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Information technology developments of logistics service providers in Hungary

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ABSTRACT

The objective of this research is to examine the role of sector-specific information technology (IT) developments and their significance in terms of the revenue and earnings before tax of Logistics Service Providers (LSPs), as well as the impact of these developments on the flexibility and integration of LSPs. A survey questionnaire was conducted with 284 LSPs participants. The data provided by the 51 responding enterprises provided a representative sample for the analysis of the sample population and the drawing of general and relevant conclusions related to basic population. It can be concluded that their revenue, earnings before tax and degree of integration into the supply chain depend on the sector-specific IT developments carried out by the given enterprise. IT investments will remain important in the future and the introduction and leveraging the best technologies may yield competitive advantages and higher financial rewards for LSPs.

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Logistics service providers; information technology; performance; competitiveness; distribution management; case study

1. Introduction

In recent years it has become increasingly topical to examine logistics as a field of science that significantly influences the value creation and competitiveness of enterprises, and more specifically to get to know and analyse the activity of enterprises providing logistics services. In order to achieve these aims, it necessary to identify the management success factors supporting the fundamental competitiveness of logistics enterprises, as it is an essential development step for the companies involved (Wu 2012; Jazairy, Lenhardt, and von Haartman 2017). Information technology (IT) is the use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data. Performance consequences of IT investments continue to be a hot topic in light of the continued development of these technologies and their growing use in global commerce (Sabherwal and Jeyaraj 2015; Chaysin, Daengdej, and Tangjitprom 2016). It also highlights the contribution of IT in helping to restructure the entire distribution set up to achieve higher service levels and lower inventory and supply chain costs. In order to survive and remain competitive in the global market, one has to manage the future (Patro and Raghunath 2015). Effective use of the success factors of IT enhances the production, revenue and profit potential of firms. IT investment is positively associated with higher revenue and quality performance.

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The logistics services industry has experienced enormous growth rate for more than two decades (Maloni and Carter 2006) and the work of LSPs has been increasingly recognised during the last few years, as has the significance of functioning supply relationships (Huemer 2012). LSPs provide typical warehousing activities such as receipts, shipments, inspections, packing for specific clients, and then bill the client for these warehouse services. A more advanced role for LSPs has been created by the connectivity and communication requirements of leading supply chains. The literature shows that the logistics services industry is an increasingly important topic for researchers (Panayides 2004; Sohail, Austin, and Rushdi 2004; Maloni and Carter 2006; Yeung et al. 2006; Selviaridis and Spring 2007; Trentin 2011; Marchet et al. 2017; Mehmman and Teuteberg 2016). The most frequent references to the topic since the 1990s are mostly American and British, but researchers from North European countries such as Sweden and Norway have also been publishing their scientific findings related to the sector since the turn of millennium (Murphy and Daley 2001; Hertz and Alfredsson 2003; Markides and Holweg 2006; Lukassen and Wallenburg 2010; Huemer 2012). LSPs are required to continuously sustain a more and more competitive cost structure (i.e. efficiency) and develop capabilities to improve their services (i.e. innovation); hence, the evaluation of these key success factors is considered a key issue (Marchet et al. 2017).

This research contributes to the sparse literature that has examined the relationship between key success factors (IT developments) and performance of logistic service providers in Hungary context. However, the role of the IT capability of LSP has not drawn much attention so far. Of the strategic 'factorial correlations' organised into four groups, this paper examines the relationship between the degree of integration of LSPs in the supply chain, the impact of sector-specific IT solutions and developments and flexibility, as well as their impact on the financial results of the enterprise. Industry-specific IT investments: introduction of integrated corporate governance systems, application of fleet management systems, information technologies supporting warehouse activities, IT systems (interfaces, VMIs) introduced to meet client expectations, storage and backup hardware and software tools, value protection equipment (cameras, alarms and access control systems) and other modern hardware devices.

The identification of answers could support LSPs in Hungary in identifying their management success factors which could assist them in meeting the expectations of their customers in the value chain – supply chain – supply network.

When formulating the research questions (RQ), the main attribute to consider are the key success factors – IT developments – which develop management. It is necessary to analyse their impact and correlation with the competitiveness of LSP enterprises. Specifically, the research reported in this paper addressed three questions:

- RQ1: Do the revenue and earnings before tax of LSPs depend on the sector-specific IT developments implemented by the enterprise?
- RQ2: Does the degree of integration of LSPs into the supply chain depend on the sector-specific IT developments performed by the enterprise?
- RQ3: Does the sector-specific IT development level of LSPs have an impact on the flexibility of enterprises?

In the next section, this study explores the theoretical background that provides the basis of this research, which examines whether there is a correlation between the sector-specific IT developments of LSPs and the degree of success of the given logistics enterprise. After discussing the findings, the study considers the implications for both academics and managers. Finally, the paper addresses the limitations of this research and directions for future study.

2. Literature review

Several key success factors proposed in the literature related the LSPs to evaluate performance (Marchet et al. 2017). Investments in IT systems would enhance logistics performance (Devaraj and Kohli 2000; Lim and Palvia 2001; Bardhan, Mithas, and Lin 2007; Pinna, Carrus, and Pettinao 2010; Sinkovics et al. 2011; Evangelista et al. 2012; Ghobakhloo and Hong 2014; Karagöz and Akgün 2015; Wong, Soh, and Goh 2016). Large-size logistics companies would probably invest in information systems more in order to attain a competitive edge and to take the lead in the global supply chain network (Sauvage 2003). Bi et al. (2013) propose that IT capability enables the development of a higher level of supply chain capability which is embedded within inter-firm processes and in turn enhances organizational agility.

2.1. The role and support of IT in time-based competition

The penetration of IT and the development of information and communications technologies are unbroken and unstoppable (Weill, Subramani, and Broadbent 2002).

Wu et al. (2006) studied the impact of IT on the performance of supply chains and their member enterprises with the conclusions that enterprises rely on IT to a constantly increasing extent in order to develop processes of their supply chain, while making investments in IT does not necessarily guarantee the increase of enterprise performance. IT-backed skills of supply chains are basically enterprise-dependent and they are difficult to replicate between each organisation. According to Weill, Subramani, and Broadbent (2002) provident IT-infrastructure investments make it possible for enterprises to react rapidly and cost-effectively to electronics-based challenges. Enterprises which have better infrastructure are able to react more quickly, as well as to reach better growth rate, better sales and to realise shorter return on investment. Christopher (2000) examined this factor from an even more flexible and futuristic aspect by stating that future enterprises will be characterised by the efficient management and flow of information (virtual enterprises), instead of handling products and stocks. Thus, effective information flows within and across organisations are essential to manage supply chains, and such SCM operations cannot be possible without IS management (Tatoglu et al. 2016).

2.2. The impact of IT developments on the integration of LSPs

Jayaram and Tan (2010) concluded that the cooperation between enterprises and the integration of LSPs in the supply chain are cumbersome without a high standard of IT support. The integration of LSPs into the supply chain is essential, but the integration of IT systems and solutions between cooperating partners is of special significance. The adoption of advanced information systems in supply chains means sharing and analysing large amounts of data among multiple actors (Urciuoli and Hintsä 2017).

Bagchi and Skjoett-Larsen (2003) examined the integration into supply chains in two dimensions: from the aspect of IT integration and organisational integration.

The product quality and profitability of logistics firms have been improved by better information systems (Stank, Crum, and Arango 1999). Such a view advocates that unique capabilities are crucial to achieving a sustained competitive advantage (Tripathy et al. 2016). Capabilities in logistics services are drivers for superior performance. These include electronic data interchange (EDI) linkage, freight consolidation, warehousing, consulting and freight bill payment. It corresponds to physical equipment and information system that has a LSP to facilitate communication and execution of logistics operations of its customers. It is related to attributes such as EDI, tracking/tracing, technology capabilities, information accessibility, availability of computer network, informatisation level, technical/engineering capability, materials handling equipment and information security (Bottani and Rizzi 2006; Göl and Çatay 2007; Briggs, Landry, and Daugherty 2010; Hsu, Liou, and Chuang 2013).

According to Vaidyanathan (2005), when selecting LSPs, the following factors have to be taken into consideration in terms of IT: the speed, reliability and continuity of data transmission, automated processes in data transmission, proper system security, encryption and encoding, data storage and traceability, as well as proper invoicing and stock control software. The use of information systems also helps in monitoring and evaluating the LSP service progress towards building a long-lasting relationship (Qureshi, Kumar, and Kumar 2008).

Maiga, Nilsson, and Ax (2015) results indicate that (a) internal information systems integration has a significant positive association with external IS integration, (b) both internal IS integration and external IS integration are significantly positively associated with cost and quality performance, (c) quality performance is significantly positively associated with cost performance and (d) both quality and cost performance have significant positive associations with firm profitability. Chow et al. (2008) posit that SCM and information systems practices are both structurally and contextually bounded, that is, varying perceptions concerning implementing and managing SCM and information systems practices can exist across different countries.

Yu (2015) results show positive direct relationships between IT implementation and three dimensions of supply chain integration, namely internal, customer and supplier integration. The results also suggest that IT-enabled internal integration is significantly and positively related to both operational and financial performance. Another research shows that performance is the most important criterion group, followed by cost, service, quality assurance, intangible and IT (Hwang, Chen, and Lin 2016).

2.3. The impact of IT developments on the flexibility of enterprises

Several studies examined the relationship between IT and enterprise flexibility. According to Allen and Boynton (1991), IT can specifically contribute to flexibility with the help of IT architectures which make it possible to quickly react to market changes. Based on the research of Lucas and Olson (1994), IT contributes to organisational flexibility in the following three ways: it changes the nature of organisational boundaries and the time band in which work is performed, it alters the nature and pace of work and makes it possible for companies to react to market changes. Duncan (1995) highlighted that technical literature sources define the potential value of IT infrastructure as flexibility and reactivity.

Opportunities in IT systems reach beyond organisational boundaries according to Venkatraman (1994). Furthermore, the IT capability of LSPs enhances their ability to deliver and provide significant improvement in operational performance measures such as reducing the cost of the service in the long run according to Vaidyanathan (2005).

As a summary, it can be established that, in conformity with the summary and opinion of Golden and Powell (2000), IT is a fundamental factor which enables organisational flexibility. IT does not always have a positive impact on flexibility as IT can be the source of rigidity and inflexibility as well. However, based on the findings of international research and technical literature sources, it can be stated that enterprises currently face an even more disturbing problem: markets change, while computerised systems do not (Allen and Boynton 1991; Lambert and Peppard 1993; Avison et al. 1995). According to Allen and Boynton (1991), the source of inflexibility is that IT structures are built up for specific competitive situations and that organisational changes are needed for the new structures which conform to new circumstances. If the problem is examined from the aspect of already finished enterprise processes, Eardley, Avison, and Powell (1997) state that certain rigid IT structures are specifically against flexibility by making it impossible to change the business strategy. Simchi-Levi (2010) emphasised that IT investments bring profit only if processes within the enterprise are already running in a rational way. The problem with current systems is that it is not easy to make significant changes in them, especially in the case of software products. Accordingly, Upton (1995) concluded that the phrase 'soft' misled lots of enterprises, as it suggests that something can be transformed and changed easily, while manufacturing-integration IT systems cannot be easily

altered at all. Lucas and Olson (1994) underline two types of flexibility: organisational and technological flexibility. The difference between these two types leads to a paradox. Technology can contribute to organisational flexibility, but IT itself is often inflexible, as the IT which provides flexibility becomes outdated very soon and maintenance is difficult.

3. Research methodology

A list of around 300 Hungarian LSPs was compiled from information provided by the professional organisations contacted by us before starting the research, as well as official sources which can be accessed in the trade press (Hungarian Government 2013). From this list the target group was selected including enterprises with revenue (net sales) of at least EUR 100 thousand, but not higher than EUR 100 million per year. This group is composed of 284 LSP enterprises.

Thirteen percent of the interviewed LSP were established in 1990, when several entrepreneurs decided to set up their own companies due to the political and economic restructuring. Thirty six of 56 enterprises examined were founded with international road transport activity. More than 50% of the examined LSPs were engaged in domestic road and international road transport of goods or road forwarding services directly after their establishment. Thirty-two per cent of the newly established LSPs were primarily involved in warehousing activities. The following activities ranged between 10% and 20%: railway transport and/or forwarding, air freight and/or forwarding, water freight and/or forwarding, transport and/or forwarding of containers, custom-house agent activities, transport and/or forwarding of oversized goods, logistics activities outsourced by clients inside or outside the factory yard, freight insurance and logistics consultancy. Seventy-five per cent of the enterprises involved in the research were primarily Hungarian-owned.

The geographical distribution (Budapest and non-Budapest) was drawn up to illustrate the basic and sample population of the research data showing the regional location of the Hungarian logistics enterprises based on the available data for the purpose of providing geographical representativeness. The regional locations categorised into two NUTS 3 counties properly show the 'identity' of distributions and verify representativeness. Also, representativeness is further confirmed by the test results of the basic and sample population of the obtained research data, as well as the similarity of the histograms illustrating distributions. The obtained test results led us to conclude that neither of the two distributions are normal ($p < .001$) in both cases and that the two distributions are indeed very similar based on the examined parameters. Furthermore, neither the sample-based, nor the population-based distribution can be regarded as normal (their parameters differ), but the graphic draft shows that the pointedness of both distributions are similar, bending to the left and stretching to the right. Hence, a conclusion can be made that the curves of both the examined population and the sample are similar to each other (even though they deviate from the normal curve). *F* test statistics further verify similarity, since the variance of the two variables can be regarded as similar ($F = 2.213$; $p = .138$).

During the compilation of the questionnaire, we considered the need to extract the answers to the questions posed by the hypotheses. GfK Hungary Market Research Institute contributed significantly to the structure of the questionnaire, we created the professional content, and the possible response forms and types were greatly influenced by the data quality and type that can be managed and expected by the evaluation software (SPSS). Questionnaires were completed using the Computer Assisted Web Interviewing (CAWI) method. The internet-based questionnaire technique provided an effective research background for this target group by allowing respondents to answer questions on delicate corporate issues (financial issues, role of suppliers, etc.) more honestly, as the interviewee's response was not affected by the presence of the interviewer. In addition, it was an advantage that more precise answers could be given, as the questions were read by the interviewees themselves, and they could check the accuracy of their responses. There was no time limit for answering the questionnaire and the respondents were able to look at the precise data and to think about the questions. The data were analysed with the SPSS 14.0 software using different examination methods

(Levene's test, Analysis of variance, Student's *t*-tests, Welch's unequal variances *t*-test, Cramer's *V*, Phi, Principal Component Analysis).

A 51 survey questionnaire was compiled for the target group to accept or refute research questions. The first 14 questionnaires were related to the characteristics of the company. The following 30 questions included trust issues (business confidence 1–2, within the industrial sector 3–11, within the company 12–19, membership(s) of organizational bodies 20–23, strategy 24–30). The penultimate part dealt with the service portfolio (1–6), while the last six questions asked about the characteristics of the leader of the company.

The authors of this research pre-tested the questionnaire in 10 companies representative of the different environments present in the sampled population. The main objective of this pre-test was to verify the appropriateness of the questionnaire. Hence, this analysis assessed the difficulties faced by the respondent in understanding the questions, in retrieving the required quantitative information and eventual ambiguities in the questions.

The net revenue and earnings before tax of all 51 responding LSPs for the period between 2004 and 2011 were used to examine the research questions. The total revenue of the respondents was HUF 127,657.51 million in 2011, a year for which stable statistical data were provided. This value is more than 50% of the cumulated annual revenue of all logistics enterprises in 2012.

Based on these, it can be stated that the sample reflects primarily the opinions of market participants with a higher revenue. Our sample represents the opinions of big companies of the sector, because of relative low response rate and high share of revenue of the industry. At the same time, as shown above, the regional distribution of the sample corresponded to the distribution of the base population.

4. Results

RQ1: The revenue and earnings before tax of LSPs depend on the sector-specific IT developments implemented by the enterprise.

As a first step, an index was established for all LSPs which describes whether the given enterprise had any sector-specific IT investment in the recent period or not. The next step examined whether there is any significant difference between the results of these categories (there was investment/there was no investment). Since these result indexes are quantitative variables measured on a ratio scale, the independent samples *t* test can be used, considering that it is previously checked whether variances are the same or different in each category (Levene's test, *F* test). Result indexes are considered to be the net sales (NS) of the end of 2011 and earnings before tax. After performing the necessary tests, it can be seen that there are significant differences between the two populations in terms of both result indexes. Based on the test performed with earnings before tax, variances are identical in both groups. However, the respective *t* test shows a significant difference. Also, a significant difference was shown in both groups when being tested with net sales, however, variances differ from each other (Table 1).

There are clearly significant differences. In order to be able to identify the direction of correlation, a variance analysis was performed in which the result indexes were the dependent variables: EBT; NS. Both analyses are shown in Tables 2 and 3.

Table 1. The average of different result indexes in both groups and the result of the *t* test (HUF million per enterprise).

	There was no sector-specific IT investment	There was sector-specific IT investment	Levene <i>F</i> -sig.	<i>t</i> -sig.
Earnings before tax, 2011	8.03	59.84	0.006	0.050
Net sales, 2011	1151.50	2123.30	0.781	0.026

Source: Authors' own composition.

Table 2. Results of ANOVA, Earnings before tax (EBT) – 2011.

Source of difference	Squared sum of differences	Degree of freedom	Variance	F	Significance
Between groups	31,993.409	1	31,993.409	3.984	0.052
Within groups	369,424.740	46	8030.973		
Total	401,418.149	47			

Source: Authors' own composition.

Table 3. Net sales (NS) – 2011.

Source of difference	Squared sum of differences	Degree of freedom	Variance	F	Significance
Between groups	11,448,189.151	1	11,448,189.151	5.358	0.025
Within groups	100,430,993.760	47	2,136,829.654		
Total	111,879,182.911	48			

Source: Authors' own composition.

These computations also indicate significant differences in both cases; therefore, the thesis can be formulated.

Thesis 1: The revenue and earnings before tax of LSPs depend on the sector-specific IT developments implemented by the enterprise. Based on this research, it can be seen that the financial resources used for IT investments – especially in the case of sector-specific developments – result in a stable return in terms of degree of financial success and more profitable operation for LSPs. For guidance purposes, it can be concluded that sector-specific IT investments will continue to be important in the future, while the introduction and use of best technologies can yield competitive advantage and better financial results for LSPs.

RQ2: The degree of integration of LSPs into the supply chain depends on the sector-specific IT developments performed by the enterprise.

Before answering this research question, a variable of 'the degree of integration into the supply chain' was established and its extent to which it differs in the populations characterised by each sector-specific IT investment was examined. If there was a difference, it could be confirmed that there was a correlation between the two variables. Factor analysis was used to establish the variable of the degree of integration into the supply chain by using variables B1 (How many professional organisations is the given enterprise a member of?) and by using variables B2 (How many clusters is the given enterprise a member of?). The resulting factor (KMO: 0.500; Bartlett sig.: 0.018; total variance explained: 66.4%) characterises the sample. Since the range of factor weights is rather narrow ($R = 4.2$) and they have a standard normal distribution, it is difficult to use them for comparison; therefore, a categorised variable was established (Figure 1).

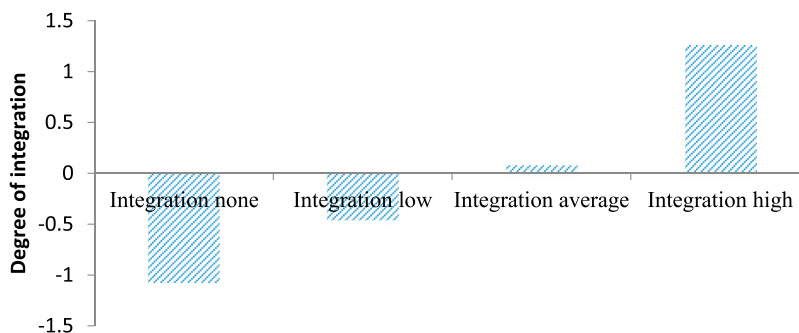


Figure 1. Categorised variable of the degree of integration into the supply chain. Source: Authors' own composition.

Table 4. Measuring the level of association.

		Value	Estimated significance
Level of associations	Phi	0.454	0.015
	Cramer's V	0.454	0.015
Number of cases to be analysed		51	

Source: Authors' own composition.

The following tests were used to measure the categorised variable of the degree of integration into the supply chain and the level of association: Phi index and Cramer's V index. Both indexes showed average association between the dichotomous (was there a sector-specific investment or not) variables of the degree of integration and sector-specific IT investments (Table 4).

The contingency table in Table 5 suggested the level of association.

The data in Table 5 led to the conclusion that in the case of enterprises which made sector-specific IT investment, 72.7% (54.5% + 18.2%) are characterised by average, or higher degree of integration. By contrast, in the case of companies which did not make such IT investment, 62.1% (20.7% + 41.4%) of them can be characterised by low degree or no integration.

Thesis 2: The degree of integration of LSPs into the supply chain depends on the sector-specific IT investments implemented by the organisation: in the case of enterprises with higher sector-specific IT development level, the degree of integration into the supply chain is significantly (sig.: 0.015) higher. It can be concluded that the available services provided by sector-specific IT investments appear as 'cross-border' services of LSPs and they provide proper process effectivity support for the member companies of the supply chain. During common IT use, the process integration of LSPs could be better implemented, especially if the service provider organisation's ability to integrate is high (e.g. it is a member of several professional organisations and clusters). Simple road haulage-oriented LSPs show next to no such integration whereas companies heavily engaged in sea and air transport as well as big international freight forwarders count more memberships and this has more or less nothing to do with neither process nor supply chain integration.

RQ3: The sector-specific IT development level of LSPs has an impact on the flexibility of enterprises.

Table 5. Contingency table of integration categories and sector-specific IT development.

			Was there sector-specific IT development?		
			no	yes	Total
integration_categories	none	Count	6	1	7
		% within 'integration_categories'	85.7%	14.3%	100.0%
		% within 'Was there sector-specific IT development?'	20.7%	4.5%	13.7%
		% of total	11.8%	2.0%	13.7%
	slight	Count	12	5	17
		% within 'integration_categories'	70.6%	29.4%	100.0%
		% within 'Was there sector-specific IT development?'	41.4%	22.7%	33.3%
		% of total	23.5%	9.8%	33.3%
	average	Count	4	12	16
% within 'integration_categories'		25.0%	75.0%	100.0%	
% within 'Was there sector-specific IT development?'		13.8%	54.5%	31.4%	
	% of total	7.8%	23.5%	31.4%	
substantial	Count	7	4	11	
	% within 'integration_categories'	63.6%	36.4%	100.0%	
	% within 'Was there sector-specific IT development?'	24.1%	18.2%	21.6%	
	% of total	13.7%	7.8%	21.6%	
Total	Count	29	22	51	
	% within 'integration_categories'	56.9%	43.1%	100.0%	
	% within 'Was there sector-specific IT development?'	100.0%	100.0%	100.0%	
	% of total	56.9%	43.1%	100.0%	

Source: Authors' own composition.

Table 6. Cross table of flexibility categories and sector-specific IT developments.

		Was there any sector-specific IT development?		Total
		no	yes	
Flexibility category	A few days	1	0	1
	One day	10	6	16
	A few hours	9	9	18
	Immediately	9	7	16
Total		29	22	51

Source: Authors' own composition.

We have created the following flexibility categories (immediately, a few hours, one day, a few days) to correspond to the questions in the questionnaire. These questions are the following: What is a typical practice for a company when a customer requests a new (non-routine) order from your company? How quickly does the company respond to customer requests?

As a first step, a cross table was made to identify the cardinality of category cases and their total value. There are no significant difference in either flexibility category in terms of whether a sector-specific IT development was made or not (Table 6).

Phi and Cramer's V index was determined to measure the closeness of correlations of association. Sector-specific IT investments have no impact on the flexibility of the examined logistics enterprises (Table 7). Also, further analyses showed that no IT investment has any effect on flexibility. Consequently, no thesis could be formulated as a result of examining research question 3.

Following the examination of RQ 1–3, the obtained results could be summarised as follows: The revenue and earnings before tax of LSPs in Hungary and the degree of their integration into the supply chain depend on the sector-specific IT developments carried out by the organisation, but these developments have no effect on the flexibility of enterprises.

5. Discussion and conclusion

The empirical study was conducted among the LSP undertakings and enterprises registered and operating in Hungary. For today, the interviewed logistics enterprises can be assumed to have (or strive to have) a significant mediatory role in the international logistics process and that they provide vertically integrated logistics services to their partners, given their scale and the wide spectrum of their services.

Following the examination of RQ 1–3, the results obtained could be summarised as follows: *The revenue and earnings before tax of LSPs and the degree of their integration into the supply chain depend on the sector-specific IT developments carried out by the organisation, but these developments have no effect on the flexibility of enterprises.*

It can be concluded that sector-specific IT investments have a positive impact mainly on the degree of financial success and integration, but not on the flexibility of enterprises. This could also show that sector-specific IT investments improve process effectiveness and service standards, but they do not improve the reactions, that is, the flexibility of the service provider expected by customers. This fact is mostly in connection with the scale of enterprises, as it can be assumed that the enterprises which made sector-specific IT investments are larger than those that did not. During

Table 7. Measurement of the level association.

		Value	Estimated significance
Level of associations of correlation	Phi	0.161	0.726
	Cramer's V	0.161	0.726
Number of cases to be analysed		51	

Source: Authors' own composition.

common IT use, the process integration of LSPs could be better implemented, especially if the service provider organisation's ability to integrate is high (e.g. it is a member of several professional organisations and clusters).

The study is limited to respondents from the Hungary which makes it difficult to generalise findings to other countries. Replication of this study in other countries would improve the generalisability of the results, preferably in a country outside Europe. Another limitation of this research is the low response rate among LSPs. As regards the more distant future, this research, the previous research findings and the trends to be drawn lead to the conclusion that the future of LSPs potentially lies not only in 'braking down barriers between LSPs and those using these services', but even the transformation of LSPs into 'organisations sans frontiers', to form a so-called LSP supply chain. The future of the LSPs will be determined by the interaction of the service provider and those using these services. LSPs in Hungary should not expect the development of their flexibility from sector-specific or any kind of IT investment, but rather from the approach of their colleagues and the level of trust of the business environment established by the primary manager. Summing up, new sets of skills required for 3PL providers are arising, above all the capability of proposing innovative solutions and offering more complex and shipper-tailored services (Colin et al. 2011).

It can also be concluded that, during the establishment of the service portfolio, LSPs in Hungary should consider the profitability of the complex service in addition to that of each activity, thereby searching for the optimal point of enterprise profitability, while making sure that they do not lose any of their flexibility. Of the strategic 'factorial correlations' organised into four groups, the technical literature focused processing and empirical-analytical examination of IT developments, as well as the identification of the actual challenges and potential answers could effectively support LSPs in their attempt to find their management success factors which could potentially assist them in comprehensively meeting the expectations of their customers in the value chain – supply chain – supply network.

Third, 3PL need to invest more in technology and stay financially healthy to accelerate the diffusion of innovation under a more competitive cost structure (Wong, Soh, and Goh 2016).

As a result, LSPs are expected to establish the business solutions which could help them find the proper way forward in order to maintain their competitiveness and increase their market share. New findings can be achieved from the existing dataset by further developing the research methodology in order to make comparison analysis of LSPs in neighbouring countries. In this way, new findings may lead to a more detailed understanding of LSPs.

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