they have to work harder on the customer front in order to improve forward relationships. There is little in the literature, though, to suggest that the few companies describing customer relationships as not appropriate can have a very bright future in a hyper-competitive environment.

The overwhelming majority of the companies ($n = 69$, 87%) consider third party logistics (3PL) partners as not appropriate, with just three companies (4%) being satisfied with 3PL companies, and six companies (8%) having started implementing such collaborations recently. Taking into account that 3PL companies are vital nodes in both local and international supply networks around the world, these results create a number of questions. Are 3PL partners overlooked because of their inability to offer significant value to companies in that region or due to the somewhat isolative and confrontational mentality suggested earlier in this study? These two possible explanations do not need to be

mutually exclusive but in any case this is an issue in need of further investigation.

5.3. Information systems

Table 2 portrays the information systems currently used and intend to implement in the future. WMS, MRP and Bar Coding are the most popular IT solutions. On the other extreme, the use of theory of constraints (TOC) and RFID are still in their infancy in this region. Concerning future implementation, CRM proves to be the most desired IT solution, followed by e-Commerce and e-Business applications. This result is in accordance with previous findings on supply and demand chain partnerships. Almost half of the companies stated that they seek to improve their relations with customers. It is no surprise that one of the most appropriate IT solutions which enables forward relations, namely CRM, is at the top of the list. In the same direction, the popularity of e-Commerce and e-Business applications for future implementation suggests that the strategic direction in the region is shifting from production to market-oriented. Nevertheless, intentions do not ensure fast or successful implementation. More importantly, none of the respondents raised issues related to information distortion [33], which will have a negative impact on the efficiency of any information systems.

Investigation of the benefits from companies' experience in using LSCM-related IT solutions, led to an intriguing finding. As shown in Table 3, all benefits are consistently rated between 3 and 4 meaning that companies benefit in all these ways by more than average, namely 3, but lower than great, namely 4. Such a uniform approach is surprising having in mind the common knowledge that IT systems do not always deliver on promises. Additionally, as shown in Table 4, the types of problems facing companies when using LSCM-related information systems are below average, 3, and above little, 2. What these results are actually saying is that the sample companies in the region can be characterised as overall satisfied with IT solutions for LSCM.

Still some internal differences are evident from these results and are worth mentioning. Concerning benefits, resource planning tops the list (3.71) followed by better quality (3.70) and quantity (3.68) of information, better operational efficiency (3.61) and forecasting (3.61). Concerning problems, integration with supplier's systems comes first (2.70) followed by shortages of skills (2.50), integration with existing (2.49) and customer's (2.49) systems and hidden costs (2.47). Integration of systems within and outside companies seems to be a notable issue for IS vendors in the region to consider.

Table 3
How much do you benefit from using the systems?

	Mean	Standard deviation
Better quality information	3.70	.869
Better quantity information	3.68	.973
Flexibility	3.41	1.080
Reduced lead time	3.20	1.193
Cost saving	3.57	1.044
Forecasting	3.61	1.061
Resource planning	3.71	.842
Better operational efficiency	3.61	.918
Reduced inventory level	3.31	.961
More accurate costing	3.54	1.048
Increased coordination between departments	3.37	1.123
Increased coordination with suppliers	3.54	.979
Increased coordination with customers	3.44	.993
Increased sales	3.26	1.121

1, not at all; 2, little; 3, average; 4, greatly; 5, a lot.

Table 4
Problems when using the systems

	Mean	Standard deviation
Resistance to change from employees	2.40	1.067
Resource shortages	2.16	1.067
Skills shortages	2.50	1.144
Insufficient vendor support	2.19	1.035
Hidden costs	2.47	1.080
Integration with existing systems	2.49	1.310
Integration with supplier's systems	2.70	1.355
Integration with customer's systems	2.49	1.316

1, no problem at all; 2, little problem; 3, some problem; 4, significant problem; 5, serious problem.

5.4. Policy recommendations

Companies were asked to evaluate current policies in their South East European countries with regard to LSCM. Table 5 summarises the results. Although individual differences do exist between countries, the overall score of 2.58 is not flattering for policy makers since it is below the average score of 3. This means that as a whole, companies in the sample are only somewhat satisfied with their governments' policies on LSCM. Within the sample, Romanian companies are the most satisfied ones while companies from FYROM are the least satisfied from all others.

Table 5
How satisfied are you with the current policy regarding LSCM and IS?

	Mean	Standard deviation
Overall	2.58	0.970
Albania	3.00	.707
Bulgaria	2.50	.861
FYROM	2.13	.990
Greece	2.67	1.047
Romania	3.33	1.155
Serbia and Montenegro	3.00	1.069

1, not at all; 2, somewhat satisfied; 3, satisfied; 4, quite satisfied; 5, very satisfied.

Table 6
How important are these future measures in supporting LSCM & IS?

	Mean	Standard deviation
More education	3.66	1.131
Easier access to vocational training	3.41	1.171
More funding and financial support	3.78	1.195
More inter-country regional agreements	3.29	1.312
Better infrastructure	3.97	1.132
Improved information provision	3.44	1.268
Increased regional cooperation	3.65	1.387
Closer cooperation between companies	3.61	1.275

1, not at all; 2, somewhat important; 3, important; 4, quite important; 5, very important.

The overall low score should be considered in relation to the results from Table 6. All eight policy measures proposed to companies are deemed as more than important (3 and above). Better infrastructure tops the list (3.97), followed by more funding and financial support (3.78), more education (3.66), and increased regional cooperation (3.65). These results exemplify a certain eagerness characterising South East European companies for support from policy makers. Companies seem to realise the increased importance of such policy recommendations, whilst at the same time they reveal weaknesses of their region. Policy makers need to look closer to the needs of these companies and to provide meaningful policies that would assist directly the improvement of their competitiveness. This is a one-way street to survival and policy makers emerge as an integral part of the equation.

6. Conclusions

South East Europe has the potential of becoming a major node in global supply chain networks, since its geographical position allows it to be the natural bridge between the advanced Western Europe and the emerging markets of the East. This study embarked on exploring the state of LSCM and the use of information system to support LSCM in South East Europe, in order to provide insights to practitioners and policy makers both within and outside the region. Instead of focusing on the differences between countries involved, the study took an original macro-perspective considering the region as an entity.

Major findings suggested that companies and governments alike in that region do not seem to be ready for playing a significant and demanding role in global supply chains. Current insufficiencies, including limited abilities in building valuable forward relations, weak strategic planning and organisation, and infrastructural problems, are major obstacles for fast development in LSCM. At the same time though, traces of changing mentalities do exist, setting the ground for improved performance and ultimately for a better position in global business.

The findings of this study are valuable both for academics and practitioners. Nevertheless they should be considered with caution because of few inherent limitations. Although the number of companies included was considered acceptable for an initial investigation of LSCM in the region, it has limited generalisation power. In order to acquire more concrete evidence on South East Europe, a larger sample that would potentially include all countries in the region, would be necessary. Furthermore, the nature of the study indicated a certain approach which restricted depth of analysis in favour of breadth. This is because the study tried to touch upon various significant issues in LSCM and information systems at the same time in order to provide a first overview of South East Europe. Thus, potentially important variables such as frequency in system usage, and company size and type were not incorporated into the analysis. Nevertheless, further studies could be based on these results focusing on more specific issues and intriguing topics such as customer orientation, strategic thinking, and systems integration, as well as conducting specific inter-country comparisons.

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