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Economic and Regional Sciences Doctoral School

**SCIENTIFIC ANALYSIS OF THE INVISIBLE SUPPLY CHAIN
CONCEPT AND EXAMINATION OF ITS APPLICATION POSSIBILITIES
IN THE PARTNERSHIP OF LEADING SERVICE PROVIDERS AND
THEIR PARTNERS**

DOCTORAL DISSERTATION (PhD)

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Gödöllő

2021

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1. BACKGROUND AND OBJECTIVES OF THE RESEARCH

By the twentieth century, time-based competition had become a defining element of the distinctive strategy of production and service companies. In order to remain competitive, the necessary competencies must be acquired, but these competencies are constantly changing and expanding. The logical consequence of the competition is the three-level optimization process outlined by SZEGEDI (2018) (Figure 1).

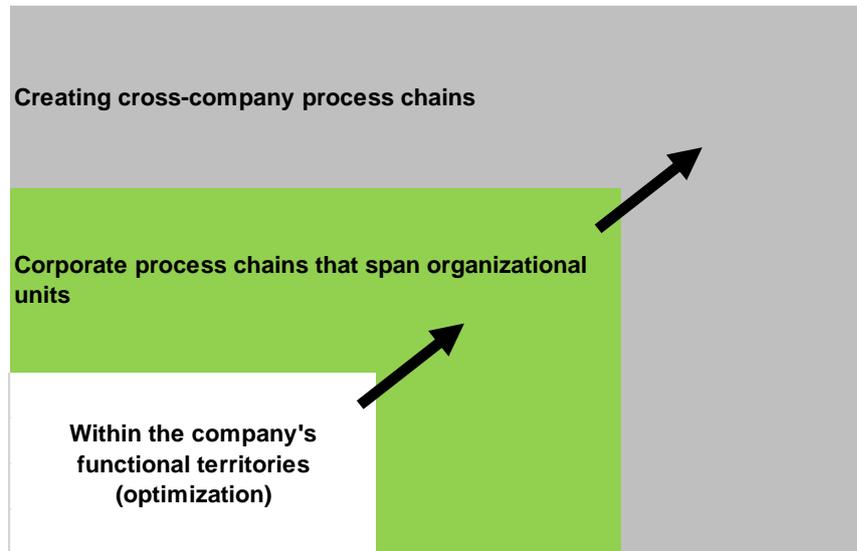


Figure 1.: How can we achieve competitive advantages in the value chain?

Source: SZEGEDI, 2008

The result of this process is, on the one hand, an increase in outsourcing, through which the freed-up human and material resources can be concentrated on the main activity, and, on the other hand, product, service and process optimization that goes beyond the company's activities.

For some companies, the goal is not only to reduce the costs required to ensure the expected quality of logistics services to an acceptable level, but also to formulate and provide a complex and competitive customer value proposition that is a source of competitive advantage for the company. However, logistics can only support the implementation of a corporate strategy if it is managed from a strategic perspective (GELEI, 2013).

The economic crisis that started in 2008 also had an adverse effect on the indicators of many companies. Sales of durable consumer goods and FMCG products also declined sharply across Europe, and consumption patterns also changed somewhat in individual countries.

The choice of the topic of my dissertation was also generated and helped by the changed circumstances caused by the economic crisis. The previously familiar and well-functioning system was no longer sufficient. Change, but also renewal, was needed to increase efficiency and thereby further reduce costs.

As a pilot, I observed a multinational company providing logistics services (hereinafter referred to as the “Company”), which has food service customers. Building on this, I conducted an investigation at service companies in the logistics industry where problems occurred similarly. Based on this, I started my empirical research.

In this changed situation, most customers have the so-called a cost-dictating (cost-driven) strategy came to the fore, at least clearly in terms of logistics service. This also required an increase in adaptability for service providers and meant that all elements of their operation had to be critically examined and new solutions found that required greater efficiency. The main focus of my research was the possibilities for further development of the customer service process. As part of this, new service elements were developed to achieve significant efficiencies and cost reductions, leading to the idea and implementation of the “Invisible Supply Chain” (ISC) concept. The ISC concept is part of a multi-year development process and one of its completions, as several sub-processes and supply parameters had to be changed in order to introduce and implement it. This required my scientific knowledge gained during my PhD studies, which could be successfully put into practice in this way. However, the ISC concept goes beyond the benefits of those directly and actively involved in the integration, as if implemented, it will bring significant and similar benefits to other, passive members of the supply chain if the supplier or service partner is common to the cooperating partner's service partner.

In the dissertation, I analyzed the supply chain relationship systems related to the FMCG value chain. I examined the sample through the example of the largest international fast food chain network operating in Hungary (99 restaurants) and their logistics service provider, the previously mentioned international logistics service company (hereinafter “Company”).

The range of activities in the PULL system - with significant IT support - is based on strong professional and trusting cooperation, close partnership, which - I assume is still quite rare today and which results in an advanced and shared supply chain solution that

- ensures an efficient and competitive level of costs,
- due to its dynamic design system, continuously responds appropriately to customer needs, and
- the service provider also ensures competitiveness for other customers.

1.1. Objectives

An advanced PULL system can also be upgraded. One of the most important possible ways to do this could be to involve a higher level logistics provider.

By preparing the dissertation, I aimed to achieve the following sub-goals:

O1: Comparison of service models of logistics providers.

In the case of logistics service providers and for the sake of development, I consider it important to clarify the service levels and present the models, their content, in the knowledge and in the light of which the service provider's current location and further development opportunities can be clearly determined.

I consider uniform categorization to be important. The content of the 1-2-3-4PL logistics service concepts is widely known and uniformly defined. However, according to my research, this is less true for the 5PL or Lead Logistics Provider service concept, the content elements and definition of which are not uniform yet and the service concept itself is not well known, so I summarize the relevant literature I find and suggest definition.

O2: Analysis of the development and current service elements of the Hungarian logistics service market.

Knowing the internationally accepted levels of logistics service providers, I consider it expedient to get to know and present the current service level of logistics service providers in Hungary. To this end, I am conducting a survey among logistics service providers operating in Hungary. After that, and based on my survey, the next stage of possible - and even expected - development can be realistically determined, including its content elements.

O3: The analysis of the Invisible Supply Chain (ISC) concept as a possible development direction for LLP provider(s).

The Invisible Supply Chain concept is the result of individual developments and implementation, which, however, in addition to its case study value, may also be suitable for guiding new cooperation between companies cooperating in other fields and industries (client-service provider).

I critically present the elements and operation of the ISC concept and examine the extent to which the ISC concept can fit into the LLP service model, and thus to what extent it can be considered as one of the possible ways to become an LLP.

1.2. Hypotheses

In my research - and in my dissertation as well - I am looking for the answer to the question of how logistics service providers could move to a new, more advanced level of service and supply chain management. In order to achieve the research goals and during the processing of the literature, I formulated the following hypotheses:

- H1** Today's Hungarian logistics providers are typically at the 3PL and / or 4PL level.
- H2** The LLP concept provides specific financial and other benefits to the client and the to service provider.
- H3** In Hungary, at the current management level, there is a significant need to involve LLPs (Lead Logistics Service Providers) in value creation processes.
- H4** It is already possible to implement LLP in domestic supply chains.

2. ROLE AND DEFINITION OF LEADING LOGISTICS PROVIDERS

Following the formation and spread of 1, 2, 3 and 4PL, the logical 5PL and even the definition of further levels and the striving for it (NARASIMHAN, 2011) reached up to the definition of 10 PL as follows:

- 1PL – Shipper
- 2PL – Traditional Transportation Provider
- 3PL – Integrated Logistics Service Provider
- 4PL – High Level Logistics/IT Consulting
- 5PL – Consulting for the High Level Logistics/IT Consultants
- 6PL – Artificial Intelligence Driven Supply Chain Management
- 7PL – Autonomous Competitor Created to Test Alternative Supply Chain Strategies
- 8PL – Super Committee Created to Analyze Competitor's Results
- 9PL – Crowd Sourced Managed Logistics Strategy
- 10PL – Supply Chain Becomes Self Aware and Runs Itself

According to the literature review, the exact distinguishing content of the 6-10PL definitions is already quite difficult to interpret in addition to the currently known and widespread practical experience, as the functions defined at each level can actually be interchanged, ie the function described at the upper levels is not always conditional function described at the previous level. However, it is clear from level 5 onwards that the fundamental difference is:

- IT development and applications,
- consultancy, ie knowledge outsourcing,
- examination of alternatives and supply chain simulations, and
- automation.

If we want to compare everything we have learned about 4-10PL with 1-2PL and 3PL, we can say the following:

- 1-2PL: outsourcing of individual tasks,
- 3PL: outsourcing of several logistics tasks to one service provider,
- 4-10PL: Business Processing Outsourcing (BPO).

Analyzing the 4-10PL further, we can see another significant difference between the 4PL and the 5PL, as the 5PL no longer only uses advanced IT solutions, but is also part of the consulting. This is a significant step forward from the level within which the client alone decides the scope of tasks to be outsourced and determines the expected parameters.

According to my surveys in Hungarian professional circles, currently the definitions of 6-7-8-9-10PL are not really justified, especially because the leading logistics service providers who develop and offer new and advanced service models to their customers on 6-10PL offer solutions that vary within. However, even the description of the 6-10PL solutions is not sufficiently detailed and widely accepted. If the 6-10PL definition is accepted, it could also show some development path for service providers and service models, but this is not yet the case.

In conclusion and based on my surveys, it could be right to move on from the 4PL to the 5PL concept, but as the next widely feasible step and content of development is not clear and standard, it's recommended to use a more general term for this level for the time being, "Lead Logistics Provider" (LLP) concept.

In the case of the service providers I examined, which already operate as LLPs, I summarized the following common features in terms of the LLP concept:

- partnerships,
- full supply chain approach and pursuit of optimization,
- use of own and external resources,
- design,
- consultancy,
- innovation,
- application of advanced IT solutions.

Taking into account these seven characteristics, it can be concluded that the Lead Logistics Service Provider is able to:

- is able to recognize the current and future real needs of customers and able to respond to them,
- is able to meaningfully act in order function as Lead Logistics Service Provider,
- its corporate culture is open and honest,
- its operation is increasingly determined by tasks rather than hierarchy,
- improves its processes with continuous innovations and improvements,
- is able to respond quickly to changes.

Based on all this, I propose the following definition to define LLP (Lead Logistics Provider):

The **Lead Logistics Provider** function is the result of a logistics service provider development that is characterized by a high-level professional and partnership relationship of trust with the customer established during the years of cooperation. Based on this, the customer submits to the professional recommendations of the service provider (LLP) in terms of supply chain planning, management and operation tasks and empowers the service provider to continuously optimize

certain and comprehensive supply chain processes with innovative developments using state-of-the-art and efficient IT solutions.

Figure 2 details the development phase from 3PL to LLP, which is based on trust what is constantly growing among the partners as we move towards the LLP concept, which is a good illustration of cost-effective innovative solutions, advanced IT systems and the important and differentiated role of the Lead Logistics Provider compared to the 3PL and 4 PL providers.

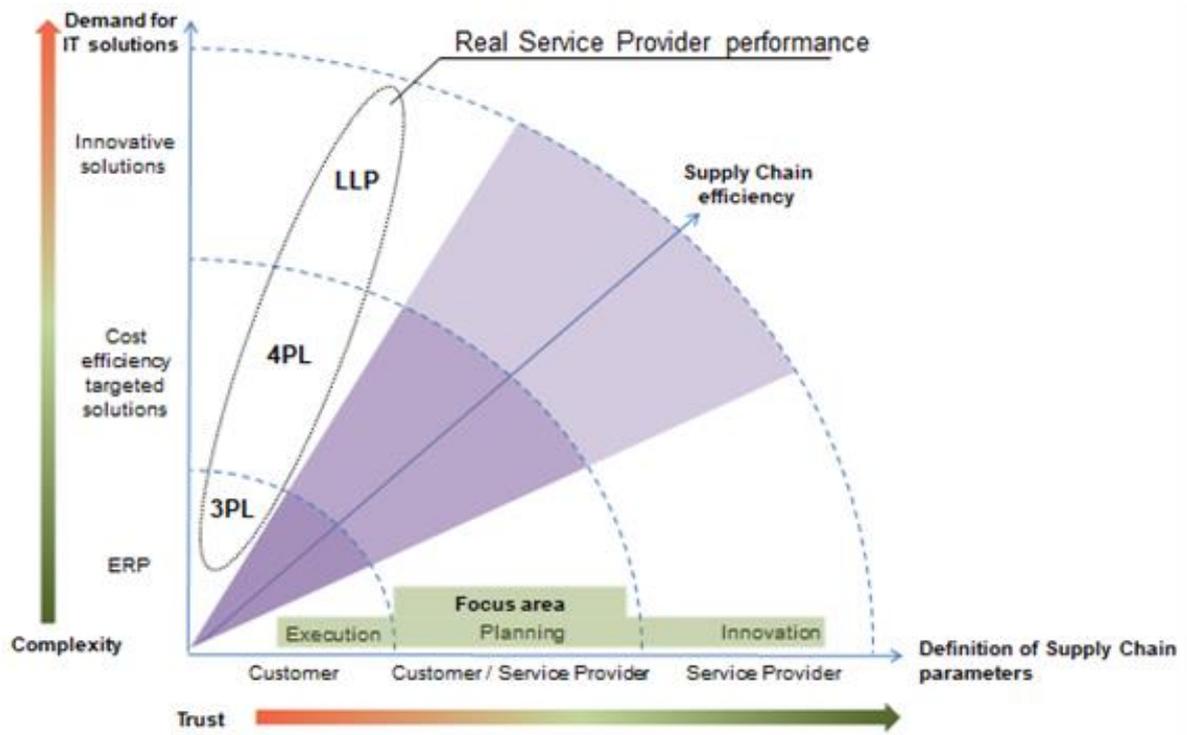


Figure 2.: The role of innovation and IT solutions in advanced logistics providers

Forrás: VALENTINYI - BALOGH, (2017)

The overall goal is to continuously improve supply chain efficiency and reduce costs. To achieve this goal, supply chain professionals with a good knowledge and understanding of the supply chain are increasingly taking over supply chain planning and management by defining supply chain parameters. This is done in regular consultation and agreement with the client, as the proposed changes may need to be implemented several times within the client's previous activities, including taking over certain tasks by the service provider.

Achieving LLP as a service level and concept is therefore a development process in which the entire supply chain must be comprehensively examined from the outset and the compliance expected by the various stages of development must be implemented in parallel.

From an economic point of view, this development process can also be characterized as a shift from a cost-oriented approach to a value-based concept.

3. RESEARCH METHODS

I continued my research with qualitative research, including quantitative methods based on the methodology of observation, based on my many years of professional experience.

Quantitative research may be carried out by a researcher if:

- its purpose is to provide quantitative support for the detection of observed or suspected phenomena,
- would like to obtain quantifiable information from a larger sample,
- the applied quantitative methods significantly contribute to the interpretation of the research result.

Therefore, in the course of my quantitative research, my goal was to obtain numerically substantiated results, and to be able to answer and justify my research questions and assumptions. This research method researches regularities, but also differences, it is suitable for the researcher to draw conclusions based on these.

Before starting the research, when planning it, selecting the methods and tools, the researcher must be aware of the possibilities of each method: what, how exactly, how economically it can be learned with each method. When selecting and applying methods, care must be taken to ensure that they are valid (validity) and reliable (reliability) (FALUS, 2014; SZOKOLSZKY, 2015).

Validity means that the method or instrument properly measures what we want to measure.

Reliability expresses the property of a method to obtain the same result any number of times the test is repeated under defined conditions.

After studying the literature, I conducted a questionnaire survey as primary research among logistics service providers operating in Hungary, examining their services and their elements, from which I concluded the level of development of today's Hungarian logistics service providers based on LLP aspects.

During sampling, I sought to create a representative sample. A sample can be said to be representative if it reflects the composition of the population based on certain properties chosen by the researcher. However, there are currently no precise descriptive statistics available on the population, making it difficult to establish a representative sample.

As part of the primary research, I examined the current customer relationships and IT development of logistics service providers, basically in terms of the conditions and expectations of the Lead Logistics Service Provider (LLP).

As a determination of the possible direction of development of logistics service providers, I developed the so-called Invisible Supply Chain (ISC) concept, which we successfully implemented with the further development of the PULL process system, and which exemplifies the development opportunities and criteria of logistics service providers. The ISC model developed and presented in scientific form in my dissertation is not only a model of efficient and beneficial supply chain management, but also a good example of the possibilities of strategic partnerships established by cooperating companies, therefore other domestic value and supply chains can be a guide in this respect. (eg supply chains including the SME sector).

4. INVESTIGATION OF HUNGARIAN LOGISTICS SERVICE PROVIDERS

I started the questionnaire research in February 2018 and closed it in December 2019.

During the 22 months of the survey, I sent the online link of the questionnaire directly to more than 250 logistics providers as part of an arbitrary sampling procedure and asked them to complete it. At the same time, HALPIM (Hungarian Association of Logistics, Purchasing and Inventory Management) asked the representatives of the service providers in the newsletter sent to its members to help me with my research by filling in the questionnaire.

In my research, I received 106 evaluable responses.

4.1. Characterization of the sample:

I estimate a total of approx. 450-500 companies providing logistics services in Hungary received my questionnaire and based on this the response rate was 20-21%, which can be said to be good compared to the 8-10% response rate of similar surveys.

The annual sales revenue of the respondents from logistics services exceeds HUF 420 billion. Comparing the annual sales revenue of the responding companies with the data of the HCSO's (Hungarian central Statistical Office) 2017 yearbook in Chapter 2.3, I state that the companies included in my survey represent about 25% of the sales revenue of the entire Hungarian logistics market.

Based on the number of respondents and their annual sales to the entire Hungarian logistics market, I reached the full spectrum of logistics service providers with my questionnaire research. I formulated my findings based on the answers of the companies included in the questionnaire, ie based on the sample of respondents, so the results of my research can be considered as realistic, real and reliable conclusions about the state and services of the Hungarian logistics market.

According to the EU COMMISSION RECOMMENDATION 2003/361 / EC (2003), based on the annual turnover, the respondents can be classified into the categories according to Table 1.

Table 1: Company categories of questionnaire survey respondents by annual revenue

Company category (size)	Annual revenue > 50 million EUR	Annual revenue < 50 million EUR	Annual revenue < 10 million EUR	Annual revenue < 2 million EUR
Large company	8			
Medium-sized company		28		
Small company			31	
Micro size company				39

Source: own editing

At the same time, I did not try to create a representative sample during the sampling, because currently no descriptive statistical data is available on the population, but the size and composition of the sample justify drawing conclusions and making development suggestions.

4.2. Services provided by the logistics companies

Summary of the responses to the activities of logistics service providers in Figure 3.

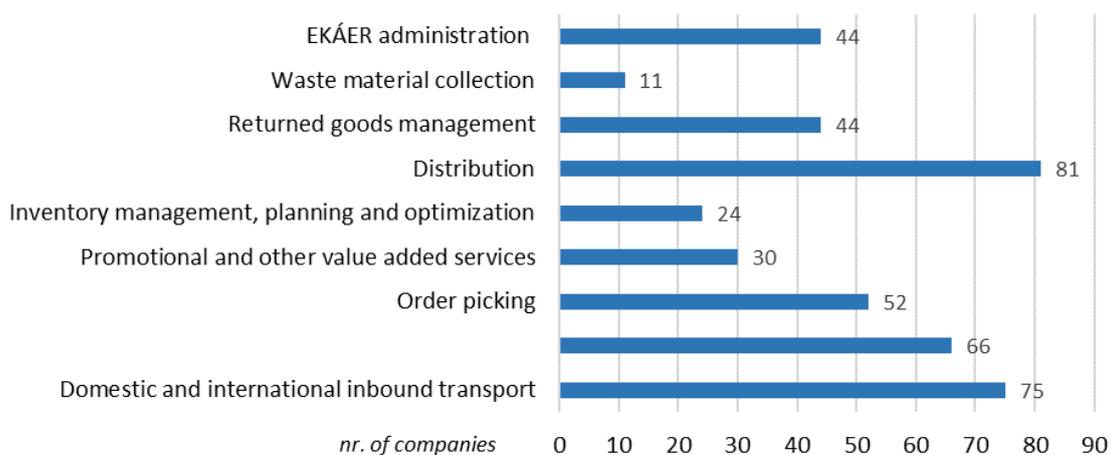


Figure 3.: Services of logistics providers in Hungary

Source: own editing

From the obtained data and their aggregation, I concluded that the interviewed service providers significantly provide the classic basic services to their customers. Within these, the range of transport-related services is dominant, averaging over 70%. Within this, domestic distribution is performed by 75% of service providers. Considering the composition of the respondents, I rate the 75% rate as realistic and valid. On this basis, however, I conclude that there are a relatively large

number of service providers that focus on certain tasks, such as international transport, warehousing, or transport to central warehouse(s) of manufacturing plants.

Examining the services provided by industry (Figure 4), it is clear that promotional and other value-added services are typically provided mostly by service providers operating in the FMCG and the general industry category.

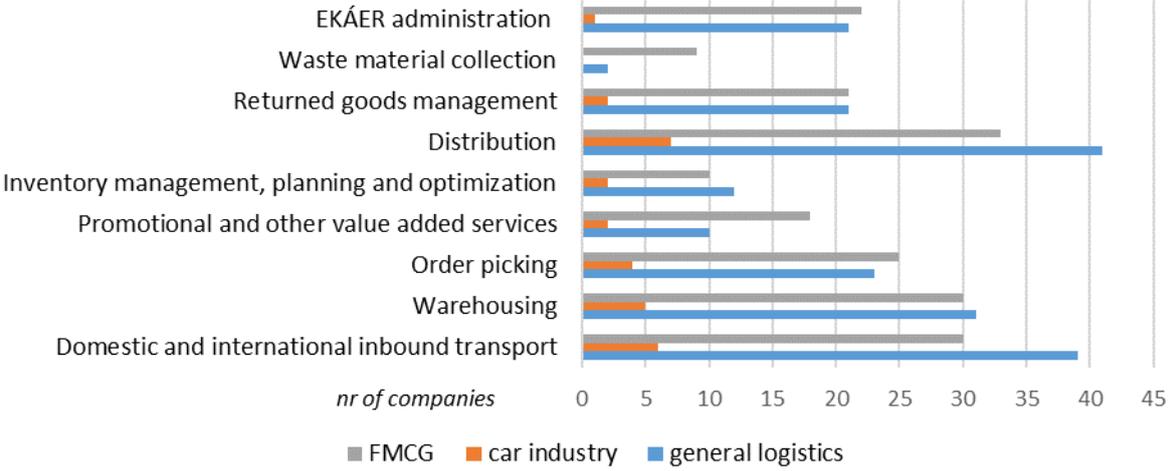


Figure 4.: Services by industry among respondents

Source: own editing

4.3. Customer relations of Hungarian logistics service providers

I examined the cooperation of the interviewed logistics service providers and their clients from two aspects. In terms of the length of existing collaborations, the percentage of cooperation of 1 year or less is strikingly dominant, accounting for 34.3% of all relationships (Figure 5). In the case of such short-term assignments, a partnership based on trust cannot be established, although that could be the basis for long-term and even joint developments. In these cases, most likely, the principal’s primary goal is to achieve the lowest cost, resulting in a regular change of service providers.

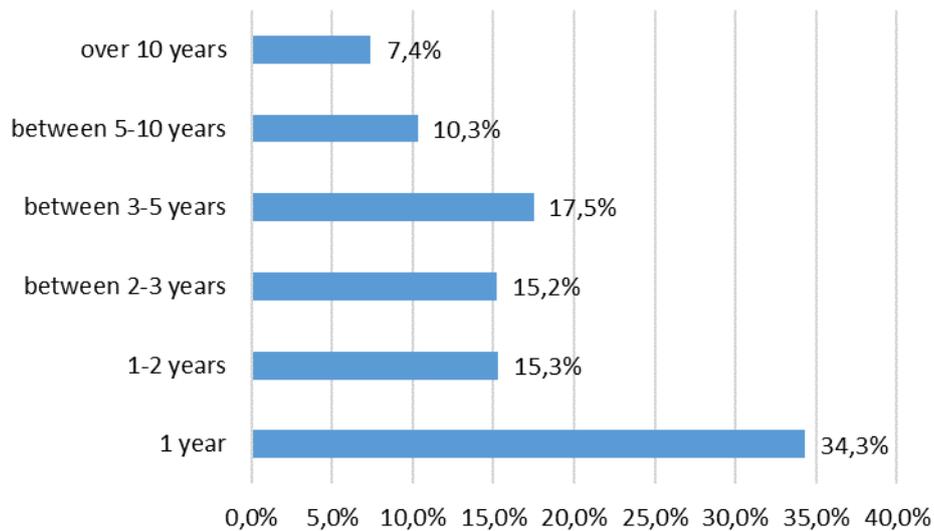


Figure 5.: Percentage distribution of the average duration of client-service partnerships

Source: own editing

In terms of the length of the collaborations, I find it also remarkable that the rate of 5-10 year collaborations reaches 10.3%, while collaborations longer than 10 years account for 7.4% of all collaborations. These two categories together account for 17.7% and among the 106 responding service providers, there are 57 service providers with a minimum of 5 years of principal-service provider relationship and 40 service providers have customer relationships that are longer than 10 years. The proportion of long-term business relationships of 17.7% is therefore not yet considered high, but it is an encouraging sign that the number of service providers who have been providing services to certain customers for a long time (minimum 5 years) is relatively high. These are the categories for which the long-term cooperation is most likely due to the satisfaction of the partners - and relationships, which can already be a good basis for new professional developments, as a result of which the logistics provider could take over more and more tasks from the client to operate a more efficient supply chain and to be able to formulate longer-term development goals together.

Examining the collaborations further, I asked about the tendering habits of the clients and the frequency of the tenders (Figure 6).

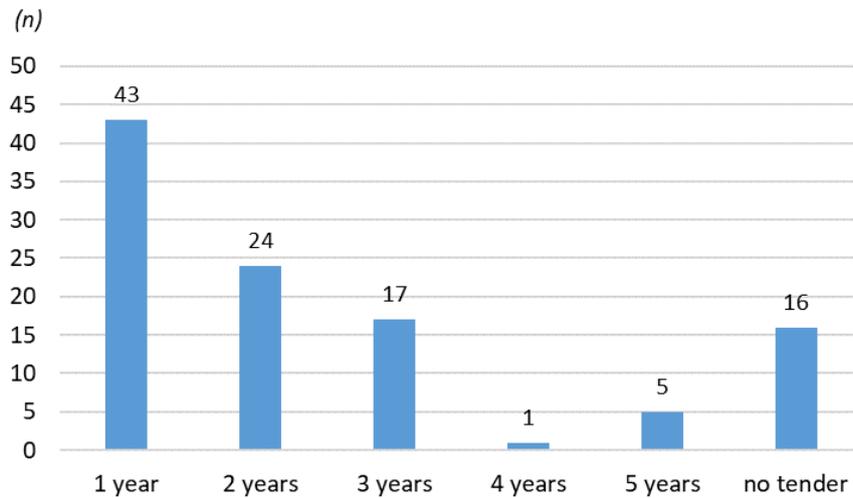


Figure 6.: Frequency of logistics tenders in Hungary

Source: own editing

It can be read from the data that the clients typically tender every year (for 43 service providers) or every 2-3 years (for 24 service providers). These two categories together account for 63.2% of respondents, which is significant, nearly 2/3 of the responding service providers.

Examining the two previous statements, it can also be seen that there are most likely client-provider relationships that can already be said to be long-term, yet the client regularly tenders for the task. In my experience, the most probable reason for this is the continuous control of costs (benchmarking), but since some tenders do not change service provider, we can also assume that the client is satisfied with the quality of the service.

The aim of such business relationships is also to establish a relationship of trust and a market information channel, the existence of which does not require tenders if the client is satisfied with the services he has purchased.

Omission or thinning of tenders will, on the one hand, lead to cost reductions and, on the other hand, help and encourage both partners to formulate and implement long-term plans, ie not only to formulate their strategic plans until the next tender.

4.4. IT systems of Hungarian logistics service providers

As part of the research, I also examined the IT systems used by logistics service providers. 90.6% of respondents use integrated corporate governance software. On the one hand, this is a positive result, and on the other hand, it is justified, as the Hungarian legislation practically requires it. The average annual turnover of the respondents is almost HUF 4 billion, which presupposes more

complex business management, and the use of the integrated corporate governance system may be justified in this respect as well.

41.5% of service providers use WMS inventory management software. In terms of services, however, 66 service providers (62%) answered that they provide warehousing services (also) to their customers and 52 service providers (49%) perform commissioning tasks. Given these data, it is surprising that 22 of the storage service providers (also) do not have a WMS system.

I also consider it important to examine the existence and use of supply chain optimization software for the use of other software. According to my survey, out of the 106 service providers surveyed, only 8 service providers use optimization software, which is only 7.5% of the service providers. The average annual sales revenue of these service providers is almost HUF 5 billion.

Based on all this, I consider the rate of use of optimization software to be low, development in this area would be necessary and expedient.

A summary of the IT systems used by service providers is provided in Figure 7.

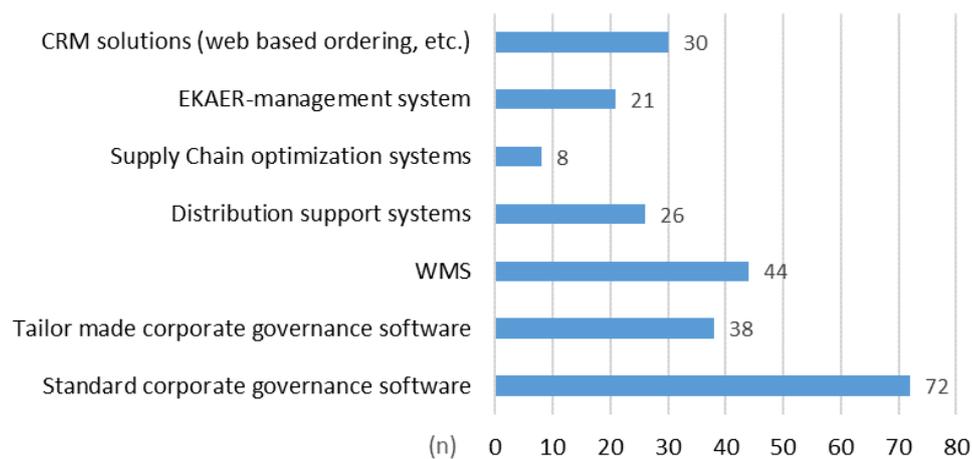


Figure 7.: IT systems used by logistics providers

Source: own editing

Regarding the different IT solutions, I found electronic data interchange (EDI) at 77 service providers, which represents 72.6%. Examining the composition of service providers and their activities, I can say that this is a good percentage. Today, almost every client expects electronic data transmission from their service provider. In this respect, I therefore consider the preparedness of logistics providers to be good.

33% of service providers have electronic data exchange connection with suppliers. Taking into account current market trends, this ratio is expected to improve further in the coming years.

Tracking & tracing system is used by 60 service providers, which is 56.6% of the respondents. If we compare this data with an earlier statement that 66 of the responding service providers are engaged in warehousing, it can be seen that 9.1% (6 service providers) does not have a tracking system although they provide warehousing services. This number is not high, but product tracking is a basic requirement for a logistics provider, so I assume that these 6 providers still use some kind of tracking solution (e.g. excel based), but I do not have specific data from the survey.

Four of the respondents have chip-based authentication. This is a very low number at first glance, but it would only be realistic to judge this in the light of the products being treated. However, these providers can also serve as a positive case study for others.

The paperless warehouse concept was implemented by 13 respondents, representing 12.3% of all respondents. This result could be considered a good initial condition. However, if we look at the features of the available warehouse softwares, we can state that nowadays it is not necessary to use paper-based solutions for the high-quality operation of a warehouse. In this respect, therefore, I have also lagged behind in this area.

17 service providers (16%) have other solutions. These solutions were not always detailed by the respondents, so I refrain from evaluating other solutions.

A summary of the IT solutions used by logistics providers is provided in Figure 8.

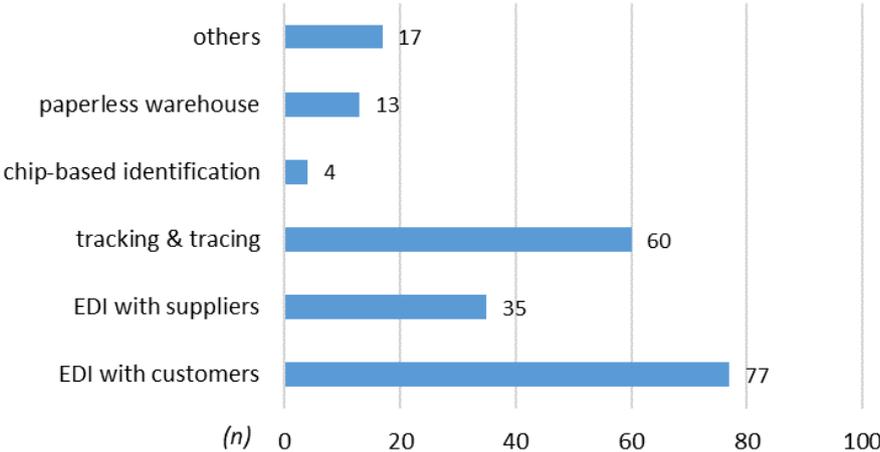


Figure 8.: IT solutions among logistics service providers
 Source: own editing

Examining the IT systems and IT solutions used by logistics service providers, I conclude that good and advanced IT tools and solutions are present among the logistics service providers in

Hungary, which provide an opportunity to operate an efficient supply chain, but the spread of these tools and solutions among service providers is still very low.

Rapid and efficient progress in this area would be needed to increase efficiency and potential data sharing.

4.5. The development of the logistics market in the next 5-10 years, according to the service providers

In my questionnaire research, I asked the opinions of logistics service providers for the next 5-10 years (Figure 9). The answers show that the service providers operating in Hungary expect a kind of market concentration with content and quality development and are - probably – prepared for that. This finding is confirmed by the fact that only 7.5% of the respondents think that new Hungarian service providers will appear on the market, and only 9 respondents predict the emergence of new international service providers. In addition, 39 (36.8%) service providers believe that the number of service providers will decrease in the next 5-10 years.

38.8% of the respondents (41 service providers) trust in the strengthening of the client-service provider relationship. Incidentally, this fact also confirms the topicality of my research.

I also consider it good and hopeful that 65 service providers (61.3%) hope that the importance of new IT services and developments will increase in the future. In addition, however, I am not really optimistic that only 38 service providers (35.8%) believe that their remit will be broadened and that they will have larger supply chain integrator tasks.

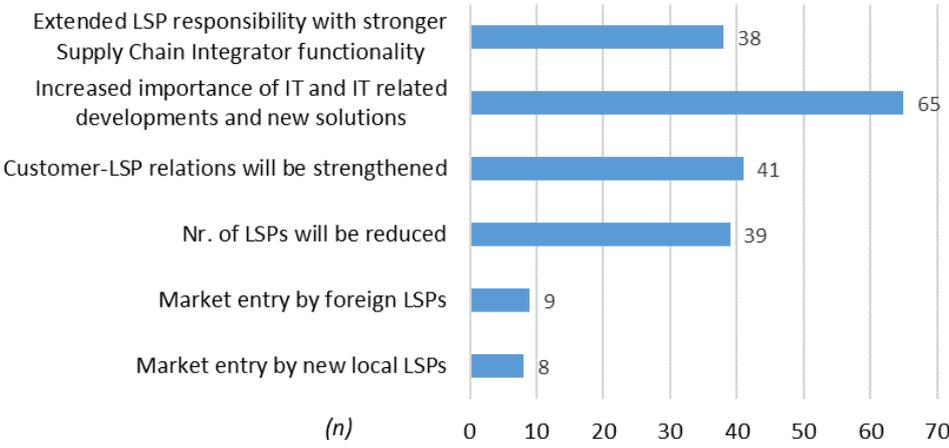


Figure 9.: What processes are expected in terms of changes in the logistics service market in the next 5-10 years?

Source: own editing

I also feel cautious hope based on my other question, which maps expectations for the future (Figure 10). Every service provider gave some answer to this question. Providers are basically expecting growth from the next period.

40.5% of service providers believe they can increase their service portfolio and most likely the service providers are also preparing for this change.

The other category of answers, which I think is important and worth highlighting, is that 54.7% of service providers trust the introduction of new, advanced IT solutions, which is in line with the answers to the previous question, according to which 61.3% of service providers believe that the importance of introducing new IT services and developments will increase in the future.

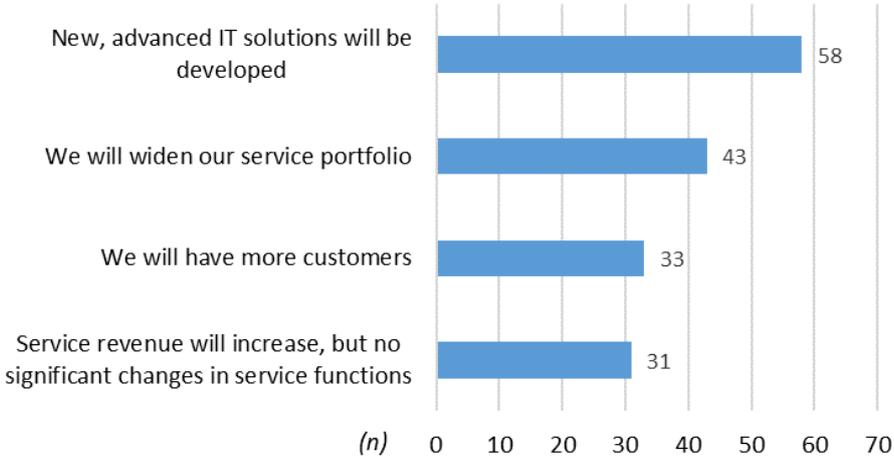


Figure 10.: In what areas is the development of service activities expected in the next 5-10 years?

Source: own editing

Development could be greatly accelerated if existing knowledge and experience were shared more actively and in more detail by logistics providers. However, this has both economic and cultural difficulties, so I think that the significant spread of LLP in Hungary will take at least another 10 years. During the development process, the role of complex logistics service providers is expected to increase, and existing service providers and businesses that will not be able to meet expectations are expected to integrate into the systems of LLP companies as simple subcontractors.

The stated direction of development is, in my opinion, unquestionable. Achieving the goals, on the other hand, would require the fastest possible development, open and honest partnerships, joint developments and a high level of expertise. The basics of these components are also present in Hungary. And good and practical examples can play an important role in initiating faster development. One such guiding case study could be the Invisible Supply Chain (ISC) concept I developed and presented in the next chapter.

5. THE INVISIBLE SUPPLY CHAIN CONCEPT

The Invisible Supply Chain concept and its implementation are the result of an effort and research whose main purpose is to outsource and take over tasks from the client's activities that are not part of the client's core competence, and which may lead to direct or indirect benefits for both the client and the service provider.

Each client makes their decisions right for them, which we call local optimum. However, the multiplicity of local optimal solutions in most cases does not result in the so-called. global optimum. Such a global optimum can be considered to be the global optimum of the various elements of a given principal, but the global optimum of the service provider must be the global optimum of all the service provider's principals. The global optimum of LLP cannot typically represent all local optimums of all serviced clients, so client level criteria and expectations should be formulated at values and in bands that require acceptable local trade-offs and where the service provider has the ability and ability to find global optimum. The results of this definition will be the so-called "Local optimum bands". The global optimum thus achieved must have more advantages for each element than any disadvantages that those elements must suffer in order to accept the compromise, i.e. to determine the local optimum bands.

At the same time, the search for the optimal bandwidth and the ability to prevent this type of cooperation may be the lower, less developed level of the relationship between the service provider and the client, and the lack of a partnership based on trust and mutual benefits. Based on these principles, we can distinguish clients on the basis of the level of partnership between the service provider and the client and the ability to adapt:

- client,
- base client or base customer.

The basics of the global optimum search are clearly provided by the so-called "Base customer provides. I illustrate this process in Figure 11.

An important criteria for the base customer is not only the flexibility and willingness to cooperate as it is expected, but also the required size, i.e. volume, which can provide the required flexibility to the service provider in the process of finding the global optimum.

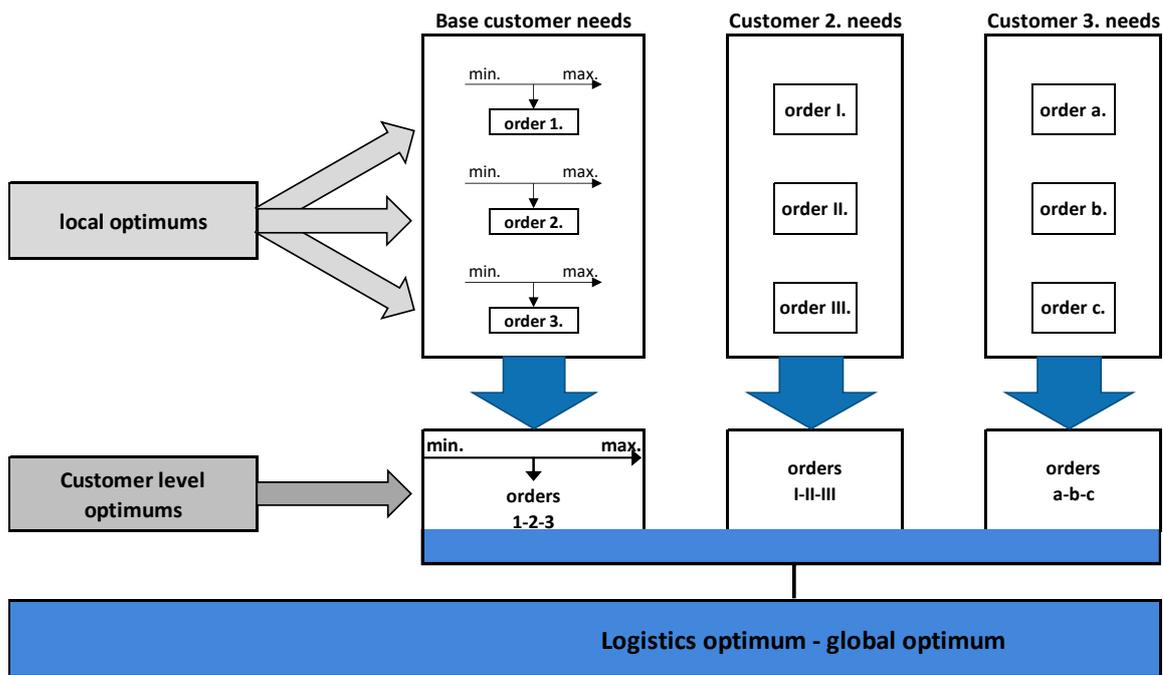


Figure 11.: Multilevel optimum search model

Source: own editing

However, the most important cost-oriented goal of the ISC model is to optimize transport costs, to strive for the best use of transport capacities on the basis of time and quantity, since in the case of the examined logistics tasks the transport (distribution) costs represent approx 45-50% of the total logistics cost. Based on these, the objective is logical and justifiable, as the most significant cost savings can be achieved by saving a certain percentage of transport costs.

5.1. Service elements of the concept

The goals of the Invisible Supply Chain - in the case under study - were achieved in several steps, ie several elements and activities of the supply chain have to be transformed and / or regrouped, which allow to determine the global optimum. In the case under study, the steps of the ISC concept were as follows:

1. Store Storage Optimization (SSO)

Defining and systematically developing storage order and inventory holding capacities based on internal (local) processes and needs.

2. Determination of delivery frequencies by the service provider

Determining the required delivery frequencies depending on sales volume and local storage capacities.

3. Introduction of Invisible Delivery

Transfer of the tasks of receiving the goods at the client (receipt of goods, inspection, packing, rotation) to the service provider.

4. Defining customer needs (orders) by the service provider - Stock Manager

Calculation of customers' needs by the service provider, preparation of an order proposal.

5. Management of the client's stocks and warehouses by the service provider (Vendor Managed Warehouse)

Taking over the local inventory tasks of the client (s) by the service provider.

5.1. Advantages of the ISC model

The Invisible Supply Chain concept is actually a well-coordinated group of simple solutions and apparently a fairly simple and practical solution. The difficulties are not the individual sub-solutions, but their interconnection and the reliable flow of data and information between them and the proper use of the data.

Examining the advantages of the ISC concept, it is expedient to analyze the aspects of the client and the service provider separately, the results of which are presented in Tables 2 and 3.

Table 2.: *The effects of the ISC concept for the client*

Effects of the LEL concept for the client						
LEL concept elements	costs	resources	stocks	flexibility	predictability	reliability
Store Storage Optimization	+	+	+	∅	∅	+
Determination of delivery frequencies	+	+	-	∅	+	+
Invisible Delivery	+	+	∅	∅	∅	∅
Stock Manager	+	+	+	∅	+	+
Orders' modification	+	∅	-	∅	∅	∅
Vendor Managed Warehouse	+	+	∅	∅	∅	∅

legend: + positive impact

- negative impact

∅ no significant impact

Source: own editing

Table 3.: The effects of the ISC concept on the service provider

Effects of the LEL concept for the service provider				
LEL concept elements	costs	profit	competitiveness	flexibility
Store Storage Optimization	∅	∅	∅	+
Determination of delivery frequencies	+	∅	∅	∅
Invisible Delivery	-	+	+	∅
Stock Manager	+	+	+	+
Orders' modification	+	∅	+	+
Vendor Managed Warehouse	∅	+	∅	∅

legend: + positive impact - negative impact ∅ no significant impact

Source: own editing

5.2. SWOT analysis

In order to fully examine and evaluate the concept, it is worth examining its

- strenghts,
- weaknesses,
- opportunities, and
- threats.

All these are summarized in Tables 4 and 5 in the form of a SWOT analysis.

It is clear from the SWOT analysis that the ISC concept offers significant benefits and additional opportunities for the client.

Weaknesses and threats highlight the logical consequence that the customer moves away from the actors in the supply chain (eg suppliers) in some respects, as the logistics service provider takes over its operational tasks and all of this increases the customer's vulnerability. However, this change and the situation that has developed can be reassured if the partners maintain their strong relationship of trust and effective communication.

Table 4.: SWOT analysis of an Invisible Supply Chain concept from the perspective of the client

Invisible Supply Chain concept SWOT analysis FROM THE PERSPECTIVE OF THE CLIENT	
Strengths	Weaknesses
Possibility to focus on the main activity (Core Competence)	Vulnerability to the service provider
Less need for own labor	The service package becomes more complex, making it more difficult to replace the service provider
Reliable supply	
Lower logistics cost	
Better capacity utilization - growth opportunities with the same capacity	
Avoid increasing storage capacity (investment) due to traffic growth	
Opportunities	Threats
Competitive supply chain costs compared to competitors	Less direct insight into the activities of other actors in the supply chain (suppliers)
Less labor market vulnerability	

Source: own editing

Table 5.: SWOT analysis of Invisible Supply Chain concept from the service provider's point of view

Invisible Supply Chain concept SWOT analysis FROM THE PERSPECTIVE OF THE SERVICE PROVIDER	
Strengths	Weaknesses
Lead Logistics Provider concept	complex planning/management system
Competitive cost level for all existing customers	Continuous planning demand (eg no standard route plan)
It is difficult to copy due to the required criteria	Vulnerability to the "Base Customer"
Possibility of complete optimization (stocks, delivery)	Correcting a possible error can be costly
Customers - especially the "Base Customer" has a stronger connection/independency to the service provider	Complex IT system requirements
Possibility to optimize deliveries due to delivery time windows independent of restaurant operation	The need for a high level of expertise
Expansion of the range of services and increased service revenue	
Increasing customer satisfaction	
Opportunities	Threats
Competitive supply chain costs for new customers as well	Due to changes in the labor market, maintaining the quality of service can lead to significant cost increases
Develop and integrate additional Base Clients	
Extending supply chain management and new solutions (e.g. VMI) to suppliers	

Source: own editing

Examining the situation of the logistics service provider, the higher degree of vulnerability to the base customer is also noticeable. Increased vulnerability can therefore be found on both sides, and in this case it is no longer worth talking about vulnerability, but interdependence, which can further strengthen the already established strategic partnership and turn this weakness or threat into strengths and opportunities for new partners.

6. QUALIFICATION OF HYPOTHESES, NEW RESEARCH RESULTS

In my dissertation, based on the literature analysis supporting the confirmation or refutation of the hypotheses I have formulated, the research I have carried out and their results, I describe my answers to my previously established hypotheses below. Based on these, I formulate the following theses:

T1: Today's logistics providers in Hungary are typically at the 3PL and / or 4PL level.

In my primary research, using my online questionnaire survey, I conclude that the hypothesis is correct. The survey clearly shows that logistics providers currently largely provide the classic basic services to their customers (transport, warehousing, picking, repackaging, labeling). Although there are services on the service palette that may already be within the remit of LLP, they only work for a few providers and are typically just a kind of isolated extra service element.

Examining the existing customer-service provider relationships, it can be stated that we can not typically talk about established real partnerships, which may result in even a greater degree of task reallocation to the service provider. This finding is supported by the length of collaborations so far and the frequency of tendering by customers.

Examining the IT readiness of the service providers, I also state that the current Hungarian service providers are not at the level of IT development that could result in a rapid change of concept towards LLP.

Thus, today's logistics service providers in Hungary typically operate at the 3PL and / or 4PL level.

T2: The LLP concept provides significant financial and other benefits to the client and the service provider.

In my dissertation, I also described the benefits of LLP from the perspective of the customer and the service provider.

The LLP concept clearly helps customers (as principals) and enables them to focus on their core business while the service provider operates the supply chain efficiently, ensuring the optimal cost level, while continuously improving processes.

The ISC model developed and described by me serves as a concrete case study for this, in which case one of the results of the new solutions introduced was a significant cost reduction of over 8%. Examining the aspects of the service provider, it is clear that with the takeover of the tasks, the service portfolio increases and thus the service revenue also increases, which logically means new profit content and growth.

In addition to the specific business interests of the service provider, I consider the professional conceptual and functional development of the service provider through the introduction of the LLP to be an important factor.

The hypothesis is correct, as LLP provides significant financial and other benefits to both the client and the service provider.

T3: In Hungary, at the current management level, there is a significant need to involve LLPs (Lead Logistics Service Providers) in value creation processes

In Hypothesis 2, I have already described the benefits of collaboration between a customer and a service provider using LLP.

The introduction of the LLP concept brings additional benefits to both the service provider and the customer participating in the LLP, as LLP has the potential to lead to efficiency gains also for customers for whom the LLP concept has not yet been implemented. An example of this I present is the base customer concept and the opportunities and benefits that flow from it.

In the case where the service provider serves several customers and performs certain activities in combination, such as combined deliveries, it is possible to perform the entire task optimally. Overall and in general, this means cost reductions in the service provider's activities, and taking advantage of these synergies also means additional savings for the base customer.

The partnership and good co-operation assumed and expected by LLP is typically accompanied by the application of a “win-win” concept, which shares the benefits gained (eg in the case of a combined route planning and delivery) with the cooperating partners.

Thus, the LLP concept provides significant benefits for both the client and the service provider, which indirectly confirms the correctness of my hypothesis that there is a need to introduce LLP in Hungary as well.

T4: It is already possible to implement LLP in domestic supply chains

Examining the readiness of the Hungarian logistics market from the point of view of LLP, I conclude that from the point of view of the range of services, Hungarian service providers are not yet generally ready for the rapid introduction of the LLP concept.

At the same time, the means and quality of the services currently provided do not lag behind the development of the means and the level of service in other countries. This is partly due to the presence of a significant number of international logistics service providers in Hungary, which is characterized by the fact that the exchange of experience, benchmarking and the standardization of processes and tools work well within international companies.

Another reason for this development is that with globalization, the latest tools and solutions are now available anywhere in the world. We can not talk about the backwardness of Hungarian service providers in this area either.

At the same time, the ISC model I have presented proves in this respect that it is possible to implement LLP in Hungary as well.

The hypothesis is therefore correct.

However, implementing LLP is a laborious and time consuming process. In my opinion, there will be another good examples of LLP in Hungary in the coming years, but we will have to wait at least another 10 years for the concept to spread.

New, novel research results:

Based on the 4 theses formulated above, I list the following new and novel scientific results:

R1: I systematically analyzed and compared different logistics service models, examining them from the perspective of the service portfolio using the definitions found in the literature. I have found that there is currently no justification for specifically defining and differentiating service provider levels above 4PL. For service models beyond 4PL, in summary, I propose the definition of Lead Logistics Provider.

R2: I mapped out the current descriptions of the LLP concept, based on which and based on my own research and experience, I formulated the following definition:

“The **Lead Logistics Provider** function is the result of a logistics provider development that is characterized by a well-established and achieved high-level professional and partnership relationship with the customer over the years of cooperation. Based on this, the customer submits to the professional recommendations of the service provider (LLP) in terms of supply chain planning, management and operation tasks and empowers the service provider to continuously optimize individual and comprehensive supply chain processes with innovative developments using state-of-the-art and efficient IT solutions.”

R3: I developed a new model for the role of innovation and IT in the 3PL, 4PL and LLP concepts, pointing out their significant differences in supply chain efficiency (Figure 12) and showing the evolution of the complexity of the given solutions and the quality of the client-service relationship. also moving towards the LLP level.

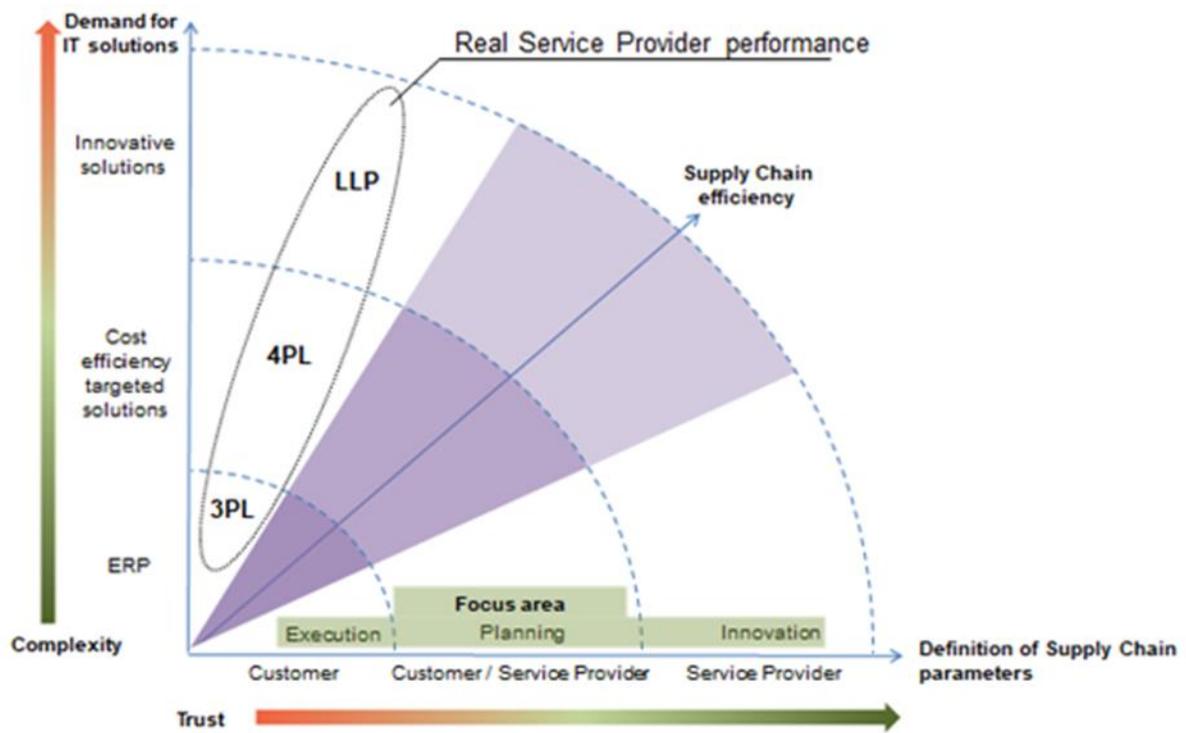


Figure 12.: The role of innovation and IT solutions in advanced logistics providers

Source: VALENTINYI - BALOGH (2017)

- R4: I analyzed the client-provider partnerships and described the criteria and characteristics of the partnerships that are essential to achieve LLP.
By further examining the LLP toolkit, I also demonstrated the fundamental need for advanced IT tools and solutions (hardware and software) to achieve LLP.
- R5: I conducted quantitative primary research by interviewing companies providing logistics services in Hungary, analyzing their current service elements, customer relationships regarding the duration of contracts and tendering habits, the readiness of logistics providers mainly from an IT point of view and assessing the opinion of Hungarian logistics providers for the following 5-10 years period in terms of the logistics service market and the expected development of service providers.
- R6: Based on the results of my research, I stated that Hungarian logistics service providers currently typically provide their services at the 3PL or 4PL level. However, there are already service providers in the domestic market that, as the Lead Logistics Service Provider (LLP), manage the supply chain and serve their customers.

R7: In the dissertation I presented the elements of the Invisible Supply Chain (ISC concept) I have developed in recent years, the implementation process and the advantages of the concept and I proved its functionality in the form of a case study.

Within the framework of the developed and presented ISC concept, the cooperating partners regroup the significant tasks compared to the usual ones into the scope of activities and responsibilities of the logistics service provider. In this way, the logistics service provider will also have a degree of planning and operational freedom and opportunities that will allow it to fully understand and manage this part of the supply chain, which is a tool for implementing efficient solutions and to achieve the global optimum, while creating the conditions and opportunities for the client to truly focus on its core activities.

7. CONCLUSIONS, SUGGESTIONS

Examining the LLP criteria, I see the fundamental difficulty in the absence of strategic links. This is also confirmed by the part of my survey according to which the proportion of 5-10 year co-operations reaches 10.3%, while co-operations longer than 10 years account for 7.4% of all co-operations. In this case, there is already a chance for trust to develop, but the proportion is still small. Thus, the spread of LLP will take more time, in my opinion at least 10 years, in Hungary. Looking at the demand side, ie the clients, it can be clearly stated that there is a need for the spread of LLP, as it involves a specific cost reduction and shifts a significant task from the clients to the logistics providers, so the client can really focus on its core business.

Supply chain management is no longer conceivable without an active network of cooperating partners, in which those operating at several levels of the supply chain, such as e.g. producers, processors, logistics providers and commercial teams who are owners of the supply chain.

The Invisible Supply Chain concept aims to implement LLP, the conceptual elements of which can be applied in any industry, but only if it is supported by an appropriate IT solution.

Technological advances and the intensification of client needs may reduce the time required for the spread of LLP. This requires innovative solutions and state-of-the-art IT applications, the application of artificial intelligence and automation. Today, the most important question is no longer how many years a warehouse investment will pay off, but how and with what technology we can replace human resources. The introduction of new, innovative solutions also requires the openness of partners and a certain level of risk-taking capacity. All of this potentially also represents a kind of cultural change and requires on both sides.

Based on my research in the international literature, it can be argued that we usually underestimate the speed of development, but the development direction of Hungarian logistics service providers is given and it would be desirable to direct domestic practical developments and research in this direction as well.

8. LIST OF USED LITRITURES

1. EU 2003/361/EK BIZOTTSÁGI AJÁNLÁS (2003): Felhasználói útmutató a kkv-k fogalom meghatározásához,
https://www.google.com/search?source=hp&ei=0efjXI7lMZLQrgTUiIuIDg&q=eu+v%C3%A1llalkoz%C3%A1s+kateg%C3%B3ri%C3%A1k&oq=eu+v%C3%A1llalkoz%C3%A1s+kateg%C3%B3ri%C3%A1k&gs_l=psy-ab.12...930.13580..13989...6.0..0.204.3103.20j10j1.....0....1..gws-wiz.....0..0j0i131j0i10j0i22i30j0i8i13i30j33i160j33i21j33i22i29i30.B6qzg0_wUUw
Letöltve: 2019.07.03.
2. GELEI A. (2013): Logisztikai döntések - fókuszban a disztribúció
Akadémiai Kiadó, Budapest
3. FALUS I. (2014): Bevezetés a pedagógiai kutatás módszereibe
Műszaki Könyvkiadó, Budapest
4. NARASIMHAN G. (2013) - <http://logisticsupplychain.blogspot.de/2013/09/outsourcing-1-to-10-pl.html>
Letöltve: 2019. 06. 24.
5. SZEGEDI Z. (2008): A logisztikai optimumtól az ellátási lánc optimumig. Az időalapú verseny követelményei
OPTASOFT konferencia, Budapest
6. SZOKOLSZKY Á. (2015): A konzervativizmus kutatásának hat évtizede: adornótól a biopolitikáig kritikai tanulmány
Magyar Pszichológiai Szemle, 2015, 70. 2/7. 405–458.
DOI: 10.1556/0016.2015.70.2.7
7. VALENTINYI Z. – BALOGH CS. (2017): Az innováció és az informatikai megoldások szerepe a fejlett logisztikai szolgáltatóknál
HAVI Logistics belső vállalati anyag

9. OWN PUBLICATIONS RELATED TO THE TOPIC OF THE DISSERTATION

Magazine articles published in foreign languages

1. VALENTINYI Z. – WALEED W. A. – HORVÁTH Z. – REICHER R. (2021): Current Services and Prospects of Hungarian Logistics Providers in the Next 5-10 Years. *SELYE E-STUDIES*, 12:(1), (Megjelenésre befogadott), ISSN: 1338-1598
2. VALENTINYI Z. – FODOR Z. – BALOGH CS. - DUNAY A. (2020): The Lead Logistics Provider (LLP) Concept: Case Studies. *INTERNATIONAL JOURNAL OF SUPPLY CHAIN MANAGEMENT*, 9:(6), pp. 72-81., ISSN 2050-7399, SCOPUS: Q3
3. SZEGEDI Z. - VINOGRADOV S. - DOMJÁN E. – STÖRKEL M. – VALENTINYI Z. (2014): Problems of the co-operational attitude of supply chain members in the Hungarian FMCG sector. *JOURNAL OF INTERNATIONAL SCIENTIFIC PUBLICATIONS: AGRICULTURE AND FOOD*, 2:., pp. 472-479., ISSN 1314-8591 (Online)

Journal articles published in Hungarian

4. SZEGEDI Z. – PAPP I. – TÓSI J. – VALENTINYI Z. (2020): Az ellátási láncon belüli együttműködés hatása a magyar kis- és középvállalkozások stratégiájára. *LOGISZTIKAI ÉVKÖNYV*, Magyar Logisztikai Egyesület, Budapest, pp. 57-73., ISSN: 1218-3849
5. FARKAS T. – VALENTINYI Z. – RÉV E. – LELKES Z. (2008): Ellátólánc optimalizálása homogén termékszállítási korlátok mellett. *LOGISZTIKAI ÉVKÖNYV*, pp. 217-221., ISSN: 1218-3849
6. VALENTINYI Z. (2000): Kiszervezés több fázisban” - interjú az Amstel Sörgyár Rt. logisztikai outsourcing project-jéről. *SUPPLY CHAIN MANAGEMENT MAGAZIN*, 4:(8), pp. 12-14. p., ISSN: 1417-3352

Book excerpt

7. SZEGEDI Z. – VALENTINYI Z. (1999): Az A.B. Hungary, 1997. In: Szegedi Z. – Marer P.– Waisvisz P. (szerk.-k) Vállalati esettanulmányok (II. kötet: Stratégia, privatizáció). AULA Kiadó, Budapest, pp. 113-124., ISBN 963 9215 13 9

Foreign language conference publications

8. FODOR Z. – SZEGEDI Z. – VALENTINYI Z. - REICHER R. (2019): Presence of supply chain management approach in domestic small and medium enterprises. In: Illés B. Cs. (ed.) Proceedings of the International Conference on Management: “People, Planet and Profit: Sustainable business and society”: Volume I, Szent István University Publishing House, Gödöllő, Hungary, pp. 86-91.

9. KOSZTYI D. – FODOR Z. – **VALENTINYI Z.** (2019): Special competitiveness enhances stock management model for engineering SMEs. In: Dunay, A. (ed.) Proceedings of the 9th International Conference on Management: "People, Planet and Profit: Sustainable business and society": Volume II , Szent István University Publishing House, Gödöllő, Hungary, pp. 59-66.
10. SZEGEDI Z. – MORVAI R. – **VALENTINYI Z.** – TAKÁCS G. (2015): Differences and similarities of supply chain integration of Hungarian and German SMEs. In: Tompos A. – Ablonczyné Mihályka L. (eds.) "Kitekintések - 25 éves a győri közgazdászképzés": Kautz Gyula Emlékkonferencia, Széchenyi István Egyetem Kautz Gyula Gazdaságtudományi Kar, Győr, Magyarország, pp. 1-8.
11. FARKAS T. – **VALENTINYI Z.** – RÉV E. – LELKES Z. (2008): Supply Chain Optimization with Homogenous Product Transport Constraints. In: Braunschweig, B. - Joulia, X. (eds), 18th European Symposium On Computer Aided Process Engineering, Ser. CACE 25, Elsevier, Lyon, France, pp. 205-210., ISBN: 978-0-444-53227-5, CD: ISBN: 978-0-444-53228-2
12. **VALENTINYI Z.** – KOTZAB H. – SZEGEDI Z. (1997): AMSTEL Hungary 1997 – Career of a Beer Multi in Hungary. In: Proceedings of the 5th Annual Conference on Marketing Strategies for C/E Europe, Vienna, Austria, pp.72-87.

Additional scientific publications have been published on the topic

13. FODOR Z. – SZEGEDI Z. – **VALENTINYI Z.** – REICHER R. (2019): Presence of supply chain management approach in domestic small and medium enterprises. pp. 19. In: Fodor, Z. (ed) Book of Abstracts of the 9th International Conference on Management: "People, Planet and Profit: Sustainable business and society": 9th ICoM 2019. Szent István University Publishing House, Gödöllő, Hungary, 178 p.
14. KOSZTYI D. – **VALENTINYI Z.** – FODOR Z. (2019): Special Competitiveness Enhances Stock Management Model for Engineering SMEs. pp. 91. In: Fodor, Z. (ed) Book of Abstracts of the 9th International Conference on Management "People, Planet and Profit: Sustainable business and society": 9th ICoM 2019. Szent István University Publishing House, Gödöllő, Hungary, 178 p.

Other publications

15. EUREKA „CARGO FLOWS” Európai Unió kutatási projekt, Az Universitaet Erlangen-Nürnberg ill. a Wirtschaftsuniversitaet Wien együttműködésében, 2001-2002
16. OTKA: Élelmiszeripari vállalatok logisztikai rendszereinek kiszervezése. SZIE, 2003-2005 (témazám: 042620)

17. Láthatatlan Ellátási Lác Innovációs Kutatás. Nyíregyházi Főiskola Műszaki és Mezőgazdasági Főiskolai Kar - HAVI Logistics Kft., 2010-2011