Gergely Gecse:

Logistics practice of small and medium-sized enterprises

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Ph.D. Thesis

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Introduction

In 2010, small and medium-sized enterprises (hereinafter: SMEs) made up 99.8% of the 20.839 million enterprises of the European Union, and employed 66.9% of the 130.718 million employees (Wymenga et al. [2011]). In Hungary, at the same time, small and medium-sized enterprises contributed 99.8% of the 547.7 thousand industrial, commercial and service provider enterprises, 71.7% of enterprise employees and 54.6% of added value (European Commission [2011]). Because of their significant economic weight, flexibility, innovation and their fast decision-making, SMEs represent a frequently researched area. Unfortunately, the same is not true of their logistics, about which very few surveys are available. There are many hypotheses commonly accepted by the logistics experts, of which here are two examples:

- "Most small companies had not discovered logistics in any way, either operationally or strategically. You hear the term best practices today; well, we're talking worst practices" (La Londe, quoted by Harrington [1995] p. 55.).
- "SMEs are frequently of the opinion that logistics may be treated as something of secondary relevance. Transportation, warehousing and materials handling are to be regarded as necessary evil" (Kummer, [1995] p. 10.).

My Thesis relies on the most extensive exploration so far of international and domestic SME logistics researches, the systematic collection and processing of researches mostly from the "grey" literature[1], often published in the local language only. It sums up their results and examines in greater depth the logistics practice of Hungarian small and medium-sized enterprises. It goes beyond the researches so far which applied relatively simple mathematical-statistics methods to promote the further scientific investigation of the logistics of small and medium-sized enterprises. Furthermore, it is an attempt to show that paying more attention to this area might enhance the performance of the SMEs and expand the market of logistics service providers. I sincerely hope that my studies will contribute to the appearance of the logistics practice of large companies among the small and medium-sized enterprises, to its becoming part of their everyday practice, to "awakening the SMEs from their logistics slumber" (Stabenau, quoted by Kummer [1995] in the preface).

[1] "Here is a far-from-complete and principled list of the items belonging here: research and development reports, theses, habilitation works, conference materials… certain translations, investigation reports, state and municipality documents" (Futala and Mohor [1995] p. 65).

My research focused on the factors influencing the logistics costs and outsourcing activities of small and medium-sized enterprises; the hidden potential in logistics outsourcing and the reasons underlying judgements on it. Furthermore, I explored the relationship between logistics and company performance, and the opinion of executives on the contribution of logistics to the success of the company overall. I used for this purpose the logistics questions of the research entitled "In competition with the world", carried out for the fourth time in 2009 on a sample of 300 enterprises (85.6% SMEs), and of the "Survey of the situation of enterprises", a representative survey conducted in 2009 by the Ministry for National Development and Economy, covering almost two thousand small and medium-sized enterprises. Besides various tests to define the significance of differences (e.g. Kruskal-Wallis, Mann-Whitney, paired-sample t test and Wilcoxon tests), I applied multivariate mathematical statistics methods for the purposes of the research, from variance and cross-table analyses through binary logistic regression to cluster and factor analysis.

I started my research with a description of various approaches to the concepts of small and medium-sized enterprises and logistics, respectively, which shed light on their multi-faceted interpretations. Then I processed the special literature on topics ranging from logistics outsourcing by the SMEs through the position of performance and of this activity within the organisation to the strategic and logistics instruments. The summary of the results presented at the end of Chapter 2 was meant to provide guidance for my hypotheses. I tested the ten hypotheses of the Thesis with the methods described in Chapter 4. The results are presented in detail in Chapter 5, which is evaluated also separately in the conclusions of the Thesis.

1. Interpretation of the concepts of small- and medium-sized enterprise and of logistics, respectively

The objective of this chapter is to provide an overview of the concepts constituting the subject matter of the present Thesis, interpreted in different ways according to the various trends in the relevant special literature. The concepts will be presented primarily with the help of the literature on the logistics of small and medium-sized enterprises.

First of all let me clarify the concepts of enterprise and company, respectively. "Any activity characterised by risk-taking can be regarded as enterprise." (Czakó [2009] p. 9.) This can be distinguished from the business enterprise embodying an activity targeting primarily the satisfaction of consumer needs while making profit (Chikán [2008] p. 24.), and the legally autonomous company providing an organisational framework for the latter. There have been many efforts to distinguish these concepts; in this regard, I share the opinion of Kállay et al. [2009] that they cannot be distinguished sharply, given the fact that corporate and entrepreneurial operations are inseparably mixed in the company, and the enterprise targets also the establishment of a company.

1.1. Interpretation of the small and medium-sized enterprise

The concept of 'small and medium-sized enterprise' defined by various enterprise size indicators (e.g. headcount, turnover/sales revenue, investment, capitalisation) is frequently used in economic/business life. The organisations concerned are defined in different ways the world over, as shown in Table 1: most frequently, the number of employees (headcount) is the sole indicator, examined in certain Asian countries (Japan, Malaysia, Taiwan) together with capitalisation, whereas in India only investment size is taken into account.

Table 1: Country-specific SME definitions

Country	Category of industry	Criteria or country's official definition
India	Tiny Medium SSI	< 2.5 million Rs. of investment in plant and M/C < 1,000 million Rs. of investment in plant and M/C < 10 million Rs. of investment in plant and M/C
Australia	Manufacturing services	Small enterprises 20 employees Medium enterprises < 100 employees
China	SME	Depends on product group usually < 200 employees
France	SME	10-499 employees
Indonesia	SME	<100 employees
Japan	Manufacturing Wholesale trade Retail trade and services	< 300 employees or asset capitalisation <100 million yen < 50 employees or asset capitalisation <30 million yen < 50 employees or asset capitalisation <10 million yen
South Korea*	Medium-sized enterprise Small enterprise Micro enterprise	In function of the branch: < 50, 100, 200 or 300 employees In function of the branch: < 10 or 50 employees In function of the branch: < 5 or 10 employees
Malaysia	SMIs SIs MIs	< 75 full-time workers or with a shareholder fund of <RM 205 million Manufacturing establishments employing between 5 and 50 employees or with a shareholders fund up to RM 500,000 Manufacturing establishments employing between 50 and 75 employees or with a shareholders fund between RM 500,000 and RM 205 million
Singapore	Manufacturing services	< SS 12 million fixed assets <100 employees
China (Taipei)	SMEs	In manufacturing, mining and construction - invested capital is <NT$40 millions or the number of regular employees not to exceed 200
Thailand	Labour-intensive sectors Capital-intensive sectors	< 200 employees < 100 employees
Great Britain	SME	No universal fixed definition
USA**	SME	branch-dependent, generally < 500 employees and USD 7 million revenue
Vietnam	SME	No fixed definition, generally < 200 employees

Source: Thakkar et al. [2009a] p. 976., revised: based on *Yang [2009], **SBA [2010].

The European Union generally applies the SME definition provided by the Commission's Recommendation concerning the definition of micro, small and medium-

sized enterprises (notified under document No. (2003) 1422)[2], which was transposed to the Hungarian Act XXXIV of 2004 on Small and Medium-sized Enterprises and Support Provided to Such Enterprises. According to the recommendation, the following enterprises shall be regarded as SMEs in the European Union[3]:

Table 2: Classification of small and medium-sized enterprises in the European Union

	Number of employees	**Annual net sales revenue**	**Balance sheet total**
Micro enterprise	< 10 persons	max. EUR 2 million	max. EUR 2 million
Small enterprise	10-49 persons	min. EUR 2 million, max. EUR 10 million	min. EUR 2 million, max EUR 10 million
Medium-sized enterprise	50-249 persons	min. EUR 10 million, max. EUR 50 million	min. EUR 10 million, max. EUR 43 million

Source: Compiled by the Author on the basis of EC Recommendation No 1422/2003.

Analyses in applied economics often simplify the EU definition. It is easy to understand based on simple set-theoretical knowledge that the most frequently used headcount-based categorisation "over-estimates the weight and economic performance of the SMEs relative to the full-scale definition codified in the legal regulation referred to above." (Némethné [2006] p. 3.), although "a rough estimate shows about 1% of the enterprises having less than 250 occupied persons, has in fact over EUR 50 million turnover". (EIM Business & Policy Research [2009] p. 8.) Let me note that several branches apply other definitions than the one defined in the above legal regulation.[4]

Based on their respective SME definitions, the researches on the logistics of small and medium-sized enterprises can be categorised as follows:

– "SME definition of the EU", adhering to the turnover (e.g. Finnish, Norwegian, and Baltic researches) or headcount limits in Recommendation No. 1422/2003 of the European Commission.

[2] In 2008, it was integrated into a higher-level legal source: Annex I of Commission Regulation (EC) No. 800/2008, the so-called General Block Exemption Regulation.
[3] At the values indicated in Table 2, enterprises in which the state or the municipality has a direct or indirect share – based on capital or voting rights – exceeds 25% individually or collectively.
[4] In Hungary, in the financial sector, for example, the limit is drawn at HUF 100 million turnover (Kállay and Imreh [2004] p. 32.).

- "North American SME definition" characterised most frequently by the maximum employee number of 500[5] (in this Thesis, I shall refer to these entities as "small businesses"). I assigned to this category also the Canadian researches which mostly define small enterprises by the turnover limit of CAD 50 million (e.g. Gelinas and Bigras [2004]).
- Some surveys do not indicate the studies on the basis they considered a given company a SME.
- "Other SME definition" includes such definitions of small and medium-sized enterprises not to be assigned to any of the above categories as:
    - The classification of the first systematic SME research (Kummer [1992]), based on headcount (fewer than 200: small, from 200 to 499: medium-sized; from 500 to 999 large SMEs), in some cases on turnover (less than DEM 20 million: small; DEM 20 to 49 million: medium-sized; DEM 50 to 99 million: large enterprise).
    - The definition under Act XCV of 1999 on Small and Medium-sized Enterprises used in some Hungarian analyses[6] (e.g. Szabó [2005]; Vízhányó [2006]).
    - Definitions which regarded as SMEs organisations with fewer than 200 employees and less than GBP 20 million turnover (e.g. Quayle [2002a]), or defined the SME by the number of commercial units (Hutchinson [2009]).

The almost 50 articles and papers on SME logistics processed as part of writing this Thesis mostly applied the EU definition; this was followed by the North American and the "other" SME definitions, in that order.

In their study focusing on the purchasing behaviour of SMEs, Morrissey and Pittaway [2004] stressed that the SMEs shall not be treated as a homogenous group. The same was indicated by Beumer et al. [2009], quoting by way of example the incomparability of the logistics strategies/concepts and arrangements of a SME employing 240 and producing a turnover of EUR 50 million, and one with a staff of 3 and a turnover of EUR 1 million. As can be seen also from the distribution of the enterprises of the EU-27

[5] This was used also in a research made in Germany (Uhlig and Gelinas [1994]).
[6] This was not different from the current one in terms of number of employees and owners' independence, but set the limits of HUF 700 and 4000 million for turnover and of HUF 500 and 2700 million for the balance sheet total.

and of Hungary shown in Table 3, in numerical terms, the latter (i.e. micro enterprises) predominate.

Table 3:Number and ratio of EU-27 and Hungarian enterprises, respectively (2010)

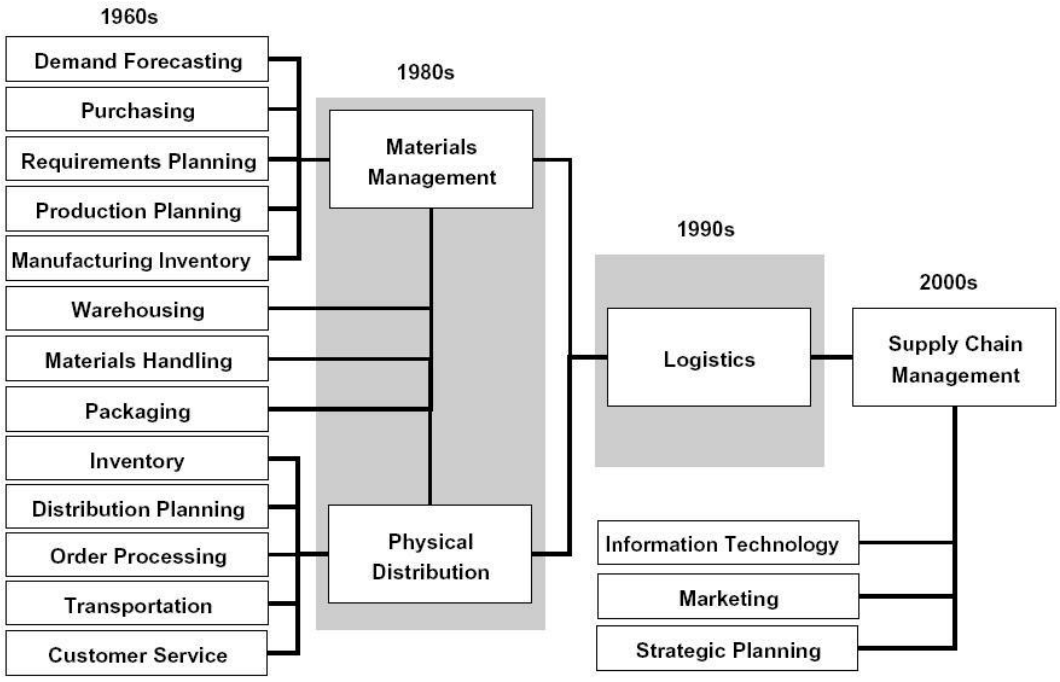
	EU-27 enterprises		Hungarian enterprises	
	number (thousand)	**% rate to all enterprises**	**number (thousand)**	**% rate to all enterprises**
Micro enterprise	19198.5	92.13%	516.1	94.23%
Small enterprise	1378.4	6.61%	26.4	4.82%
Medium-sized enterprise	219.3	1.05%	4.4	0.80%
Large enterprise	43.0	0.21%	0.8	0.15%

Source: Based on Wymenga et al. [2011] and European Commission [2011].

1.2. The interpretation of logistics

Logistics in the sense of supply of the armed forces (Kummer [1995]) was transferred from military to business life in the middle of the last century, and it became a colloquial term at the time of the First Gulf War (Tirode-Bédel [2006]). Its appearance and spread at enterprises was due among other things to functional specialisation deriving from Taylor's "scientific management" and to the development of marketing (Kummer [1995]).

Figure 1: Evolution of logistics integration



Source: Hesse and Rodrigue [2004] p. 175.

The evolution of logistics integration as depicted in Figure 1 above shows that this field had been rather fragmented in the 1960s, when it came to be regarded as a key factor of performance improvement. By the 1980s, the activities concerned had merged into materials management and distribution, and logistics in its current form appeared in the 1990s, as a result of yet another round of integration. Full-scale integration into the supply chain became feasible after the turn of the millennium, thanks to the spread of the modern info-communication technologies. I shall not define the supply chain in this Thesis, but let me mention that according to a decisive survey on corporate logistics, "the terms 'logistics' and 'management of the supply chain' "are treated in practice as synonyms" – obviously, not quite correctly (Solakivi et al. [2009] p. 34.).

Logistics is an interdisciplinary field relying on other sciences such as economics, mathematics, applied economics, organisational theory and engineering sciences (Klaus [2009] p. 56.). Besides this interdisciplinary aspect, research in this area is aggravated by the co-existence of different, overlapping, definitions of the concept of logistics. Logistics can be examined as:

- a service comprising transportation, warehousing, packaging, cargo handling, forwarding and related activities, which influences essentially the spatial and time dimensions of consumer value;
- a process or subsystem within the company (its three main stages being procurement, production and distribution logistics) or transgressing its limits, related to the flow of goods[7];
- a management activity or corporate co-ordination function.

My concept of logistics is closest to the activity-based approach. I am firmly convinced that the classification of activities in the statistical nomenclature, exempt from any overlaps, is the most suitable basis for the examination of the logistics practice of small and medium-sized enterprises, since the SMEs interpret these concepts in a more uniform way than logistics. I believe that, in spite of the fact that interviews conducted among Hungarian companies and interest representation organisations have shown that

[7] Otto [2002] distinguishes also the flow of information, the network of institutional and social relations, and Pfhol et al. [2003] the flow of values.

the concepts of transportation, forwarding and logistics are intermingled in practice due to the vertical integration of the market[8] (Bank et al. [2010] p. 46.).

[8] According to a survey covering 300 Hungarian logistics service providers, transportation/forwarding rank first among the activities performed jointly, followed by transportation/logistics and the accomplishment of all three activities together (Bank et al. [2010] p. 65.).

2. SME logistics researches

I used e-databases (e.g. ABI/INFORM, EBSCO, Emerald, JSTOR, SciVerse) and given the high proportion of the "grey" literature Google to explore the researches on the logistics of small and medium-sized enterprises. I applied various keywords to search for logistics and its sub-areas (e.g. transportation, distribution), and various names and abbreviations used for the small and medium-sized enterprises (e.g. SME, KMU[9]). I identified most researches with the snowball method, i.e. based on the bibliographies of articles known to me and on other researches by the same authors. Besides the problem of getting hold of the research materials (e.g. in the form of inter-library lending), many were published in other languages than English (e.g. German, French, Swedish, Finnish, Norwegian), so I had to use various IT applications (e.g. character identifier, translation) to understand them.

The technical literature on the logistics of small and medium-sized enterprises is not particularly extensive: it comprises only a few articles and case studies. Following procurement research by Dobler [1965] and the scientific analysis of the distribution of the Australian small firm Castrol (Love and Gilmour [1976]), the first more detailed study of enterprise logistics was that of Heinrich and Felhofer [1985]. Almost half a hundred articles and studies have been written on this topic since that time, but the bulk of logistics research still focuses on the logistics of large companies. This is due to the fact that the logistics functions of large companies are sounder and easier to research. Furthermore, SME researchers tend to direct their attention to other functional sub-areas such as marketing, production, strategy and financing (Pearson and Semeijn [1999]). In comparison with other areas of logistics, SME purchasing is relatively well-researched, although "research on purchasing in small companies is still limited, despite the recognised dependence of small companies on external resources" (Ellegaard [2006] p. 272.). Ellegaard [2006] classified by topic 76 articles on the purchasing activity of small and medium-sized enterprises and found that articles on the management of supplier relations represented the largest share, followed by network structure management, general topics, the purchasing structure, product/workflow development, negotiation and contracting and supplier performance measurement, in that order.

[9] English and German abbreviations of the small and medium-sized enterprises, respectively.

SME logistics has received relatively little attention so far at professional conferences, although Austria has had SME logistics days since 2005, and the German logistics association (BVL) has organised the Mannheim SME forum since 2007 and established also a SME logistics committee, aware of the weight of this topic. According to the authors of a case study volume born as a result of the latter move, "in terms of SME logistics, the property/proprietor-owner ought to be used as distinctive feature" because, according to the authors "capital and management is always in the hands of the entrepreneur", "he is the one who assumes the risks and liabilities", "determines the structure down to the least details through his personal presence"; "and the enterprise is the essential source of living of the family" and its "revenue", an "enterprise is a permanent mission of some kind" (Beumer et al. [2009] pp. 2-3.). The main problem with this approach is that, according to the relevant indicators, the family enterprises[10] covered by the case studies were all large companies with only one or two exceptions.

The researches so far have studied primarily the small and medium-sized manufacturing, commercial and/or logistics service provider enterprises, and mainly those of a larger size among them. The results of the isolated, non-representative cross-sectional surveys and the case studies based on relatively small samples including also large companies are difficult to compare. Sometimes they include more hypotheses than empirical evidence.

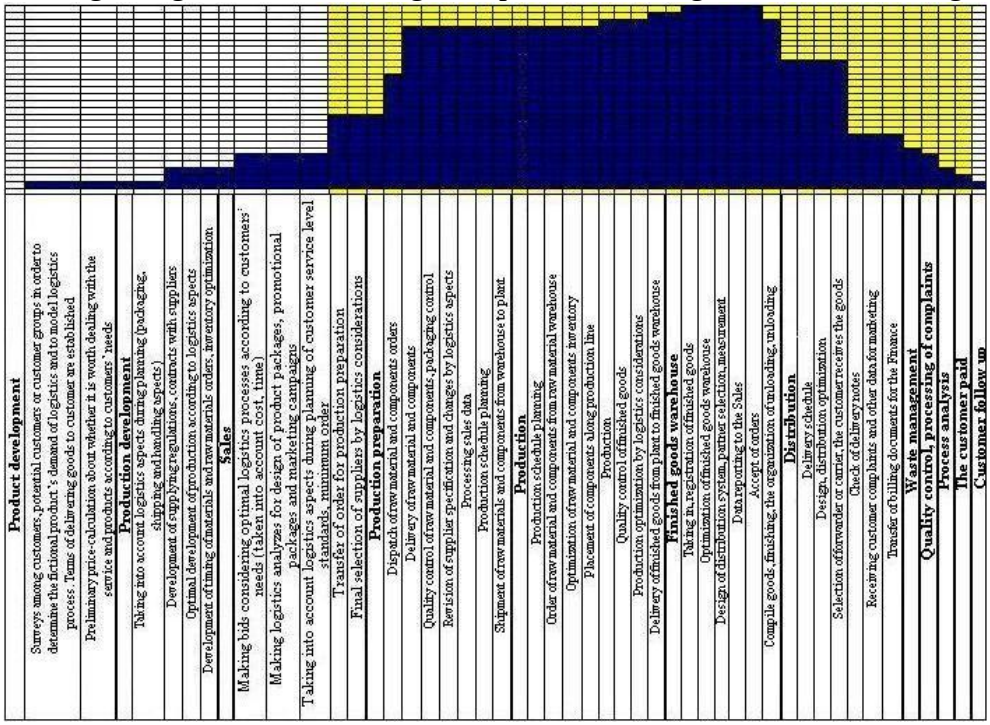
This chapter reviews the researches on the logistics of small and medium-sized enterprises, from the interpretation of logistics, to issues of outsourcing, performance (e.g. cost) concerning the place of this function within the company. Furthermore, I have also explored researches on logistics strategies and instruments, not closely linked to my own research, but necessary for the full understanding of the logistics practice of SMEs. The general logistics literature of the above fields is much richer than the material presented here, but due to limits of space, I had to focus and discuss in brief the researches related to my own hypotheses.

[10] "The family owns more than 50% of proprietary rights, and the family takes part in the management of the enterprise and in the determination of its strategic direction" (Beumer et al. [2009] p. 3.).

2.1. Interpretation of logistics and its significance for the SMEs

According to La Londe, small business must first be taught what logistics is, since, contrary to their larger peers, they have no idea what cycle time for example means (quoted by Harrington [1995] p. 57.) Unfortunately, most researches do not examine the logistics interpretation of the small and medium-sized enterprises, despite the fact that, presumably, they embody rather different approaches which impacts also on the validity of the content of the studies. The load diagram based on in-depth interviews with 27 Hungarian producer SMEs reflects the heterogeneity of the interpretations. Although the 29 commercial entities also surveyed in the research projected a more homogeneous approach than the producer companies, three groups could be distinguished even there (Szabó [2005]).

Figure 2: Beginning and end of the logistics process at Hungarian manofacturing SMEs



Source: Szabó [2005] p. 17.

90% of SMEs examined by Vízhányó [2006] thought that logistics meant exclusively transportation and warehousing; 55% among them regarded purchasing as the start of the process and delivery to the customer as its end. Kummer [1992] studied the interpretation of logistics in more detail by in his research covering 111 members of the

Chambers of Commerce and Industry of Koblenz and Dortmund, respectively[11], active in commerce, metal processing, food and beverages manufacture and construction, and he came to the following conclusions:

- The majority of SMEs had a comprehensive concept of logistics, but large companies considered it a broader, co-ordinating, function going beyond the company limits.
- The logistics concept of small SMEs was relatively homogenous, that of the medium-sized and large ones heterogeneous, whereas large companies adopted a more uniform approach.
- Food and beverages manufacturers demonstrated a more homogeneous approach; Kummer [1995] assumed that the underlying factor was the significant role of distribution. The construction industry showed substantial inhomogeneity. The differences by industry were attributable mostly to differences in the knowledge and implementation of logistics, and the different complexities of the materials and information flows of the industries concerned. In food and beverages manufacture, for example, purchasing and manufacture were less complex functions than distribution, whereas in metal processing production logistics was decisive, and distribution was given less attention.
- The widest gap between the theoretical significance and actual implementation of logistics occurred in the category of medium-sized SMEs and the narrowest in that of large companies.
- Company group affiliation, the coincidence of the role of owner and manager and membership in a professional logistics organisation played no role in the interpretation of logistics.

The contingency co-efficient measuring the association between the functional interpretation of logistics and the size of the company shown in Table 4 could be regarded as significant at the level of 10% in three cases and at that of 5% in one case (Kummer [1995]).

[11] 38 small, 42 medium-sized, 16 large SMEs and 15 large companies.

Table 4: Distribution of the logistics interpretation of German companies, by size[12]

Functional interpretation of logistics	Average employee headcount				Contingency co-efficient	Significance level
	100-199 persons	200-499 persons	500-999 persons	999+ persons		
Similarly to other cross-functional areas, logistics is a co-ordinating function	1.80	1.90	2.20	1.40	0.45	0.10
Logistics attempts to co-ordinate the logistics processes also beyond the company borders	2.12	1.70	2.00	1.33	0.47	0.05
Logistics ought to control the flow of materials and the flow of information preceding, accompanying or following that	2.00	2.00	2.27	1.67	0.38	0.42
Delivering and processing of orders is not part of the logistics tasks	3.36	3.84	3.00	3.33	0.36	0.53
Independent logistics planning is needed within the context of strategic business planning	2.28	2.35	2.56	2.50	0.36	0.25
Logistics is only a small problem within strategic business planning	3.03	2.66	3.00	3.60	0.45	0.10
Logistics ought to be restricted to the transportation, storage/warehousing and cargo handling tasks	2.89	3.23	3.44	3.73	0.39	0.36
Logistics ought to carry on short-term management (e.g. management functions from other areas)	2.12	2.83	2.56	3.07	0.40	0.28
The goal of the logistics plan is to minimise the costs of the logistics processes	2.53	2.84	3.00	3.43	0.41	0.25

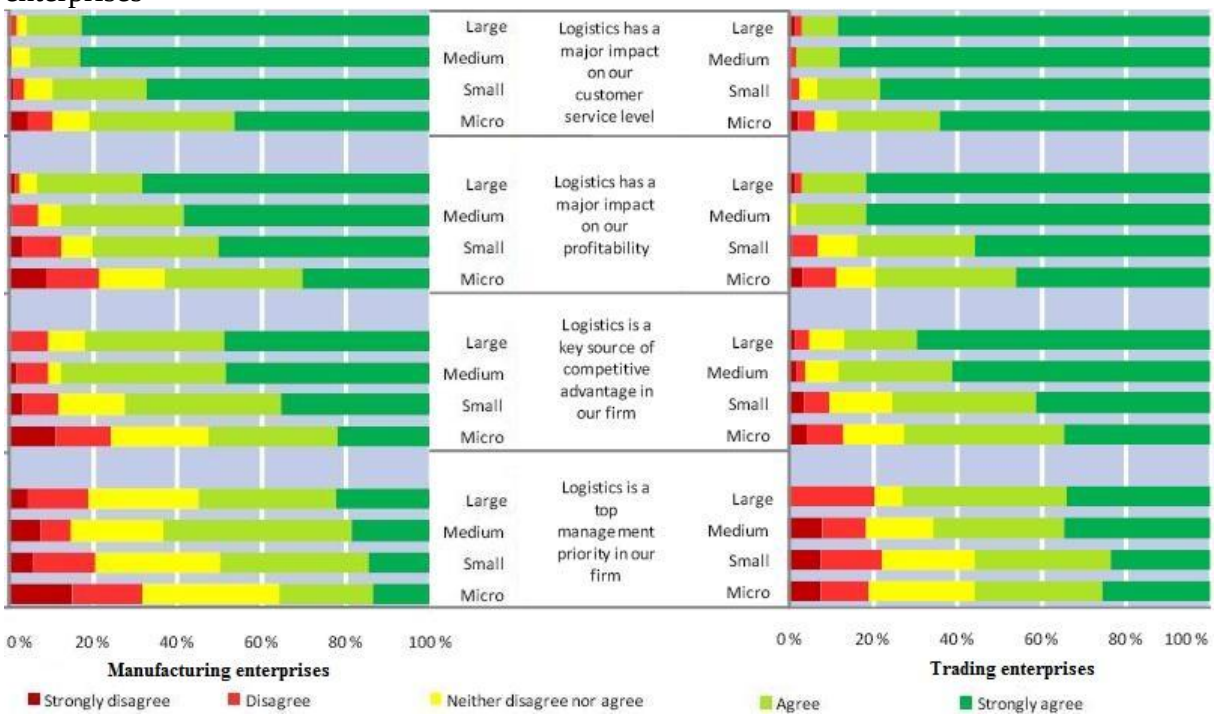
Source: Kummer [1995] p. 46.

In the opinion of Heinrich and Felhofer [1985], more intensive commitment to the logistics tasks is the result of major changes, uncertainties in demand and shorter delivery times. Contrary to the interpretation of logistics, part of the researches does examine at some level its significance. In most cases, respondents consider logistics important, and under the questionnaire-surveys applying mostly the Likert scale, they assign it great significance (Berr et al. [1990]; Kummer [1995]; Szabó [2005]; Vízhányó [2006]). The logistics surveys carried out on commission of the Finnish Ministry of Transport and Telecommunications since 1993 examined the relevance of logistics in a more sophisticated manner. The survey of 2006 revealed that medium-sized and smaller

[12] Averages on a five-point (1 completely agrees … 5 completely disagrees) scale.

enterprises were aware of the relevance of logistics, but their development options were limited (Naula et al. [2006]). In 2008, the Finnish large companies and medium-sized enterprises deemed the role of logistics more important than their micro- and small peers. Researchers explain that to a significant extent with the growing complexity of the supply change concurrent with the increase in company size. From among the four components under study, logistics exerted the biggest influence on customer service quality, the poor management of which was felt by the companies irrespective of company size. The biggest difference was found among large companies and micro enterprises in terms of the profitability effect of logistics (Solakivi et al. [2009]).

Figure 3: Significance attributed to logistics by Finnish manufacturing and trading enterprises



Source: Solakivi et al. [2009] pp. 55-56.

The articles investigating SME procurements also touch upon the issue of the significance of this area and come to contradictory results. Quayle [2002b] found that 65% of the 232 SMEs investigated by him did not consider purchasing important. The small enterprises under study ranked purchasing 14th of 19 functions. "The general view …was that with little or no perceived purchasing power, there was no need to pursue the activity through additional, already scarce, resource(s)" (Quayle [2002b] p. 155.). He found a similarly low procurement priority (Quayle [2002a]) investigating the e-commerce of 298 British SMEs. In the research of Vörösmarty et al. [2010], closely

linked to the studies of Quayle, the 76 small and medium-sized enterprises rated purchasing 5th of 20 items.

Some researches set out also to define the enterprise size limit above which the SMEs start to reflect on their logistics practice:

- The Transport Research Group of the Norwegian Research Council studied in 1994 the degree of logistics grounding of SMEs, and showed that the logistics of enterprises with more than 20 staff is better than that of the smaller ones (Virum [1994]).
- According to an earlier survey of German enterprises, co-ordination between the various units and hence the linkage of the flows of materials and information are not considered important at entities with fewer than 200 employees, and hence they have no systematic logistics management either (Kummer [1995]).
- In his thesis, Gritsch [2001] partly confirmed the following hypotheses via the data of the research "In competition with the word":
    - "Logistics integration takes place (except for companies of a logistics type – logistics service provider and trading ones) in a well-identifiable phase of company development" (Gritsch [2001] p. 50.).
    - "The company sets out to deal with logistics when the external circumstances force it to do so or when the size of the company creates the possibility of cost reduction by logistics" (Gritsch [2001] p. 50.).
- Based on the results of a questionnaire survey, Vízhányó [2006] established in his dissertation that small and medium-sized enterprises started to deal deliberately with logistics once they reached the turnover threshold of HUF 1.5 billion.

In summary, although the majority of authors of the relevant scientific literature did not study the logistics interpretation of the SMEs, certain researches (Kummer [1995]; Szabó [2005]; Vízhányó [2006]) showed that, in reality, it was not uniform. The SMEs considered logistics important (Berr et al. [1990]; Kummer [1995]; Szabó [2005]; Vízhányó [2006]; Solakivi et al. [2009]; Vörösmarty et al. [2010]), although certain purchasing researches (Quayle [2002a]; Quayle [2002b]) contradicted that. The surveys failed to give a clear answer as to the company size above which the small and medium-sized enterprises started to reflect on logistics (treat it deliberately) (Virum [1994]; Kummer [1995]; Gritsch [2001]; Vízhányó [2006]).

2.2. Outsourcing of logistics activities

There is no uniform definition of outsourcing; in the narrow sense, it means "the out-placement, assignment to external service providers of established tasks, functions carried out previously within the company or the institution, or of the related tools, equipment and capacities" (Szabó [1998] p. 138.). There are several synonyms for logistics outsourcing (Ivanaj and Masson Franzil [2006]; Selviaridis and Spring [2007]) such as 3PL, contractual logistics, logistics alliance or, formerly, subcontracting.

The majority of articles on logistics outsourcing did not study the relevant theoretical background[13] (Selviaridis and Spring [2007]), but if they did, the most frequent explanations were the theories of transaction costs, (core) competencies and, less frequently, other theories (e.g. agent or game theory) (Ivanaj and Masson Franzil [2006]).

Transaction cost theory developed by Williamson [1975] based on Coase [1937] is one the new institutional economics trends relying on a synthesis of neoclassical macroeconomics and organisational theory. Transaction economics states that process participants have a limited sense of rationality; they are opportunists and risk-neutral. The costs of the transfer of the ownership rights of the commodity or service (the transaction) occur at the time of the implementation and organisation of the process (e.g. costs of information acquisition, negotiation, control, agreement interpretation, amendment, respectively), which, together with the production costs, depend on the transaction-specific investments, on the degree of uncertainty and on the frequency of the transactions.

Table 5: Cost implications of transactions features

	Transaction-specific investments	**Uncertainty**	**Frequency**
Transformation costs	-	0	-
Transaction costs	+	+	-

(+: increase; 0: no effect; -: decrease)

Source: Kieser [1995] p. 289.

[13] 69% of the 114 articles on logistics outsourcing studied by Selviaridis and Spring [2007] presented only the industrial trends, without assigning any theoretical background to them.

As for the reasons of choosing in-house production vs. external procurement (make or buy[14]), transaction cost theory provides the following explanation:

- "If the transactions entail no special uncertainties or transaction-specific investment, the market is the most advantageous institutional solution" (Kieser [1995] p. 298.).
- "The more difficult and costly it is to take into account every random aspect of the neoclassical trade-offs, and the higher the possible gains, …, the more attractive the production of the goods and services within the organisation" (Kieser, [1995] p. 300.).

Few have examined the connection between logistics outsourcing and transactions cost theory. Ivanaj and Masson Franzil [2006] found that the logistics activity sometimes required transaction-specific investments (e.g. cold stores, special trucks). Although the level of such investments decreases with standardisation, even transportation (Kotabe and Mol [2009]) and warehousing (Skjøtt-Larsen [2000]), the most standardised functions to date, can only be outsourced to a medium extent. According to Aertsen [1993], high asset-specificity coupled with performance measurement difficulties ought to be conducive to own distribution. Maltz [1994] connected high asset-specificity with own warehousing, and high transaction number with the outsourcing of this activity. Skjøtt-Larsen [2000] associated asset-specificity with uncertainty which, in the opinion of Dornier and Fender [2001], increases in the case of logistics proportionally with the growing complexity of the institutional and regulatory environment and with globalisation, a process altering also the traditional logistics systems (e.g. relocation, delaying and JIT). SMEs are characterised by a low degree of outsourcing, the underlying reason being the excessive relative transaction costs of the services concerned due to diseconomies of scales; furthermore, the minimum transaction size of the various services also differs (Kállay and Imreh [2004]). Van den Berg [2009] came to the same conclusion, i.e. that the traditional outsourcing model had been designed for large contracts to achieve economies-of-scale, but with the development of ICTs it is now becoming accessible also to the SMEs.

According to Hamel and Prahalad [1990], the core competencies constituting the basis of resources theory make it possible for the company to enter and hold its ground in

[14] According to Maltz and Ellram [1997], outsourcing is one form of the classical make or buy decision.

competition in various market segments. Competencies which are valuable, scarce, difficult to copy and embedded in the organisation are built up of several resources and partial competencies which may be complex already in themselves. Gelei [2007] thinks that a significant part of the technical literature does not use the concept of competencies in a consistent way: it mixes the approaches from the side of output and input, respectively. Few have examined whether logistics was a core competency (core activity) and they, too, have come to contradictory conclusions. Sheffi [1990] considered logistics to be part of the corporate core competencies. Halley and Guilhon [1997] were of the opinion that logistics seemed to be a core competence of small businesses (in agriculture and the food industry). Olavarieta and Ellinger [1997], relying on the resource-based view of strategy, found that the logistics competencies may be difficult to copy, valuable and rare, i.e. core competencies fundamental for the company. Fine and Whitney [1996] thought that the management of the outsourcing processes was a core competency in itself. The research of Bentzen et al. [2000] on the contrary confirmed that medium-sized enterprises did not consider the servicing activities– including transportation, warehousing, inventory management – their core competences.

In the past twenty years, logistics outsourcing research usually focused on the questions of what, to what extent and why, which offer few general conclusions (Solakivi et al. [2011] p. 132.):

- Logistics outsourcing has been increasing steadily over the years: in the opinion of Ashenbaum et al. [2005] by an annual 5-8% at large companies in the 1996-2004 period based on the "Lieb series" and "Langley series". According to Razzaque and Sheng [1998] this tendency was driven mainly by the development of globalisation and technology.
- Individual services, originally mainly transport and warehousing, expanded to a limited extent in the direction of the more complex ones, the share of which increased with GDP growth (e.g. Ojala et al. [2007]).
- Logistics outsourcing is more common in the developed than in the developing economies (e.g. Pezzotta et al. [2006]).

The studies of SME logistics outsourcing can be divided into surveys comparing the outsourcing practice of small businesses and large companies; surveys based on the

dyad of the client and the service provider, and case studies. Ivanaj and Masson Franzil [2006] and Hong et al. [2004b][15] regarded company (or: account) size, whereas Arbaugh [2003] the attitude of the owner/manager as one of the contingency factors of logistics outsourcing. The contingency role of size has been demonstrated but partly by Bardi and Tracey [1991] and by the following comparative researches of the relevant practices of small businesses and large companies.

Evans et al. [1990] demonstrated a significant difference between large and small firms in terms of 14 of the 26 explored carrier selection criteria. Small firms rated but one of the 14 (past performance of the carrier) as important. They identified as their carrier "procurement" criteria most frequently "pick up, transit time, damages-interlining, points served and time".

Murphy et al. [1995] examined 76 American companies engaged in international trade. In terms of the values shown in Table 6, the small business did not differ significantly from the large companies, but the sample included only companies interested in logistics.

Table 6: Logistics practice of smaller and larger firms engaged in international trade

	Smaller firms	**Larger firms**	**t value**
International shipments	28.4%	18.0%	1.52
Use of water transportation	55.3%	66.7%	0.97
Use of air transportation	15.6%	25.9%	0.99
Use of international freight forwarders	66.9%	70.1%	0.29
Use of non-vessel-operating common carrier	33.2%	24.5%	0.84
Number of logistics functions	4.2	5.1	1.00

Source: Murphy et al. [1995] p. 11.

According to the survey, international freight forwarders were the most popular, and the main reason why they were used was the document requirement[16] indicated in the first place and because of the customs implications. International cargos representing 28.4%

[15] Hong et al. [2004b] found that asset value had a positive and headcount a negative effect on the outsourcing activity of Chinese enterprises. They explained the latter by the mostly state-owned Chinese large companies and the underdeveloped logistics service provider market. Hong et al. [2004a] identified as contingency factor also the type of the industry and of production (JIT, mass customisation, large- or small-volume production), but not the ownership relations (state-owned, foreign-owned, joint ownership, other).

[16] 40-50 different documents are needed for an average export-import transaction, with around 360 copies (Czakó and Reszegi, eds. [2010] p. 384.)

of the total turnover of the respondents were delivered mostly by waterways, and they were rather active in the selection of the ports.

Murphy et al. [1999] studied the service provider choices of 116 small and large firms from North Eastern Ohio, and came to the following conclusions:

- There were significant differences between the small and large businesses in terms of the choice of the mode of transport of outbound shipments by truckload motor carriage parcel/express land and railroad transport[17], and of that of inbound shipments in the choice of parcel/express air and railroad transport.
- In terms of the origin of inbound shipments and the destination of outbound shipments[18], it was only in regard of places of origin and destinations outside the US that the tests revealed no significant difference.
- Large firms used almost twice as many logistics intermediaries and differed in this respect significantly from the than small ones, except for the transport brokers.

Pearson and Semeijn [1999] investigated 301 American exporters and importers and found little difference in the logistics service features of small and large firms. Both identified the same items as the three most important (reliability, lead time, cost) and two least important (distribution services, warehouses) features of logistics services. There were significant differences; on the other hand, in regard of the following:

- Small firms deemed freight forwarding more important than large ones. The researchers explained this by their lack of international freight shipment experiences, shortage of employees, and their smaller cargos of irregular frequency.
- The carrier considerations were less important for the small businesses, due presumably to their smaller volumes of production and higher flexibility allowed by the smaller number of suppliers. According to Pearson and Semeijn [1999], lack of resources is conducive to an easier change of carrier, and the less widespread use of JIT transportation requires less carrier stability. Therefore, small businesses are forced to have recourse to minor carriers.
- The shipping considerations were less important for the small businesses, which was attributed by the researchers to their knowledge of their own endowments, their

[17] There was no significant difference in terms of less-than-truckload motor carriage, parcel/express air, railroad, maritime and inland water transport.
[18] Based on the categories of: Ohio State, other US states, outside the US

smaller demand for global carriers and the fact that they were less capable of enticing forwarding firms to make customer-specific investments.

Besides the logistics outsourcing practice of large companies and SMEs, the researches tried to find an answer to the extent and reasons of outsourcing by involving both the clients and the service providers. McIvor [2000] designed the following four-step evaluation framework for outsourcing:

Stage 1: Define the core/other activities of the business. Unless warranted by strategic considerations, the latter are outsourced.

Stage 2: Evaluate relevant value chain activities.

Stage 3: Total cost analysis of core competences, where the lack of service providers or the higher competence of the company is conducive to own performance (its preservation or development).

Step 4: Relationship (service provider/supplier) analysis. Where a sufficient number of suitable service provider/supplier or service provider/supplier implying little hazard is available, that is conducive to the strategic outsourcing of the activities. The opposite, i.e. insufficient number of suitable service provider/supplier or little danger of competition in the future, is conducive to own activity.

One deficiency of McIvor's model is the implicit assumption that only the above outcomes are possible (e.g. there is no service provider capable of servicing the core competence and implying significant hazard).

There is a rich literature on the reasons and advantages/disadvantages of logistics outsourcing, but it is based almost exclusively on the examination of large firms. Selviaridis and Spring [2007] assign the relevant reasons to three categories: strategy-, finance- and operations-related.

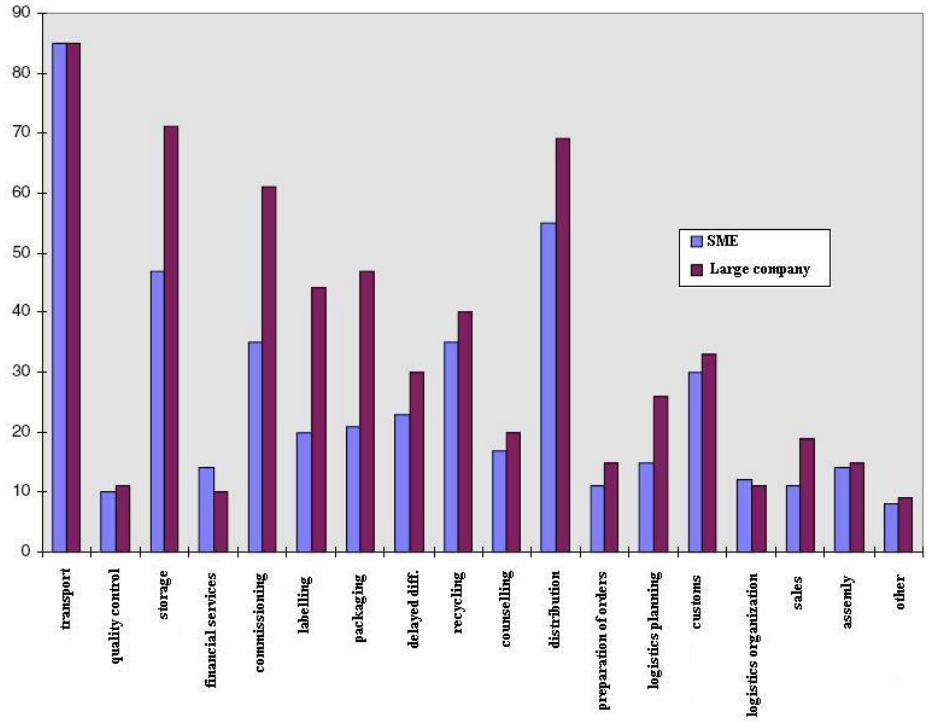
- The strategic advantages include most frequently the core competences and focusing on external expertise (e.g. Sink and Langley [1997]). The disadvantages include the loss of logistics competency, of control over this activity and of contact with the clients (e.g. Ellram and Cooper [1990]).
- The financial advantages are the possibility to make fixed costs variable (e.g. Beumer et al. [2009]) or to exploit the economies of scales (e.g. van Damme and Ploos van Amstel [1996]). However, it is not easy to evaluate cost savings given the

fact that clients are not always aware of the costs of logistics (see below under the section on logistics performance).

– The main operational advantages are the decrease of inventory levels, cycle and lead times, and the improvement of client service (e.g. Daugherty et al. [1996]), but there are also many disadvantages such as the inadequate expertise of the service provider, the loss of client feedback, inability to handle special needs and emergency circumstances (e.g. Ellram and Cooper [1990]; Sink and Langley [1997]).

Uhlig and Gelinas [1994] studied logistics outsourcing at 332 German companies, including 65 service providers and 267 service users. They found that small businesses most frequently outsourced transportation, distribution and warehousing/storage, and larger companies relied on outsourcing to a larger extent. 92% of companies using logistics outsourcing took this circumstance into consideration in their respective corporate strategies, and 86% among them actually benefited from that. They regarded logistics outsourcing as a strategic issue and a source of acquiring a competitive edge, and chose it mainly to reduce costs, enhance flexibility, or refused to use it to preserve their independence, for strategic considerations, to avoid excessive costs, to satisfy the demand for special services, owing to the difficulties of communication and co-ordination and the wish to preserve know-how. Small company size was the last among the reasons of rejection.

Figure 4: Demand of German large and small firms for logistics services to be outsourced



Source: Uhlig and Gelinas [1994] p. 734.

In the research conducted by Gelinas and Bigras [2004], 48% of small businesses and 68% of large companies in Quebec had recourse to logistics service providers. 27% of large companies was in strategic partnership with logistics service providers; among the small businesses, the corresponding rate was a mere 5%.

67% of Hungarian SMEs surveyed by Vízhányó [2006] thought of logistics outsourcing that it did not tie down the executive resources, and 63% considered concentration on the core competence its main advantage; 41% indicated cost reduction, 37% higher-quality client service, 30% more flexibility and 26% higher efficiency. The rank order of the disadvantages was loss of control over the process, excessive dependence, problems due to lack of communication, risk to operational safety, increase of transaction costs or difficulties of forecasting financial effects. They had the logistics activities performed as shown in Table 7; as for warehousing, in-house solutions excelled at 63%, 29% rented such capacities and 8% used a mixture of the two solutions.

Table 7: Outsourcing of logistics activities of Hungarian SMEs

	To external service provider	Own solution	Both
Freight forwarding	74%	0%	26%
Domestic transportation[19]	34%	38%	38%
Warehousing and commissioning	0%	89%	11%
Customs clearance	46%	37%	17%
Packaging	17%	71%	12%

Source: Vízhányó [2006] p. 64.

As for the requirements to be met by the logistics service provider, 25% indicated punctual delivery, 24% adequate price, 12% flexibility, 11% quality service, 9% expertise, skills, 8-8% good partner relations and an adequate technical/technological background and 3% the service package being offered (Vízhányó [2006]).

Although SMEs have a high demand potential and several service providers actually advertise themselves as providing such service, according to Kummer [1995] SME-specific logistics services are missing. Small service providers are a better match for the small business, because they are agile and more closely linked to the latter (Harrington [1995]).

In what follows, I will present five case studies presenting logistics outsourcing at small and medium-sized enterprises and pointing out that, for the SMEs, the objective of cost decrease due to logistics outsourcing is often overwritten by other reasons, or the activity itself is performed in a relatively primitive way. In addition to the case studies quoted here, I know of many other Hungarian researches conducted mainly for consulting or university thesis purposes which, however, could not be used here due to the confidentiality requirement.

The goods of the commercial representative of a pharmaceuticals and diagnostic equipment manufacturer needed special handling and fast delivery to be competitive, which was realised by the small firm by engaging a private carrier and a pharmaceuticals wholesaler besides using its own lorry. Futakfalvi [2007] came to the conclusion based on his studies that although the prices of the service provider would

[19] The total of the source values exceeds 100% due to rounding.

have been lower, the change-over would not have been worth the effort due to other factors (personal contact in delivery, decrease of client service quality, possible price increase, low capacity vehicles providing groupage transportation service), nor the in-house performance of the entire activity. As a result of the investigation, cost decrease was produced at one partner.

The main hindrance to transportation outsourcing by a medium-sized baker firm studied by Nagy [2008] was the confidential nature of the relationship (the drivers were often given keys to enter the smaller shops to be able to leave the goods there by opening time and to collect their counter-value). Furthermore, no service provider meeting the requirements (reliability, flexibility, continuous availability, short, rigid delivery time windows), in command of an appropriate infrastructure, contacts and know-how was available.

Holter et al. [2008] examined at a British metal processing SME producing growth by 40% annually how to turn from order-takers of transportation services[20] to order-makers of the same[21]. To do that, they analysed the parameters of the firm shipping about 300 containers worldwide[22] in the initial year of the research. The following steps were taken to ensure the change-over:

- More systematic information has made the company which used to order transportation one by one more attractive to logistics service providers, and it received more favourable quotations.
- For the sake of comparability, the tender formats were unified and detailed (e.g. transit time), and they were processed with the help of a cost model. This promoted two of the conversion decisions of the management (service/cost, lead time/cost).
- Key performance indicators (KPI) were designed for the service errors and the transit times (e.g. average length of delays), to which they assigned costs later on.

Regular conciliations with the logistics service providers have led to improved service performance.

[20] It cannot benefit from competition in the transport market; does not know how to obtain good service for a competitive price. (Holter et al. [2008] p. 23.)
[21] Able to exploit market conditions, obtain competitive rates, specify service levels; it is proactive and has some level of expertise in transport purchases. (Holter et al. [2008] p. 23.)
[22] Freight cost, transit time, transport visibility, on-time delivery, cost of transport management.

A small firm trading in large kitchen equipment studied by Tóth [2009] purchased its mostly high-value and high-volume products from foreign partners, and commissioned several logistics service providers to deliver them in addition to its own delivery. Its difficulties included a minimum export volume, special needs (e.g. tail lift truck, fragile goods) and its low storage capacity. The quality problems of the logistics service providers have led to frequent partner changes. They optimised deliveries abroad by their own facilities by organising quasi-roundtrips, but they did not measure in detail the services and the quotations. Detailed cost analysis has shown that engaging external service providers – albeit at a relatively low level[23] – would cost maximum half of delivery by own carrier means, but due to the quality requirements (e.g. weekend delivery, reliability) for the moment the only potential alternative was closer co-operation with one freight forwarder and better service monitoring, which could have been followed later on by the possible sales of own carrier means. They have also examined joint transportation with other SMEs, but this idea was discarded (Tóth [2009]).

Chao and Shah [2010] examined logistics outsourcing by four Taiwan-based manufacturing small businesses and found that none of them had a strategy for the outsourcing process and they understood it to a limited extent only. Outsourcing was motivated primarily by lack of resources and/or expertise and, in the second place, by cost considerations, and the objective they set for themselves was to minimise transportation costs and ensure on-time delivery. Only one among them did a formal evaluation of service providers, and they concluded maximum one-year service contracts. They considered their relationship with the service providers a tactical partnership, and did not execute continuous process supervision and improvement.

In summary, few general conclusions can be drawn in regard of logistics outsourcing, and the majority of articles devoted to the topic do not examine the theoretical background or, if they do, the most frequently proposed explanations relate to transactions cost economics and (core) competencies associated with resources theory. According to the surveys, the level of logistics outsourcing examined also under other names (e.g. 3PL, contractual logistics) has kept increasing in recent years, shifting from

[23] Results after taxation could improve by almost 20%.

the individual to the more complex services, and it was more frequent in the developed than in the developing regions. Ivanaj and Masson Franzil [2006] and Hong et al. [2004b] considered company size a contingency factor of logistics outsourcing, but according to Bardi and Tracey [1991] this is not obvious. Logistics outsourcing researches identified some significant differences between large companies and SMEs (Evans et al. [1990]; Murphy et al. [1999]; Gelinas and Bigras [2004]) which, however, disappeared in case of engaging in international trade (Murphy et al. [1995]; Pearson and Semeijn [1999]). In the opinion of Chao and Shah [2010]), SMEs logistics outsourcing is motivated by tactical rather than strategic considerations, but the rank order of decisions pros and cons are rather varied (Uhlig and Gelinas [1994]; Vízhányó [2006]), although according to certain case studies (Futakfalvi [2007]; Nagy [2008]; Tóth [2009]), the possibility of cost decrease may be overridden by other considerations.

2.3. Logistics performance

Logistics performance "is the evaluation of the effectiveness of (logistics) activities from the point of view of efficiency (compliance with the consumer requirements), and economical operation (economical nature of the utilisation of resources associated with a given service quality)" (based on Chikán and Demeter eds. [2004] p. 532.), the main function of which is decision support. The quantification, i.e. measurement, of logistics performance is based essentially on financial indicators, and several methods are used for it from activity-based costing (ABC) through the logistics scoreboard method[24] to the supply chain models (e.g. SCOR[25]). The methods concerned have been designed basically for large companies, but some are adapted also to SMEs (e.g. for SCOR: Thakkar et al. [2009b]). This section reviews the researches concerning the logistics performance of SMEs, with special regard to the surveys on logistics costs.

According to Halley and Guilhon [1997], the logistics performance of small businesses can be examined from several aspects:

– from the point of view of (external) financial indicators (e.g. transportation costs, stock turnover) it is relatively underdeveloped and reactive,

[24] Logistics scoreboard is essentially a version of the Balanced Scorecard adapted to logistics: it consists of the indicators of financial performance, logistics productivity (e.g. from capacity utilisation), logistics quality (e.g. damage to goods) and logistics cycle time (e.g. delivery time) (Frazelle [2002]).
[25] Supply Chain Operation Reference.

- from the point of view of organisational indicators, it is a developing activity,
- through the value-creation indicators it appears as a proactive activity affecting the competencies which extends the control of the owner/manager.

For the sake of the continuous improvement of the logistics processes, Bagchi and Virum [2000] analysed the logistics performance of Norwegian SMEs, and their main findings were the following:

- The total response cycle time consisting of the time from ordering to acceptance of goods from the supplier, length of time in raw material stock, length of time in production, length of time in finished goods stock, time from customer order to receipt of finished goods and to bill payment ranged from 81-584 days, with high variance within the industry.
- As for the improvement of the logistics management processes, special attention was paid to setting customer service objectives and to organising the improvement of the logistics processes. Contrary to the researchers' expectations, the fish processing and textile companies managed their logistics well.
- The effect on return on total assets was explained decisively by the reduction of total logistics costs and of time spent on the logistics processes, the organising for the improvement of logistics processes and the setting goals for customer service.

Grando and Belvedere [2006] examined whether the production and logistics performance of a cluster-member (industrial district) SME was better than that of an "independent" one, and whether it could bridge the gap between the former and a large company. Cluster member SMEs showed the best performance from the point of view of operational and logistics speed. The researchers have found that cluster membership significantly enhanced response capacity, and although product quality was better at the "independent" SMEs, it was worse than that of large companies. Large companies excelled in terms of flexibility, production planning and quality, and the "independent" SMEs in terms of innovation. Grando and Belvedere [2006] were of the opinion that SMEs ought to improve their product quality and delivery reliability via the spread of the supply chain principles if they want to take part in the production network.

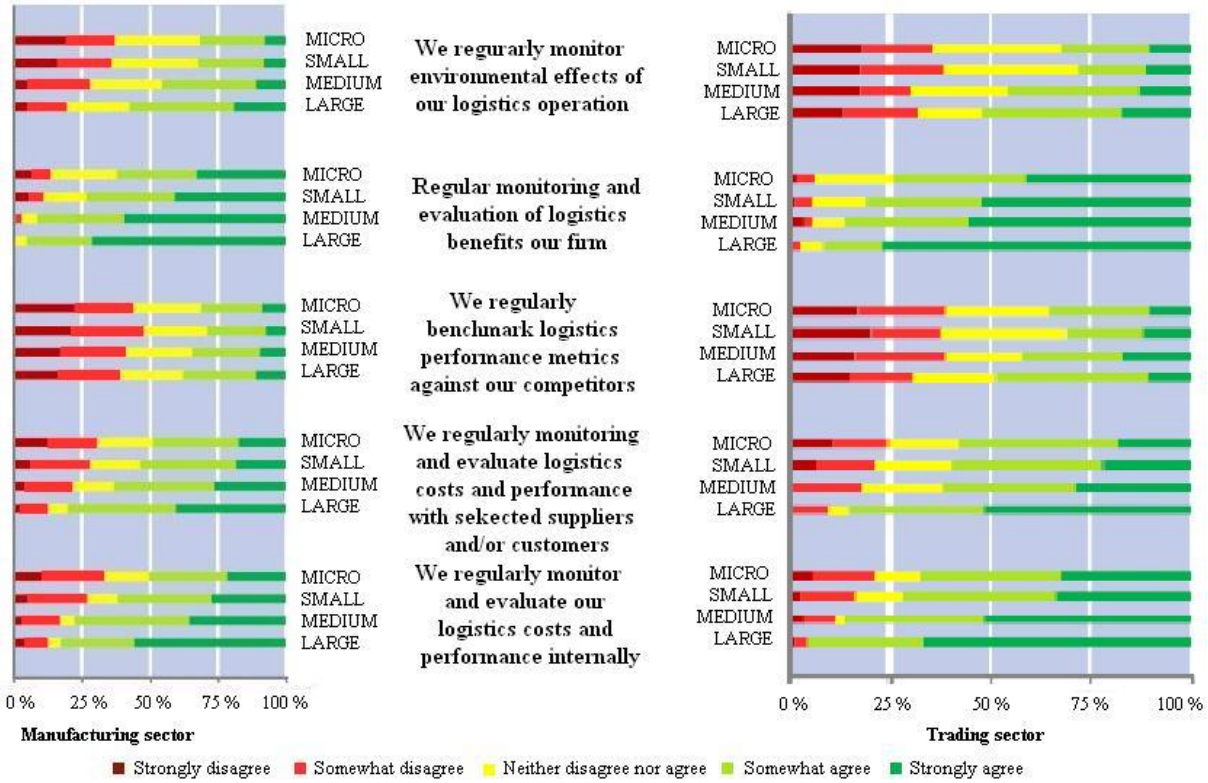
The interrelationship between the logistics and financial performance of Finnish SMEs was investigated on the basis of the cost, service level[26] and other[27] data of the "Finland State of Logistics" survey of 2006 [28]. Töyli et al. [2008] came to the conclusion that there was no statistically observable positive linkage between the logistics and financial performance of the enterprises under study. The analysis of the data for 2008 yielded similar results, again without significant realtionship between logistics outsourcing and performance (Solakivi et al. [2011]). This is all the more interesting since it is generally assumed in the logistics literature that excellent logistics performance is concurrent with high financial performance, and this has been confirmed by empirical studies in retail trade (Schramm-Klein and Morschett [2006]), manufacture (Shang and Marlow [2005]), and other areas (Bagchi and Virum [2000]; Gritsch [2001]). The same has been demonstrated in part by the relationship of certain logistics components and the profits of the company in the circle of Norwegian small and medium-sized enterprises (Lea et al. [1996]), and also the relationship identified at the Greek SMEs which has shown that logistics had a direct impact on corporate performance (Orfanos et al. [2010]).

Logistics service quality and cost efficiency were positively related, that is, enterprises characterised by relatively high service quality had relatively low logistics costs. In the opinion of Töyli et al. [2008] this suggests that Finnish SMEs have started to pay more attention to logistics recently only.

Finnish enterprises monitored most frequently the internal logistics costs, performance and the benefits thereof of the enterprise itself and its suppliers and customers, and least often the impact on the environment and the logistics performance benchmark relative to their competitors.

[26] perfect order fulfilment %, order cycle time
[27] inventory level, sales outstanding
[28] excl. of companies with fewer than 5 staff members

Figure 5: Monitoring and use of key indicators by Finnish enterprises



Source: Based on Solakivi et al. [2009] pp. 75-76.

Given their more limited resources, small businesses spend little time on purchasing and devote that to improving its efficiency; with better purchase planning, small businesses can liberate resources for creative, profit-generating activities (Dobler [1965]). Presutti [1988] studies Pittsburgh-based manufacturer small firms and showed that 82% agreed that the purchasing activity was a main source of profit for their company. Many of the small firms based in Denmark and in two US states, Indiana and California, studied by Paik et al. [2009] realised that purchasing had a significant impact on the profitability of the company, and they believed they depended to a significant extent on the efficiency of this function. The researchers think that many small business are in a 'captive buyer situation'. Paik et al. [2009] found that the complexity of the purchasing activity[29] had a positive effect on its development[30] at American companies.

[29] Measured by the impact of purchased goods and services on total costs, degree of technological change and substitute source of supply.

[30] Measured by time spent on purchasing activities, on co-ordination, on the extension of the purchasing function, by the qualification of the staff, the method of supplier selection, the purchasing performance measures, the types of supplier relations and the recognition of the importance of purchasing.

2.3.1. Logistics cost(level)s

A frequent measure of logistics performance is the level of logistics costs which has no commonly accepted definition. Furthermore, cost, expense and expenditure levels, respectively, are often treated as if they were synonymous, moreover their reference bases are different. As for the cost components of logistics, what excels at theoretical level is transportation costs examined for the first time by von Thünen [1826] in connection with the transportation of agricultural products to a single market. Transportation costs and through them the spatial approach have not been integrated in economics thinking even after the appearance of the iceberg principle of Samuelson (Samuelson [1952]); this has only occurred with the awarding of the Nobel Prize to Krugman [1991] for his article "Increasing Returns and Economic Geography".

There are two main research trends for determining logistics costs: the corporate and the macro-level one. The latter estimates the logistics costs, expenditures of certain countries usually with the help of econometric models (Rodrigues et al. [2005][31]; Klaus [2008]; Wilson [2009]; King [2010]), or based on corporate statistics (Elger et al. [2008]).

Since this Thesis treats the levels of logistics costs of small and medium-sized enterprises, I shall review in more detail the researches focusing on that topic here.

According to a research covering German precision engineering and optical SMEs, 42.4% rendered no accounts of their logistics costs (Berr et al. [1990]) and, albeit to a smaller extent, the same phenomenon was perceptible also among manufacturing small and medium-sized enterprises in Mexico (Campos-Garcia et al. [2011]). The SMEs are aware of their logistics costs to a moderate extent or not at all (Tempel and Meißner [2002]) and, as shown by the case of the 30 Norwegian SMEs examined in detail, none are aware of all of their components (Virum [1994]). The level of logistics costs of small and medium-sized enterprises must be treated with caution for the following reasons:

1. A significant part of the cost data are estimates and their reference bases (sales revenues or total costs) are not uniform in the researches. There are generally no cost centres at the SMEs (for medium-sized enterprises, the vehicle fleet, the

[31] According to their macro-level estimate based on a neural network, in Europe logistics expenditures amounted to 12.2% in 1997, 12.8% in 2000 and 13.3% in 2002.

inventory or the warehouse may be cost centres), and "logistics costs are treated as overheads" (Tempel and Meißner [2002] p. 56.). There is a shortage of data in the area of logistics costs (Kummer [1995]), and neither does the IT system support their collection everywhere[32], and if they are monitored at all (see Figure 5), that is not always done regularly.

2. Determination of logistics costs are not unified (e.g. packaging cost[33]), and they can be approached in several ways (e.g. shipment or carrier cost[34]), as is well-indicated in Table 8.

Table 8: A possible division of logistics costs

	Direct logistics costs	**Indirect logistics costs**
Alternative or overhead costs	Warehousing cost Time value Operation costs	Costs of lost sales Costs of customer service level Costs of non-marketable goods IT purchasing & maintenance costs
Cost related to activities	Transport (freight) Cargo handling Inventory costs Shipping route, toll fees Documentation costs Direct IT	Packaging materials Packaging costs Costs of logistics equipment, premises and capital Administration cost

Source: Solakivi et al. [2009] p. 21.

3. In most cases, non-representative researches contained also the values of large firms or SMEs of a similar size to them. Furthermore, costs levels are presumably influenced also by the different branches, the strategies, the main sales markets, the INCOTERMS clauses[35], the operating environments and efficiency[36].

[32] IT supported the recording of logistics costs at only almost half of the 300 enterprises covered by the 2009 "In competition with the world" survey (Chikán et al. [2010]). According to a survey of 48 Italian, German and Hungarian automotive industrial enterprises (87.5% SMEs), one third only measured their logistics costs (Pezzotta et al. [2006]).

[33] Packaging can mean consumer (primary), groupage (secondary) or transportation (tertiary) packaging.

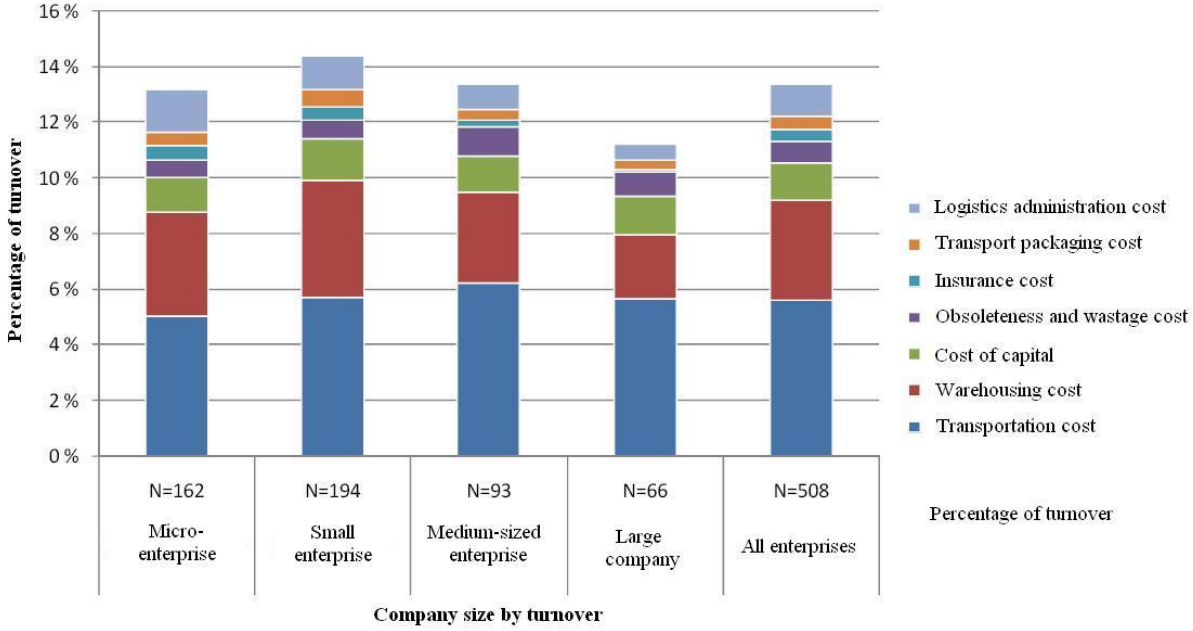
[34] It is identical in terms of content, but it is transportation cost if the activity is performed by the company itself and forwarding cost if it engages a third party service provider.

[35] If a given enterprise buys its product at EXW (ex-works) than its logistics costs are much higher than if it does at e.g. DDP (delivery duty paid).

[36] According to IMD [2008], in Hungary, the efficiency of the SME sector was substantially lower than that of the large companies; in Finland, the two were quasi-identical whereas in Germany the efficiency of SMEs exceeded that of large companies.

According to Bagchi and Virum [2000], the average logistics costs of Norwegian enterprises which are mostly highly competitive also at European level corresponded to around 10% of the sales revenue, with significant variation even within the same industry. For example, it was e.g. 14.3-16.0% at fishing companies distributing mainly low-price products (e.g. cured herring), and only 5.0% at those with high-price products. Tőkés [2010] studied Hungarian textile industrial companies and obtained similar results. Lea et al. [1996] found that the total logistics costs of exporter Norwegian manufacturing SMEs increased by large proportionally with their sales revenue, and although the same occurred to a smaller extent also with the increase of the added value of the inputs, increasing stock rotation diminished its extent. The researchers found logistics costs lower by 5.1% at Norwegian SMEs with a longer export history, higher by 8.7% at SMEs struggling with supplier problems and higher by 9.2% at those faced with short-term decline in demand (Lea et al. [1996]). Hovi and Hansen [2010], also investigating the logistics costs of Norwegian enterprises, found economies-of-scales effects based on company size (sales revenue as well as headcount).

Figure 6: Logistics cost levels of Norwegian manufacturing, commercial and construction industrial enterprises in 2007



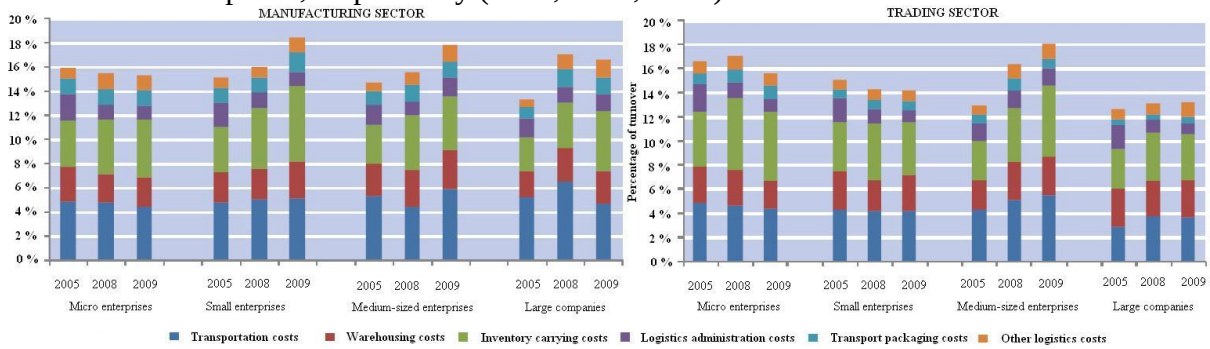
Source: Hovi and Hansen [2010] p. 27.

In 2004, the logistics cost levels of Hungarian SMEs was estimated at around 12.1% of their sales revenue (it was 11.3% for producers, 14.4% for commercial firms and 10.5%

for service providers) (Szabó [2005]). One year later logistics costs represented 19.18% of the total costs of small and medium-sized enterprises on average; it was much higher for commercial enterprises (21.94%) than for the producer ones (11.40%). Within the costs of logistics, the carrier (46.6%), and warehousing and inventory costs (37.1%) were the decisive components[37] (Vízhányó [2006]).

In 2009, the total logistics costs level of Finnish enterprise was 11.9% on average; within that, the corresponding figure for micro enterprises was lower than in the surveys of 2005 and 2008, whereas the one for small and medium-sized enterprises was higher. According to Solakivi et al. [2011] the rule of thumb, i.e. the "larger the company, the lower the cost level" is not true for medium-sized enterprises which must take into account the costs of growth already, but are too small to exploit any economies of scale (e.g. to enforce their conditions on the supply chain partners). Within the total logistics costs, the costs of transportation and stock-piling were the most significant; for the SMEs, the latter was raised also by demand fluctuations and by the attitude of large companies to suppliers (Solakivi et al. [2010]). In the research of 2005, the logistics costs level of exporter[38] SMEs was significantly lower than that of the ones producing for the domestic market (Naula et al. [2006]), but by 2008, this tendency reversed (Solakivi et al. [2009]).

Figure 7: Development of the logistics cost levels of Finnish manufacturing and commercial enterprises, respectively (2005, 2008, 2009)



Source: Based on Solakivi et al. [2010] pp. 76-77.

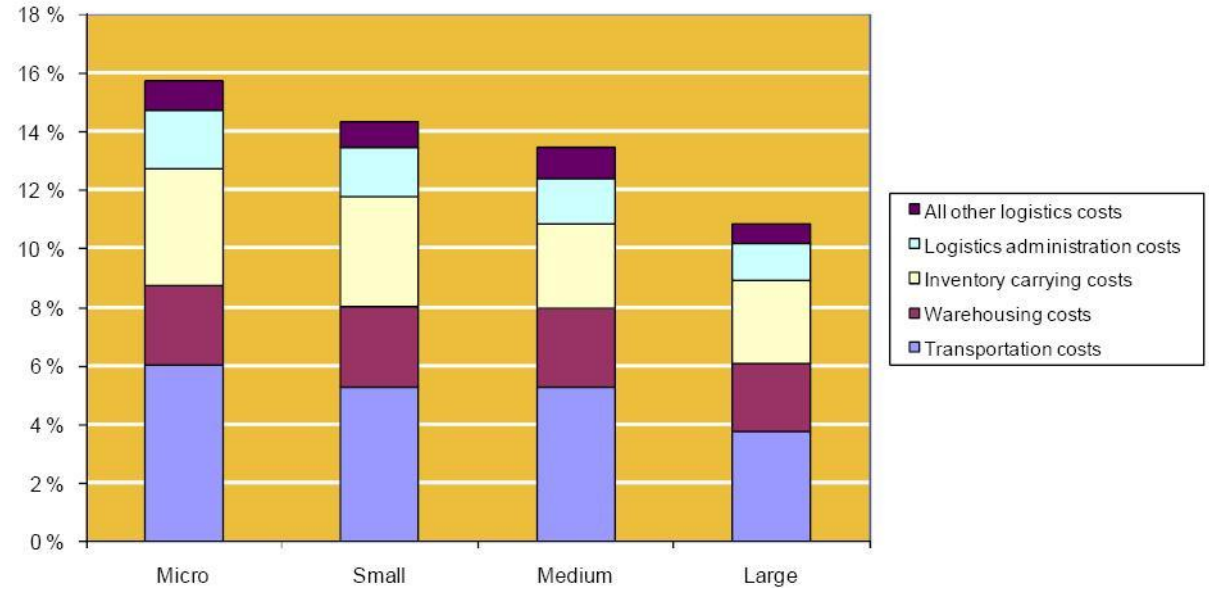
The paper by Solakivi et al. [2011] analysed 223 Finnish manufacturing and trading SMEs based on the data of the Finnish logistics survey of 2008. Resembling to inverse

[37] Packaging and commissioning contributed 8.6%; intra-plant transportation 2.4%; customs 2.1%; order processing 2.0%; cargo insurance 0.1% and other costs 1.1%.
[38] Min. 10% of sales revenues generated by exports.

U-shaped relationship was found between logistics outsourcing and costs: the levels of the total costs and of the individual partial costs, respectively, were slightly lower for entities which had no recourse to outsourcing or which outsourced more than half of their activities than for those in the interim category. The authors noted that outsourcing SMEs were more aware of their logistics costs.

A survey similar to the Finnish one, covering 1234[39] manufacturing (and construction industrial), trading and logistics service provider enterprises from eight countries[40] of the Baltic Sea region found that total logistics costs measured in proportion of sales revenues decreased with the growth of company size[41], and in manufacturing, it was independent of the geographic location of the entity concerned (Ojala et al. [2007]).

Figure 8: Logistics costs of enterprises from the Baltic Region, 2006-2007



Source: Ojala et al. [2007] p. 38.

The logistics costs of 99 Mexican manufacturing SMEs were estimated at 21.94% of their sales revenue, and this was in positive realtionship with logistics practice (Campos-Garcia et al. [2011]).

[39] Large companies represented 9.1%.
[40] Estonia, Finland, Poland, Latvia, Lithuania, Germany, Russia and Sweden.
[41] The logistics costs of large companies are lower than those of micro enterprises by around 5 percentage points, and those of SMEs by 3-4 percentage points.

It is often said in connection with logistics costs that logistics should be used "as a vehicle for reducing costs" (e.g. reduce freight costs through negotiation and freight engineering; reduce investment costs with inventory information) (Harrington [1995] p. 60.). The idea of appropriate costs is present also in some logistics definitions (e.g. Ballou [1973]; Williams, [1987]; CLM [1986], quoted by Halászné [1998]); in the 7M principle presenting the objectives of logistics (Szegedi and Prezenszki [2003]), and the concepts of total costs and trade-offs introduced by Lewis et al. [1956] have been decisive components of the logistics approach to this day. Enterprises can reduce their logistics costs primarily by exploiting the economies of scale. Wagner and Alderdice [2006] illustrated through the example of a fishing co-operative how in co-operation with other SMEs and acting as something of a distribution centre, as a supplier of large retailers (e.g. Tesco), Scot Trout and Salmon reduced its distribution costs by one fifth. One of the main objectives of the logistics policy of the Finnish state is also to reduce the logistics costs of enterprises (Naula et al. [2006]), and Norwegian transport policy also aims at that indirectly by "reducing the drawback of distance" (Hovi and Hansen [2010]). The same appears also in corporate practice (e.g. Vízhányó [2006]), and according to Halley and Guilhon [1997] typically in companies with unintegrated logistics. The effects of cost decrease, however, are limited, and the consumer value enhancement options may be lost (Kummer [1995]). The same is highlighted by La Londe who indicated that for "million dollar customer and you spend an extra 300$ on freight ... may not be cost effective from a logistics standpoint, it is cost effective from a customer retention standpoint" (La Londe, quoted in Harrington [1995] p. 56.).

In summary, the assessment of the logistics performance of small businesses based on the financial, organisational and value-creating aspects will yield different results (Halley and Guilhon [1996]), and the logistics response capacity of small and medium-sized enterprises is enhanced by cluster membership (Grando and Belvedere [2006]). Some researches have identified realtionships between certain logistics components and company performance (Lea et al. [1996]; Orfanos et al. [2010]), but according to Töyli et al. [2008] and Solakivi et al. [2011], there is no statistically significant positive relationship between logistics and financial performance.

From among the components of logistics performance, cost levels are given a priority role, and they are examined at macro- or corporate level. At the latter, according to the surveys, the logistics costs of SMEs correspond to less than 22% of their total costs or

sales revenues. Most SMEs are aware to a moderate extent or not at all of their logistics cost level (Virum [1994]; Tempel and Meißner [2002]), or they assume it is zero (Berr et al. [1990]; Campos-Garcia et al. [2011]). In the opinion of Solakivi et al. [2010], the rule of thumb according to which the total costs of logistics decrease with the increase of company size is not true for medium-sized enterprises. According to Lea et al. [1996], total logistics costs increase by and large proportionally with sales revenues, and the same occurs to a smaller extent also with the increase in the added value of the inputs, but the increase of stock rotation decreases the rate of the latter. The researchers found lower logistics costs at SMEs with a longer export history and higher ones at those faced with supply problems and short-term decline in demand (Lea et al. [1996]). The reduction of logistics costs is often set as an objective, (Harrington [1995]; Naula et al. [2006]; Hovi and Hansen [2010]; Vízhányó [2006]), with such goals have limited effects (Kummer [1995]).

2.4. Logistics strategy

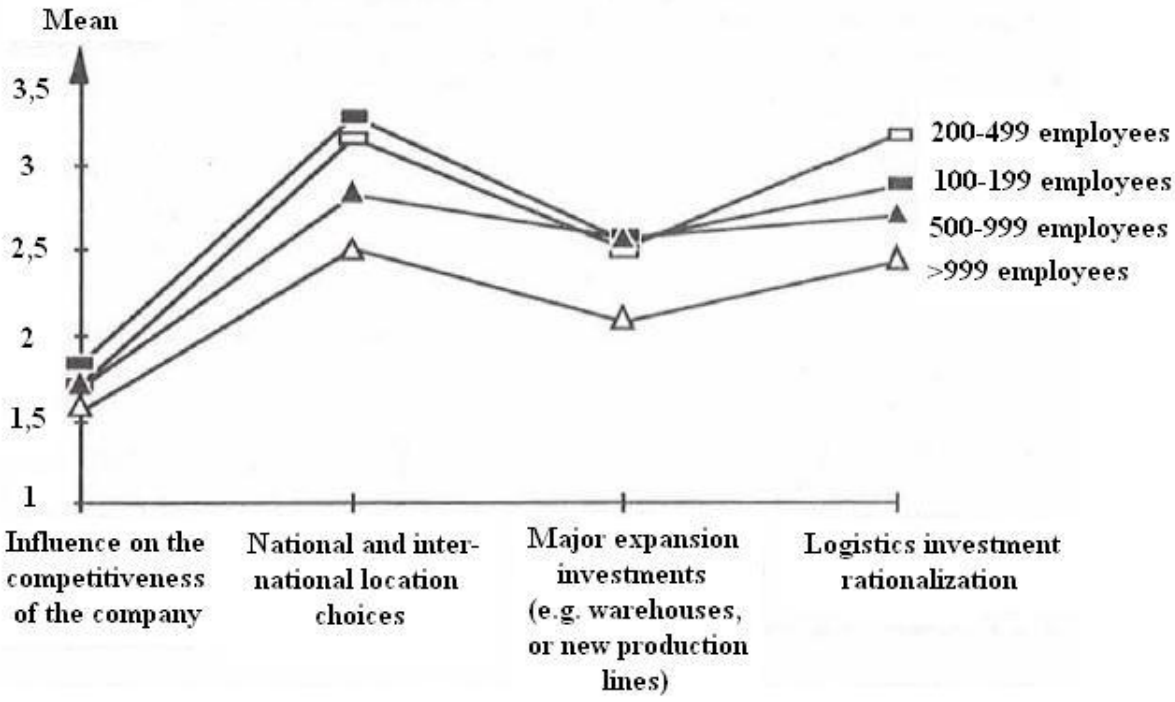
Logistics strategy as such appeared for the first time in the work of Heskett [1977], but according to Kent and Flint [1997], it took it a decade to "turn into the guideline of company operation", the part of corporate strategy "expressing corporate objectives and the method of achieving them" (Chikán [2008] p. 187.). Halley and Guilhon [1997] were of the opinion that the logistics strategy of small businesses could only be studied in function of their corporate strategy. Strategic planning at SMEs is weak or non-existent[42], with the inherent risk that the strategic components are absent from the planning of the logistics system, no strategic benefits are realised and the logistics system may even neutralise the strategy of the company. Kummer [1995] attributes the logistics backlog of SMEs to fast growth in a constant structure and also to management reasons (narrow circle of managers, improvisation, intuition, instinct, tactical rather than strategic management, low information base, low propensity for consulting and training). Logistics should first be given a greater strategic role to be regarded as potential resource rather than necessary evil (Harrington [1995]).

Kummer [1995] examined also the relevance of logistics factors in strategic planning, and found that the competitiveness effect was the strongest of all. He identified

[42] The strategy of Hungarian SMEs tends to evolve on its own rather than being developed (Salamonné [2007] p. 23.).

significant differences between the various enterprise size categories in terms of choice of business site and the rationalisation of investments, but not in terms of competitiveness[43].

Figure 9: Relevance of logistics factors in the strategic planning of German SMEs[44]

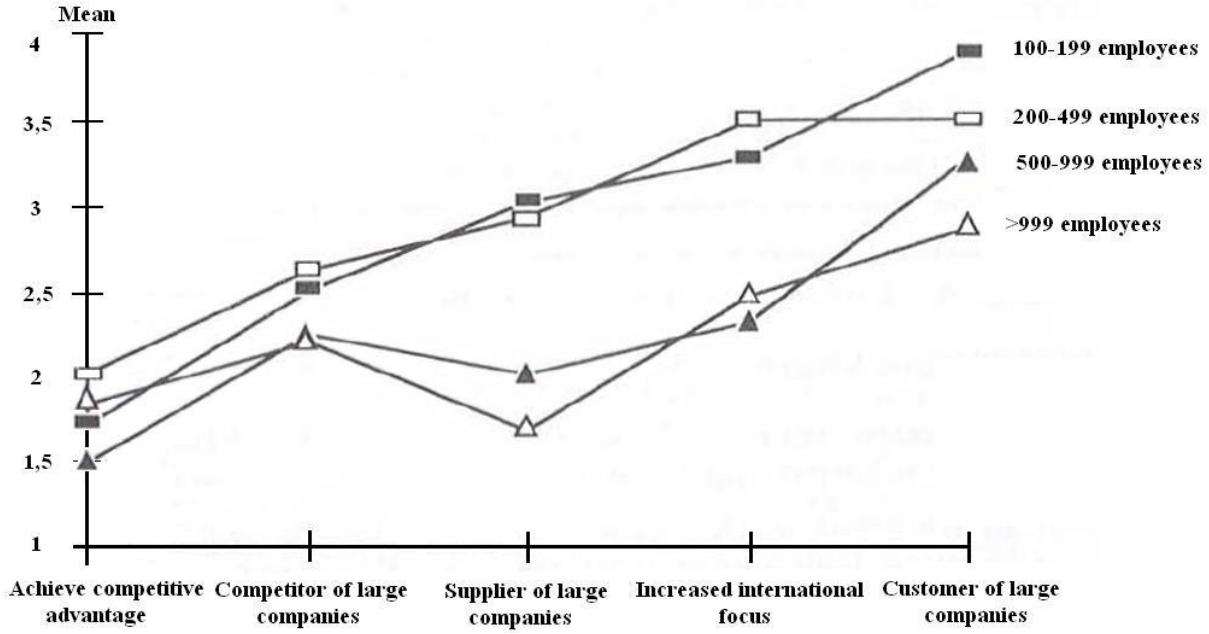


Source: Kummer [1995] p. 42.

Competition ranks first also among the reasons for the introduction of logistics strategies/concepts. Kummer [1992] found no significant difference in this regard by company size, but he did in terms of the suppliers of large companies, their more intensive international focus and their customers. He named as the hindrances to the introduction of logistics strategies/concepts the excessively low capacity of the management, the shortage of employees, inaccessibly or useless logistics information, non-existent logistics planning and ad hoc activities (Kummer [1992] p. 173.).

[43] At the significance rate of only 6%.
[44] On a 5-point (1: most important … 5: not relevant) Likert scale.

Figure 10: Reasons for the introduction of logistics strategies/concepts among German SMEs[45]



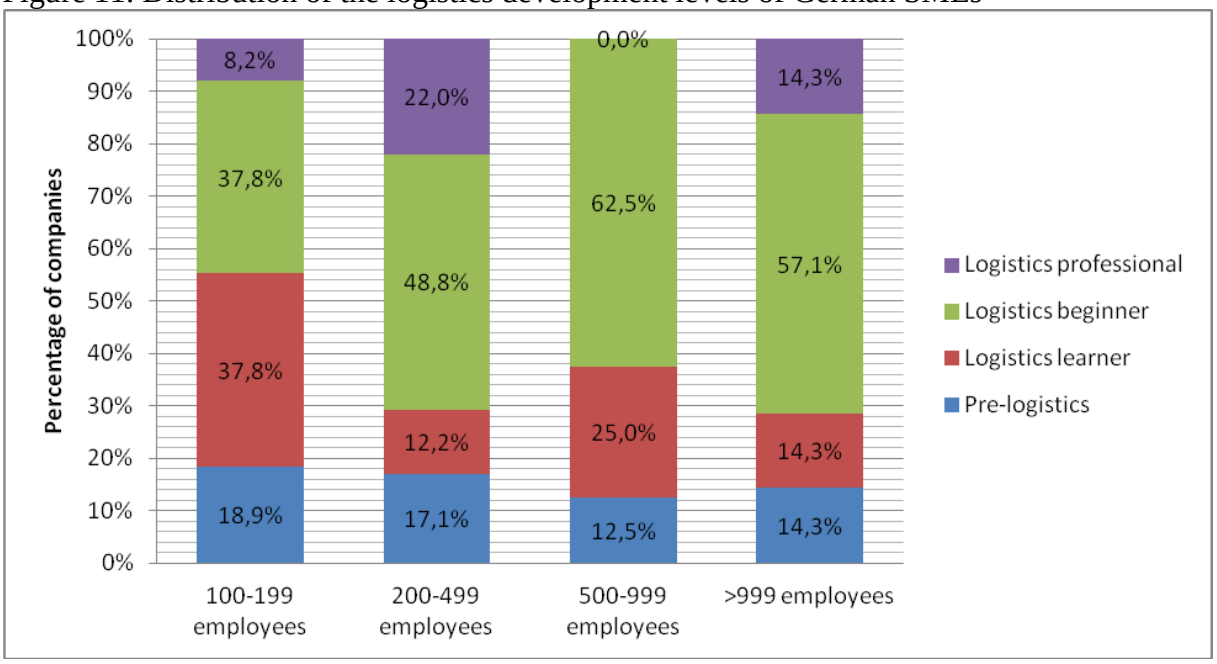
Source: Kummer [1995] p. 43.

Kummer [1995] distinguished four phases of the development of the logistics level of small and medium-sized enterprises, the distribution of which among German enterprises is shown in Figure 11:

1. In the pre-logistics phase, the company logistics tasks are not co-ordinated yet.
2. Interest in logistics represents the start of the logistics knowledge of the employees (e.g. they go to seminars) and the first pilot studies.
3. The phase of initial-level logistics means the isolated, insular implementation of a logistics strategy/concept.
4. In the professional logistics phase the logistics strategies/concepts transgress the boundaries of the company itself; they exploit the effect of the learning/experience curve in logistics, and the logistics strategy/concept is deeply ingrained in corporate practice.

[45] On a 5-point (1: most important … 5: not relevant) Likert scale.

Figure 11: Distribution of the logistics development levels of German SMEs



Source: Kummer [1995] p. 53.

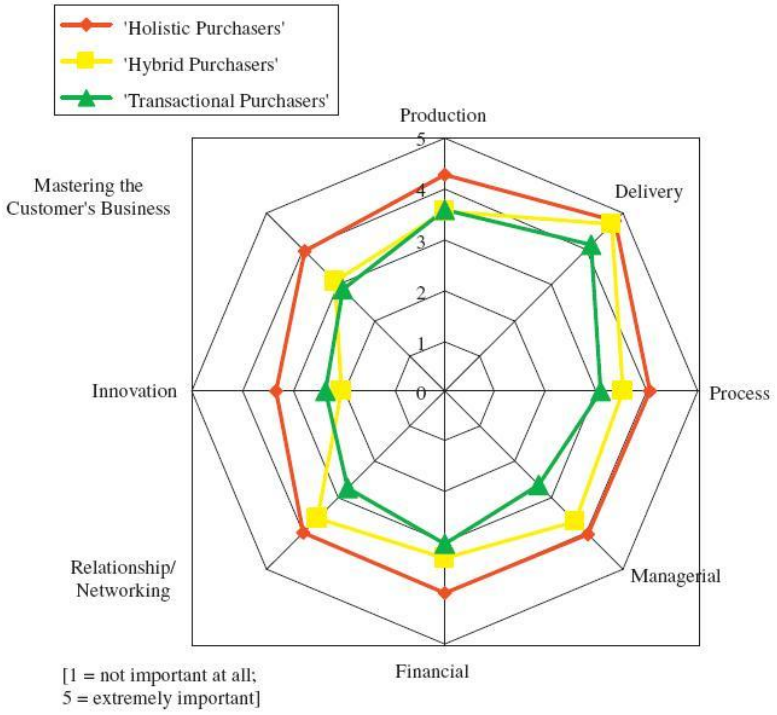
According to Halley and Guilhon [1997] there is no good or bad small business logistics strategy; it is determined by two key factors: the owner-manager and the dependence of the company on its environment. They found basically three types of models of small business logistics strategy (Halley and Guilhon [1997] pp. 487-488.):

- "A deliberate, proactive strategy enables the value chain to be redirected towards high added value activities." Logistics is a strategic function here which conditions the organisational form, the competencies, the fields of areas, while maintaining the owner-manager's control over operations.
- "A reactive strategy, where the gradual adoption of logistics activities allows existing internal and external resources to be maximised. Here logistics is an adaptation tool concerned only with one function of the organisation."
- "An emerging, evolving strategy for young small firms seeking a quality image for their products and processes, while preserving their independence from partners."

A logistics strategy can only be implemented amidst the appropriate conditions; no firm should be forced to introduce logistics in its strategic concerns, but those that do so are more effective in their markets and in their internal processes (Halley and Guilhon, [1997] p. 490.).

Within the technical literature on the purchasing activity of small- to medium-sized enterprises, strategic purchasing[46] is a research topic on its own. Pressey et al. [2009] surveying 97 manufacturing SMEs found that only 12.6% among them pursued such activity, and 48.9% evaluated their suppliers. Their findings coincided with the statement of Quayle [2000], namely that given the differences in size and the competitive quality of the market, strategic purchasing is not a suitable option for small and medium-sized enterprises which are often forced to purchase in small quantities for cash-flow reasons (Zheng et al. [2004]; Zheng et al. [2007]). Pressey et al. [2009] assigned the SMEs into 3 clusters based on the 8 competency groups expected of suppliers, of which holistic purchasers were the most demanding, expecting more of their suppliers in terms of every capability than their process-oriented peers or the logistics purchasers emphasising delivery and production capabilities.

Figure 12: Supplier capabilities expected by SMEs



Source: Pressey et al. [2009] p. 220.

In summary, logistics strategy can only be investigated in function of corporate strategy which, according to Halley and Guilhon [1997], is weak or non-existent for the SMEs.

[46] Preparation of a long-term purchase plan, adjustment to the strategic plan of the enterprise, determination of the type of the relationship with key suppliers and co-operation with other functions (Pressey et al. [2009]).

In the context of planning, the SMEs give priority to the competitiveness effect of logistics, and they focus on acquiring a competitive edge when introducing a logistics strategy. SMEs reach the stage of professional logistics past the stages of pre-logistics, interest in logistics and its initial level (Kummer [1995]). There are proactive, reactive and emerging logistics strategies based on the attitude of the owner-manager and the dependence relationship of the company on its environment (Halley and Guilhon [1997]). The authors are of the opinion that small firms cannot be forced to include logistics among their strategic concerns, and logistics strategy cannot be assigned to the categories of good or bad.

2.5. Logistics in the organisation; its co-ordination and the relevant staff training

The organisation of logistics and its integration into the company structure is given an important role in the technical literature. Most researches on the logistics organisation of SMEs are descriptive and they given an empirical demonstration of contingency theory, Maybe not deliberately. At the same time, the researchers also join a contemporary trend of contingency theory (Donaldson [2001]) by applying it to their own scientific field.

Contingency theory is rooted in several trends (e.g. Weber's bureaucracy theory), and its structural strand in particular examines the relationship between the conditions of operation (contingency factors) and structure of the organisation (Kieser [1995]). Organisation size as a contingency factor, measured usually by staff headcount (Kieser [1995]), has been a priority issue of research from the 1960s (e.g. Aston studies). In his study, Donaldson [1996] came to the conclusion that the effects of organisation size show a strong, albeit not identical, relationship with other measuring methods (e.g. sales revenue, value of assets). Unfortunately, the researches on the logistics organisation of the SMEs do not go beyond this conclusion, of a rather low information content, of contingency-theory (e.g. "the comparison of large organisations with smaller ones … reveals significantly higher-level professionalization, stronger programming and planning, a higher degree of formalisation and more emphatic decentralisation" (Kieser [1995] p. 223.).

Functional specialisation is not deep enough at enterprises of a smaller size, and hence in the majority of the cases logistics is not present in a formalised way, and due to the

limited nature of the resources, it is usually assigned to a person responsible also for other areas and not familiar with logistics (Harrington [1995]). Kummer [1995] considers the warehousing and transportation personnel of SMEs excessive.

In the interpretation of Bowersox et al. [2002], fragmentation on the beginning of the development of the logistics organisation (Phase 0) is followed by functional merger (Phases 1-3), process-orientation (Phase 4), and finally the development of a virtual organisation (Phase 5). Frazelle [2002] adopted a similar approach, distinguishing the phases of functional, integrated, process-oriented and distributed organisation, respectively. SMEs logistics research confirms the fragmented and functional phases. According to Gelinas and Bigras [2004][47], logistics is often divided among several organisational units, and the same is supported by the results of the Quebec research shown in Table 9 (Roy et al. [2002]).

Table 9: Formalised logistics organisation of Quebec enterprises

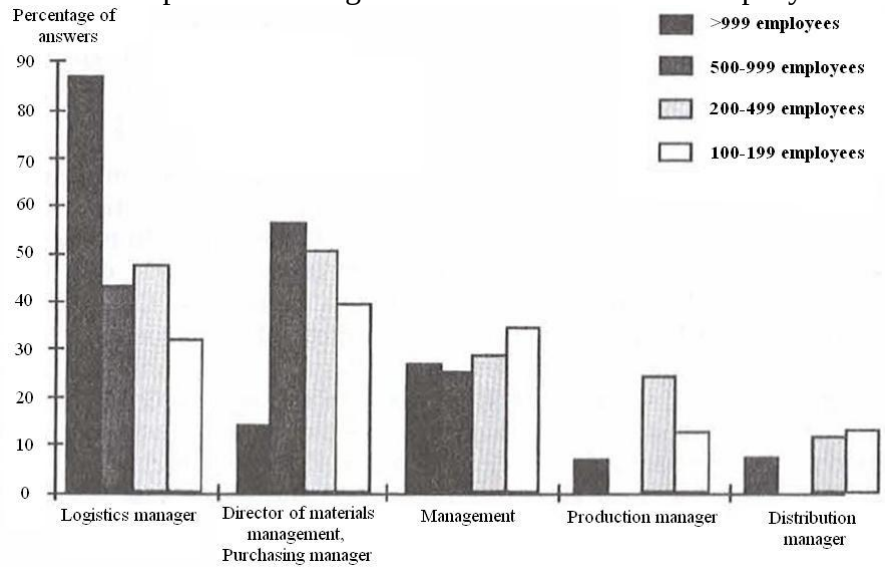
	Small enterprise	**Medium-sized enterprise**	**Large company**
No formalised logistics	53.1%	33.8%	15.0%
Logistics activities divided among several divisions	27.8%	47.8%	41.9%
Logistics department	19.1%	18.4%	43.1%

Source: Roy et al. [2002] p. 8.

The research of Kummer [1995] also corroborates the simultaneous occurrence of logistics at several places; the small, medium-sized and large SMEs indicated most often purchase and materials management as the location of this function within the company; the relevant distribution is shown in Figure 13 below.

[47] Small businesses represented 78% of firms without formal logistics function, and large ones only 0.5%. Small business make up 18% of companies with a logistics department and large companies 41%.

Figure 13: Conceived place of the logistics function within the company in Germany



Source: Kummer [1995] p. 48.

Kummer [1992] found the following distribution of logistics departments, indicative also of the differences of the headcount- and the sales-revenue-based SME definitions.

Table 10: Distribution of active logistics departments at German SMEs, by enterprise size

SME definition	Small SME	Medium-sized SME	Large SME	Large company	Total
by headcount	43.8%	54.1%	33.3%	64.3%	49.0%
by sales revenue	40.0%	42.0%	48.0%	58.3%	49.0%

Source: Kummer [1992] p. 160.

The researches found varied rates for the organisational appearance of the logistics function:

- Almost half of manufacturing small businesses in Pittsburgh organised purchasing into a separate department, and 30% appointed a person responsible for it (Presutti [1988]).
- 77.08% of American small businesses engaged in international trade and interested in logistics had a logistics or a transportation department (Murphy et al. [1995]).
- 62.5% of Danish small businesses had a centralised purchase unit, and at 48.3% of American small businesses this activity was the main responsibility of a given person (Paik et al. [2009]).

Researches investigating the level of logistics within the company hierarchy and the co-ordination of this function found the following:

- the number of logistics decisions taken at the medium or top level of the hierarchy was very low indeed (8.6%) (Berr et al. [1990]).
- "The management solves the logistics problems operatively, together with other business tasks; there is no logistics management" (Kummer [1995] p. 35.), and the logistics decision-making rules are uncleared (Kummer [1995] p. 58.).
- Small business managers tended to consider purchasing a tactical rather than strategic area (Paik et al. [2009]).
- Small and medium-sized companies in Quebec generally handled logistics at a low level (Roy et al. [2002]).

Table 11: Highest level of logistics in the management of Quebec enterprises

	Small business	**Medium-sized company**	**Large company**
Vice-president	16.2%	18.1%	31.3%
Director	36.0%	50.5%	50.3%
Manager	15.7%	10.0%	5.5%
Other	11.7%	7.4%	5.5%
None	20.3%	14.0%	7.4%

Source: Roy et al. [2002] p. 8.

- Heinrich and Felhofer [1985] found that logistics subtasks were co-ordinated almost exclusively informally, with a poor alignment of the various sub-areas (sales, production, purchase).
- The survey of Haan et al. [2007] covering Polish SMEs demonstrated the use of different co-ordination mechanisms in function of the growth of the entities concerned, and found that logistics and supply chain management were not sufficiently developed in the majority among them. SMEs of a larger size applied more formal management techniques (e.g. inventory management and modelling) to be able to cope with the increase in complexity.

Two growth thresholds were identified for the logistics of enterprises (Kummer [1995] p. 60.):

- With more than 200 employees, logistics poses co-ordination problems. Below that level, the focus is on the implementation part of logistics, and co-ordination is not

considered so important and it is solved by improvisation. Here the logistics strategies/concepts are not reflected by the structure of the organisation.

- At the level of 1000 employees, a so-called know-how threshold occurs. Logistics concepts are more widespread in this circle; growing complexity makes logistics more formalised, although its integration at a single place is less typical.

The researches have investigated the qualification and education of logistics employees:

- "Purchasers"[48] of carrier services for small firms are hard-pressed for time; they have little or no professional qualification in this field (e.g. rates which vary with such factors as weight, route, door-to-door or terminal-to-terminal) (Evans et al., 1990).
- SMEs often have no logistics (Tempel and Meißner [2002]) and purchasing expertise (Ellegaard [2009]); specialists with a university degree are relatively rare among them.
- Training, mostly in the form of on-the-job training, takes place in the purchasing units of small firms reporting to the company management, which is rather thought-provoking given the fact that consultants have found that "purchasing costs can vary by as many as 10-15% depending on the skill with which the purchasing function is organised and operated"(Presutti [1988]).
- 43% of enterprises provides no logistics training to their staff members (Berr et al. [1990]).
- The employees of small firms have no time to go to training courses, because they have to keep the business alive, so they ask their carrier or warehouse service provider for logistics advice (Harrington [1995]).
- 80% of companies with significant logistics activity invited external experts, mainly management consultants. According to the research, the companies concerned put great emphasis on training their employees; e.g. 40% trained every staff member (Halley and Guilhon [1997]).
- The figures in Table 12 show training rates in the years before the survey of Gelinas and Bigras [2004]:

[48] Staff member of the enterprise ordering the logistics services: 57% managers, 43% secretaries, administrators, warehouse staff.

Table 12: Percentage of Quebec firms with at least one employee trained in the last 5 years

	Small firms	LMEs
Supplies	6%	49%
Forecasts	1%	19%
Distribution	3%	28%
Information management	17%	58%
Logistics	6%	44%
Production planning	11%	42%
Operations management	24%	35%
Stock management	9%	49%
Transportation	10%	42%

Source: Gelinas and Bigras [2004] p. 272.

In summary, the researches on the introduction and co-ordination of logistics in the organisation unfortunately failed to go beyond the conclusions of contingency theory based on organisation size, carrying little information, but they did provide empirical evidence in support thereof. Formalised logistics is mostly absent in the SMEs, and if it is present at all, it is rather dispersed (Kummer [1995]; Roy et al. [2002]; Gelinas and Bigras [2004]). Logistics tasks are treated at a low level (Presutti [1988]; Berr et al. [1990]; Kummer [1995]; Roy et al. [2002]; Paik et al. [2009]), the decision-making rules are not clear (Kummer [1995]), sub-tasks are co-ordinated informally (Heinrich and Felhofer [1985]). The qualification of SMEs employees responsible in most cases for several functions including logistics is generally poor (Evans et al. [1990]; Tempel and Meißner [2002]; Ellegaard [2009]), they have low-level training (Berr et al. [1990]; Harrington [1995]; Gelinas and Bigras [2004]), although a survey suggesting the contrary exists as well (Halley and Guilhon [1997]).

2.6. Logistics tools, methods

Klaus [2009] said that logistics tools went back to the "Economy of machinery and manufactures" by Babbage and to Taylor's "Scientific management". He assigned this field to the "instrumentation" trend of logistics, initiated in the 1970s by German engineers (e.g. Jünemann, Baumgarten) with their goods flow, warehouse technology studies (Klaus [2009]). To date, the decisive researches of this field concern e-logistics, e-commerce, Internet and radio frequency identification (RFID).

Enterprises apply lots of instruments to accomplish the logistics processes; familiarity with such instruments and especially their use is a good indicator of logistics know-how. Given the high data-management and computation needs of logistics, IT is in the

focus of attention, but the surveys treat also logistics co-operations, alliances, purchasing techniques and other solutions.

2.6.1. Information technology

IT solutions are on the rise in the SMEs, albeit the simpler and cheaper IT tools prevail due to their lower investment and knowledge demand, as indicated by the following:

- A survey carried out in 1989 found integrated technique[49] at 22.2% of French agricultural and food industrial small business, but five years later the corresponding rate was already 42.6% (Halley and Guilhon [1997]).
- According to Pearson and Semeijn [1999], electronic data exchange (EDI) was less significant among small businesses than among large ones, due to its major investment and experience requirements. Gelinas and Bigras [2004] found that only 1.5% of small businesses applied EDI, whereas the corresponding rate among their larger peers was 20%.
- Roy et al. [2002] examined 688 Quebec-based firms and found that orders were received primarily by phone and fax, followed by EDI and the Internet. The computerisation of logistics activities was especially low at small firms (e.g. 30.6% used it for planning their materials demand). The use of other instruments as revealed by the research is shown in Table 13.

Table 13: Logistics in the practice of Quebec enterprises

	Small businesses	**Medium-sized companies**	**Large companies**
Barcode	25.1%	48.8%	70.0%
Information-sharing, automated buying	25.9%	44.9%	47.5%
Stock management	29.6%	31.1%	40.0%
Logistics co-operation	28.0%	48.5%	60.4%
Use of logistics indicators	25.6%	31.3%	61.6%
Continuous replenishment	12.3%	19.9%	35.2%

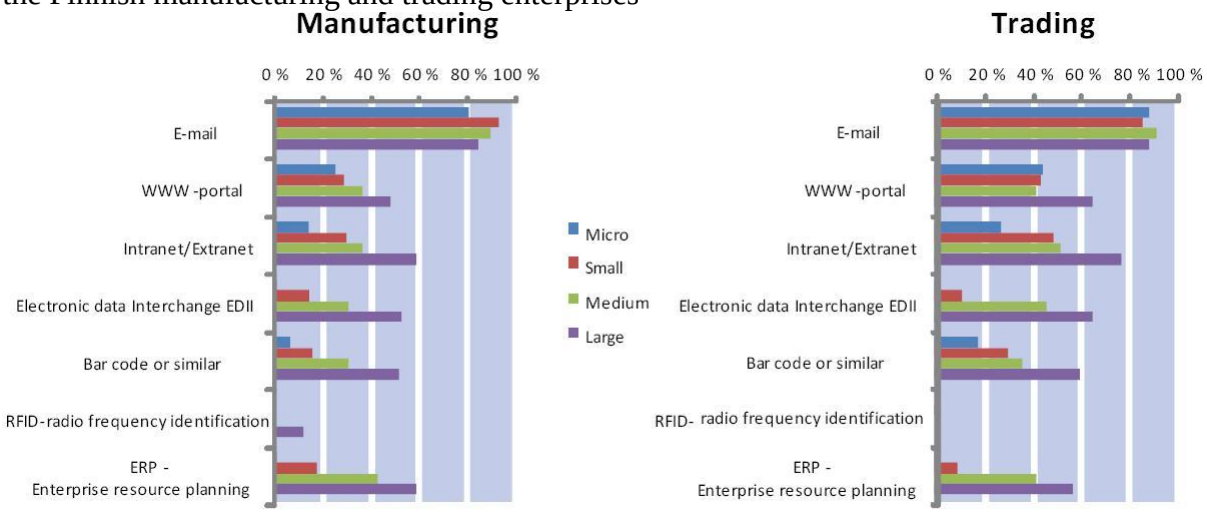
Source: Roy et al. [2002] p. 5.

- In the small sample of the survey of Hungarian SMEs, 67% monitored their stocks with an integrated system or by a special application, and 33% used only Excel to accomplish such tasks (Vízhányó [2006]).

[49] E.g. computer-aided production management, JIT, EDI, stock management

– Finnish large companies used IT systems in order and transportation management more frequently and diversely than the SMEs. For example, 60-80% of large companies and 20-40% of micro and small enterprises used Intranet/extranet. E-mail was commonly used, even among micro enterprises; around 80% had recourse to it regularly (Solakivi et al. [2009] p. 77.).

Figure 14: Use of information systems in the management of orders and deliveries in the Finnish manufacturing and trading enterprises



Source: Solakivi et al. [2009] p. 77.

The main lesson of Fodor's research [2005] covering 134 Hungarian small and medium-sized enterprises was that the companies concerned acquired a competitive edge by introducing the logistics information system – including any IT application supporting the logistics activity and supply chain management of the company –, not through the reduction of logistics costs, but by raising the quality of customer service. In the field of logistics, the Hungarian SMEs first mapped the material flows of the company by the IT systems, but sometimes they also created the logistics management system supporting logistics optimisation later on.

Szabó [2005] made in-depth interviews with the managing directors, logistics managers of 79 Hungarian SMEs and found that on average only 35%[50] of corporate information systems supported logistics which, in the opinion of the author, was not adequate.

[50] 43% for producers, 41% for traders and 18% for service providers.

The Hungarian SMEs studied by Gelei and Nagy [2010] used primarily company-specific and barcodes for the purpose of identification, and RFID did not appear at all. The rate of envisaged developments of SMEs was identical with that of large companies. According to the researchers, the SMEs used decisively the standard integrated company management systems available on the market, but there were also some insular individual solutions; they had a big backlog in the areas of inventory management, production management and purchasing. Gelei and Nagy [2010] found significant differences in several respects[51] between large companies and SMEs. The SMEs applied less developed and secure communication technologies to communicate with the client, supplier and logistics service provider partners.

2.6.2. Co-operation

Co-operation as a logistics tool of the SMEs is studied at both theoretical and practical level.

Finley [1984] indicated that the small volume of their purchases often puts the small firms into an asymmetrical power position relative to large buyers, and this reduces their chances for obtaining lower rates. He proposed to establish buying groups and co-operatives to treat this problem. The theoretical article of Hudson and McArthur [1994] proclaimed that small businesses were not attractive in a transaction due to their high risk and low transactions cost levels. Since the transaction costs of small businesses are raised, due to their young age, by their lack of prestige and of purchasing experiences, Hudson and McArthur [1994] proposed that they should join expert networks. Chikán et al. [2007] made a similar proposal, and suggested to create vertical "logistics co-operatives" for the purpose of logistics activities of the same kind (e.g. purchasing, warehousing, forwarding, distribution pools) or for providing services of several kinds.

In the context of empirical surveys of SME logistics co-operation:

- Désaulniers and Bigras [1998] interviewed Quebec-based manufacturing small firms to examine logistics alliances, and they distinguished five key strategies: economies of scale (e.g. transportation of complementary or competing products to the same destination), access to the distribution network, special transportation, knowledge of the local market and production for the export markets. Although co-

[51] In the areas of inventory management, service quality, decision support of logistics costs, product registration, commodity take-over, internal processes, support for the delivery process and integration of stock IT sub-systems.

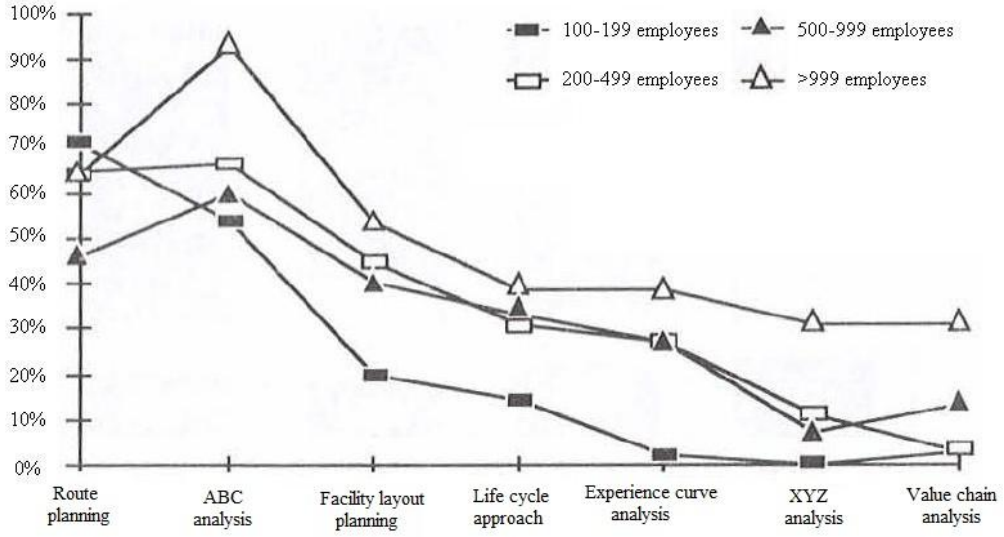
operation boosted performance, the alliances often raised the indirect logistics costs related to exports through education, for example. Almost half of the nine companies took part in several partnerships.

– Morrissey and Pittaway [2004] investigated the purchasing activity of six British plastics moulding small firms selected on the ground that their suppliers were in monopoly position and their buyers were very keen on profit maximisation. The SMEs under study were reluctant to gather into a purchasing consortium with their competitors, and they were sceptic about co-operation, thinking that hostile techniques would prevail under the surface anyway. It was found that, due to the different motivations of the owner-managers (e.g. life-style, independence), the rational model driven by profit maximisation did not work, and this questioned the idea of co-operation proposed in the purchasing literature from time to time.

2.6.3. Further instruments, methods

Kummer [1995] studied both the knowledge and the application of logistics instruments at SMEs. The most frequent among the latter were route planning, ABC analysis and facility layout planning, and the least frequent ones value chain analysis and XYZ analysis.

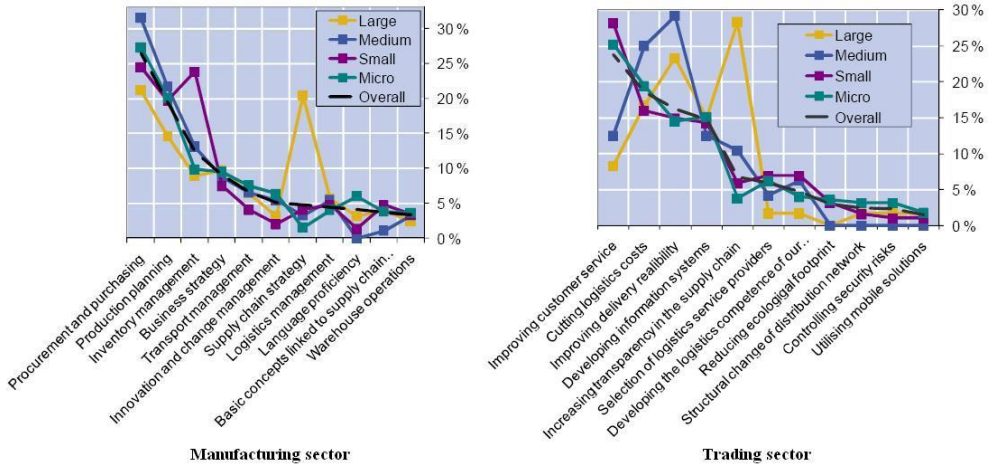
Figure 15: Use of logistics instruments at German SMEs



Source: Kummer [1995] p. 54.

The survey of the logistics situation of Finnish enterprises has revealed a difference in the development demands of SMEs and of large companies in terms of the enhancement of the transparency of the supply chain and the improvement of client service.

Figure 16: Key Finnish development requirements by company size



Source: Based on Solakivi et al. [2009] p. 84. and p. 87.

Scully and Fawcett [1994] demonstrated that small firms were committed to international sourcing and they did it quite effectively. Owing to their less intensive international orientation, decisions based on fewer factors and the perception of fewer benefits, their international sourcing is more limited, but they often detect immediate specific problems/opportunities faster. In the opinion of the authors, small firms are in the second stage of international procurement (reactive, transaction-oriented). According to Quayle [2002c], transition from local to global purchasing ought to be prepared with caution due to the concurrent risks (e.g. knowledge loss). Overby and Servais [2005] investigated the foreign purchase behaviour of 105 Danish small firms and showed that 93.8% among them purchased from at least two foreign countries, but their supplier choice was driven primarily by price and quality, not the absence of local suppliers.

At the turn of the millennium, Gelinas and Bigras [2002] developed a logistics performance controlling methodology and a public-domain application built on it, taking into consideration the requirements of easy application and interpretation of Quebec-based small businesses. This studied the characteristics of small firms, their strategic and logistics goals, indicators and the consistency thereof.

Nabhani and Shokri [2009] presented the improvement of the distribution of an English food trader SME with the Six Sigma method. Through the modification of loading and of layout utilisation, the small firm reduced delivery lead time and the number of errors and hence enhanced customer satisfaction.

In summary, due to the high data and computation demand of logistics, of all the instruments, the IT tools are given most attention. They are quite widespread among the SMEs, but due to the relevant investment demand, the cheaper and simpler versions are more typical (Halley and Guilhon [1997]; Pearson and Semeijn [1999]; Roy et al. [2002]; Gelinas and Bigras [2004]; Szabó [2005]; Vízhányó [2006]; Solakivi et al. [2009]; Gelei and Nagy [2010]). According to Désaulniers and Bigras [1998], economies of scale, network access, special transportation, knowledge of the local market and production for the export markets are the five key strategies in logistics alliances. Other authors also proposed logistics co-operation to treat the problems due to the small size of the SMEs (Finley [1984]; Hudson and McArthur [1994]; Chikán et al. [2007]), but this did not work in practice due to the motivations of the owner-managers which differed from the rational model based on profit maximisation (Morrisey and Pittaway [2004]; Tóth [2009]). Kummer [1995] was the only researcher studying the traditional logistics methods, and he came to the conclusion that route planning, ABC analysis and facility layout planning were applied most frequently. According to the researches, the small and medium-sized enterprises are active in international procurement (Scully and Fawecett [1994]; Quayle [2002c]; Overby and Servais [2005]), and the Six Sigma Method can also be applied to them (Nabhani and Shokri [2009]).

2.7. Further logistics researches

La Londe (quoted by Harrington [1995] p. 56.) identifies as the main concern of small businesses the need to tackle growth: "suddenly, orders aren't shipped on time, inventory gets lost, backorders pile up". Small businesses receive little logistics assistance to solve their problems from the traditional sources; no logistics organisation representing their interests exists, few consultants specialise on them (and they could not pay the high prices anyway) (Harrington [1995]).

Bagchi and Virum [2000] have shown that it is difficult for small and medium-sized enterprises to develop their logistics competencies and apply them as a competition instrument, since their resources are limited and are forced to provide higher-quality logistics and to remain in close contact with their commercial partners at the same time.

Chikán et al. [2007] say that a significant part of micro enterprises pursues no "logistics-intensive" activity: their procurements are similar to those of the households. In regard of the small and medium-sized enterprises,

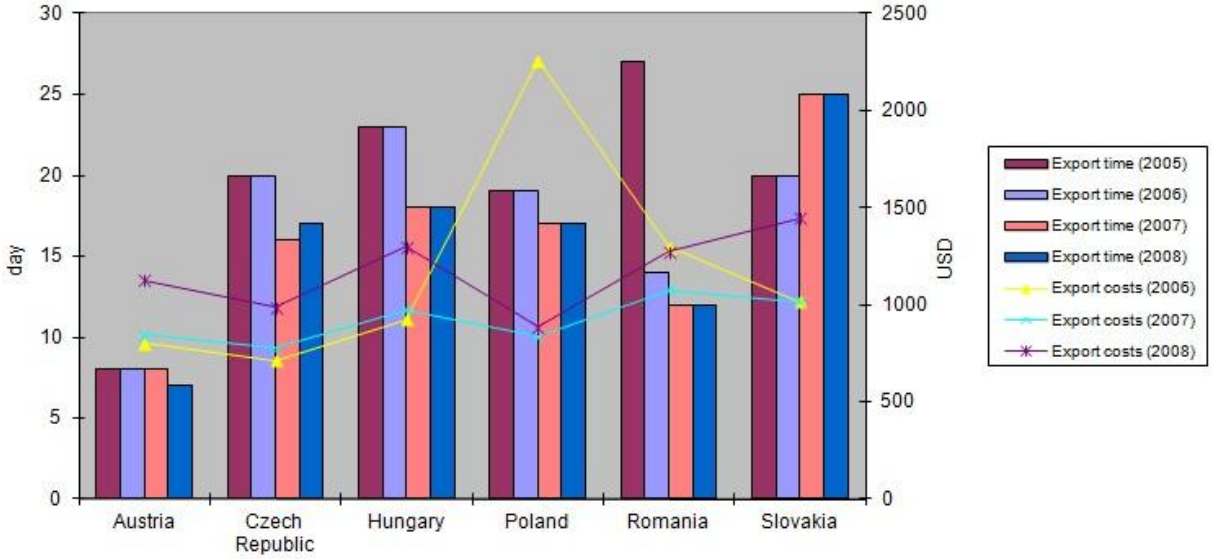
- the logistics "radius" of enterprises in the bottom segment of this category is local; their market is defined by the local specifics, and they are affected by, but not necessarily interested in, the market entry options provided by the logistics networks;
- the intensity of the logistics of enterprises in the "medium" and "upper" categories depends on their core competence, and they may be basically interested in joining logistics networks.

One research (Hutchinson et al. [2009]) assigned logistics to the external barriers of the internationalisation of retailer small enterprises. Unfortunately, few researches treat this aspect of the small and medium-sized enterprises, although there are few more international activities than logistics. I attempted to explore a narrow segment of this problem in my research comparing two indices of the Doing Business Index indirectly linked to the logistics of small and medium-sized enterprises in the V4 countries, Austria and Romania (Gecse [2009]):

- In 2008, a medium-sized enterprise[52] intending to lease a 1300 m^2 general-purpose warehouse was subject to 13-36 licensing procedures in the countries under study, lasting for 180-308 days, at a cost corresponding to 10.3-137.0% of the per capita income of the given country.
- The cost and time demand incurred by a medium-sized enterprise delivering a 20-foot container to the most used port of the given country showed considerable differences (see Figure 17). The total delivery time of a container of this type to an Austrian medium-sized enterprise for example took 11 days less in 2008 than that of a Hungarian competitor. The significant gaps derived primarily from the differences of the administrative components.

[52] With a staff of at least 60 according to the methodology.

Figure 17: Container delivery time and cost of Central East European medium-sized enterprises (2005-2008)



Source: Gecse [2009] p. 25.

2.8. Summary conclusions of the processing of the technical literature on logistics

In-depth research on the logistics practice of small and medium-sized enterprises goes back some 20-25 years, but the number of such researches is still low. The findings, available for the most only in the local language (e.g. in French, German, Finnish, Norwegian) and in the "grey" literature, are often difficult to access and, in some cases, the SMEs concerned forbid to disclose them to the public. The comparison and generalisation of the results of SME logistics research meet with many obstacles due to the very high number of SMEs, the complexity of logistics and the absence of a common interpretation of either the SMEs or of logistics[53]. The researches, mostly mutually unknown to, and hence having little effect on one another range from case studies to surveys covering sometimes as many as 2705 enterprises and, in terms of distribution by branch, they are mostly about manufacture, followed by trade and, due to the bilateral (client, user) analysis of outsourcing, logistics service providers. The investigation of the logistics of agricultural, construction industrial and service provider SMEs is almost totally absent. The most frequent topics of research are the logistics tools, performance and in particular cost levels, and outsourcing (with 22, 21 and 18 researches, respectively), followed by assessments of the significance of logistics and on organisation-co-ordination-training (13 and 10 surveys, respectively). Logistics strategy has been hardly investigated at all.

Except for the "Finland State of Logistics" project, there are no longitudinal researches and, apart from the Finnish, Quebec and German surveys, there are no systematic ones, due probably to the difficulties of the survey genre (e.g. low response rates, difficulties of representativeness) and the low information content of the results. The decisive majority of researches summed up in Table 14 applied a relatively low-level methodology of mathematical statistics (e.g. descriptive strategies).

Generally, the researches were not associated with specific theories, due partly to the interdisciplinary status and partly to the empirical nature of logistics.

The mosaics of the research findings suggest that the logistics of small and medium-sized enterprises is much more heterogeneous than could be assumed on the basis of the corresponding studies of large companies.

[53] Flow- and activity-based approaches and logistics concepts regarded as self-evident are equally present.

Table 14: SME logistics research processed in the Thesis, by SME interpretation and subject matter

Research	Number, geographical location and sector/branch of the enterprises under study	Interpretation and relevance of logistics	Logistics outsourcing	Logistics performance (costs)	Logistics strategy	Logistics org., co-ordination, education	Logistics instruments, methods
Solakivi et al. [2009]	2705 Finnish manufacturer, commercial and logistics service provider entities	x	x	x (x)			x
Naula et al. [2006]	2255 Finnish manufacturer, commercial and logistics service provider entities	x	x	x (x)			x
Solakivi et al. [2010]	1813 Finnish manufacturer, commercial, logistics service provider, consultant entities	x	x	x (x)			x
Ojala et al. [2007]	1234 manufacturer, commercial and logistics service provider entities from the Baltic region	x	x	x (x)			x
Roy et al. [2002]	688 Canadian manufacturer, commercial entities					+	+
Hovi and Hansen [2010]	508 Norwegian manufacturer, commercial and construction entities			(x)			
Lea et al. [1996]	461 Norwegian manufacturer entities			x (x)			
Töyli et al. [2008]	424 Finnish manufacturer, commercial entities			x			
Halley and Guilhon [1997]	400 Canadian and French agricultural and food industrial entities		+	+	+	+	+
Gelinas and Bigras [2004]; Gelinas et al. [2000]	353 Canadian manufacturer entities		+		+	+	+
Paik et al. [2009]	332 Danish and American manufacturer and service provider entities			+		+	
Uhlig and Gelinas [1994]	332 German manufacturer and logistics service provider entities		+				
Gritsch [2001]	319 Hungarian agricultural, food industrial, construction industrial, commercial, service provider entities	*					
Pearson and Semeijn [1999]	301 American entities		+				+
Quayle [2002a]	298 British agricultural, manufacturing, construction industrial, service provider entities	*					
Quayle [2002b]	232 British agricultural, manufacturing, construction industrial, service provider entities	*					
Solakivi et al. [2011]	223 Finnish manufacturing and commercial entities			x			
Orfanos et al. [2006]	206 Greek agricultural, manufacturing, construction industrial, commercial, service provider entities			x		x	
Bentzen et al. [2000]	202 Danish manufacturer and service provider entities		+				
Hong et al. [2004a] and Hong et al. [2004b]	192 Chinese manufacturer entities		*				

Presutti [1988]	166 American manufacturer entities			+		+	
Fodor [2005]	134 Hungarian manufacturing, commercial service provider entities						*
Berr et al. [1990]	128 German manufacturing entities	-				-	
Haan et al. [2007]	127 Polish entities					x	
Grando and Belvedere [2006]	117 Italian manufacturing entities			x			
Murphy et al. [1999]	116 American entities		+				
Kummer [1992] and Kummer [1995]	111 German manufacturing, construction industrial, commercial entities	*	*	(*)	*	*	*
Overby and Servais [2005]	105 Danish manufacturing entities						+
Vörösmarty et al. [2010]	104 Hungarian manufacturing, commercial, service provider entities	x					
Campos-Garcia et al. [2011]	99 Mexican manufacturing entities			(+)			
Pressey et al. [2009]	97 manufacturing entities				x		
Szabó [2005]	79 Hungarian manufacturing, commercial, service provider entities	*		(*)			*
Murphy et al. [1995]	76 American entities		+			+	
Scully and Fawecett [1994]	72 American manufacturing entities						+
Gelei and Nagy [2010]	63 Hungarian manufacturing and service provider entities						x
Evans et al. [1990]	54 American manufacturing entities		x				
Pezzotta et al. [2006]	48 German, Italian and Hungarian manufacturing entities		x	x (x)			
Bagchi and Virum [2000]; Virum [1994]	30 Norwegian manufacturing entities			x (x)			
Zheng et al. [2004]	28 British manufacturing, construction industrial and commercial entities				x		
Vízhányó [2006]	27 Hungarian manufacturing, commercial, service provider entities	*	*	(*)			*
Heinrich and Felhofer [1985]	21 Upper Austrian manufacturing entities	-					
Desauliners and Bigras [1998]	9 Canadian manufacturing entities						*
Morrisey and Pittayway [2004]	6 British manufacturing entities						*
Tőkés [2010]	6 Hungarian manufacturing entities		x	x			
Chao and Shah [2010]	4 Taiwanese manufacturing entities		*				
Futakfalvi [2008]	1 Hungarian commercial entity		-				
Holter et al. [2008]	1 British manufacturing entity		-				
Nagy [2008]	1 Hungarian food industrial entity		-				
Tóth [2009]	1 Hungarian wholesaler		-				
Nabhani and Shokri [2009]	1 British food industrial entity						-
Wagner and Alderdice [2006]	1 British fishing entity			-			
	NUMBER OF RESEARCHES ON THE GIVEN TOPIC, TOTAL	**13**	**22**	**21 (14)**	**5**	**10**	**18**

x: SME definition of the EU (250 persons and/or below EUR 50 million); +: North American SME definition (500 persons or below a turnover of USD 50 million)
-: SME definition unknown; *: Other SME definition

Source: Compiled by the Author.

The majority of authors of the logistics literature under study did not investigate the logistics interpretation of SMEs, assuming it was uniform, but some (Kummer [1995]; Szabó [2005]; Vízhányó [2006]) pointed out that it was far from homogenous. The SMEs considered logistics important (Berr et al. [1990]; Kummer [1995]; Szabó [2005]; Vízhányó [2006]; Solakivi et al. [2009]; Vörösmarty et al. [2010]), although some purchasing researches (Quayle [2002a]; Quayle [2002b]) contradicted that. The surveys failed to give a clear specification of the enterprise size limit above which the small and medium-sized enterprises started to treat logistics in a deliberate way (headcount of 20/200; HUF 1.5 billion) (Virum [1994]; Kummer [1995]; Gritsch [2001]; Vízhányó [2006]).

Few general conclusions can be drawn from the research on logistics outsourcing (Solakivi et al. [2011] p. 132.). The majority of articles on outsourcing did not study the relevant theoretical background (Selviaridis and Spring [2007]), or if they did, transaction costs and (core) competencies related to resources theory and, less often, other theories (e.g. agent, game theory) were proposed by way of explanation (Ivanaj and Masson Franzil [2006]). The researches on the interrelationship of transactions costs and logistics outsourcing focused primarily on asset/investment specificity (Ivanaj and Masson Franzil [2006]; Aertsen [1993]; Maltz [1994]; Skjøtt-Larsen [2000]). In the opinion of Kállay and Imreh [2004], the level of outsourced services is low among the SMEs because of the excessive transaction costs due, in turn, to diseconomies of scale. Van den Berg [2009] came to the same conclusion, although in his opinion the traditional outsourcing model based on large volumes is changing with the advance of the ICTs. The level of logistics outsourcing studied under other names (e.g. 3PL, contractual logistics, logistics alliance, subcontracting) has kept increasing in recent years according to the surveys (e.g. “Lieb series”, “Langley series”), and it has shifted from the individual to the more complex services, and it is more frequent in the developed than in the developing regions (Pezzotta et al. [2006]). The SMEs do not always outsource a given logistics sub-activity in its entirety (Bentzen et al. [2000]; Vízhányó [2006]; Futakfalvi [2007]; Tóth [2009]). According to Ivanaj and Masson Franzil [2006], and Hong et al. [2004b], company size is one of the contingency factors of logistics outsourcing, but Bardi et al. [1991] do not consider that obvious. Logistics outsourcing research identified significant differences between large companies and SMEs (Evans et al. [1990]; Murphy et al. [1999]; Gelinas and Bigras [2004]) which,

however, disappeared once the entities concerned joined international commerce (Murphy et al. [1995]; Pearson and Semeijn [1999]). The advantages and disadvantages of outsourcing have been investigated almost exclusively in the circle of large companies, and according to Selviaridis and Spring [2007] they are attributable to strategic, financial and operational reasons. SMEs outsourced logistics mainly for tactical rather than strategic reasons (Chao and Shah [2010]), and the rank order of arguments for and against such decisions was highly varied (Uhlig and Gelinas [1994]; Vízhányó [2006]). According to some case studies (Futakfalvi [2007]; Nagy [2008]; Tóth [2009]), the perspective of cost-trimming may be overridden by other considerations (e.g. personal contacts with clients, service flexibility in terms of time and capacity). A British case study (Holter et al. [2008]), however, demonstrated that with adequate techniques, it is possible to save costs. Unfortunately, the methodology of the investigation of arguments pro and con logistics outsourcing by SMEs fails to go beyond the comparison of occurrence frequencies.

Halley and Guilhon [1997] say that, according to the financial indicators, the logistics performance of small businesses is relatively underdeveloped, but the organisational indicators project the image of a developing proactive activity, integrated from the point of view of value creation. The effect on asset-proportional returns was attributable essentially to the reduction of logistics costs, of time spent on logistics processes, their improvement and the setting of client service targets (Bagchi and Virum [2000]) Research among Norwegian and Greek SMEs revealed the direct influence of logistics on SME performance (Lea et al. [1996]; Orfanos et al. [2010]), although Töyli et al. [2008] and Solakivi et al. [2011] found no statistically observable significant positive relationship between logistics and financial performance. An Italian research came to the conclusion that the logistics response capacity of cluster-member small and medium-sized enterprises intensified significantly, but from the point of innovation, they lagged behind their "independent" peers (Grando and Belvedere [2006]). Among the small businesses of Quebec, logistics performance increased under the effect of co-operation, but the relevant costs rose as well (Désaulniers and Bigras [1998]).

Despite the methodological difficulties (estimation due to lack of information, components based on different concepts/content, different reference bases), cost levels play a priority role in logistics performance measurement. They are often merged,

erroneously, with the expense and expenditure levels of logistics. At the theoretical level, the investigation of transportation costs excels from the studies of the partial costs of logistics; this area has been integrated into economics thinking thanks to the works of von Thünen [1826], Samuelson [1952] and Krugman [1991]. Logistics costs are estimated at macro level by econometric models (Rodrigues et al. [2005]; Klaus [2008]; Wilson [2009]; King [2010]) or they are assessed on the basis of corporate statistics (Elger et al. [2008]). The surveys suggest that the logistics costs of SMEs correspond to less than 22% of their sales revenues or total costs (Bagchi and Virum [2000]; Szabó [2005]; Vízhányó [2006]; Solakivi et al. [2009]; Hovi and Hansen [2010]; Solakivi et al. [2010]; Campos-Garcia et al [2011]). Most SMEs are aware of their logistics cost level to a moderate extent only or not at all (Virum [1994]; Tempel and Meißner [2002]), or they assumed it was zero (Berr et al. [1990]; Campos-Garcia et al. [2011]). According to Solakivi et al. [2010], the rule-of-thumb that the total costs of logistics decreases with the increase of company size is not true for medium-sized enterprises which already incur costs due to growth, but are too small yet to exploit economies of scale. Lea et al. [1996] found that the total costs of logistics increased proportionally with the sales revenue, due to a smaller extent also to the rise in the added value of the inputs, but the acceleration of stock rotation had the contrary effect. The researchers found lower logistics costs at SMEs with a longer export history and higher ones at those struggling with supplier problems (Lea et al. [1996]). At macro level (Harrington [1995]; Naula et al. [2006]; Hovi and Hansen [2010]), the reduction of logistics costs is often set as a goal which appears also at the companies themselves (Vízhányó [2006]), typically those with unintegrated logistics (Halley and Guilhon [1997]). The reduction of the costs of logistics, however, has but limited effects (Kummer [1995]). In the opinion of Fodor [2005], the benefits of the introduction of the logistics information system lies not in cost reduction, but in improved customer service. Solakivi et al. [2011] identified a resembling to inverse U-shape relationship between the logistics outsourcing and logistics costs of Finnish SMEs.

Logistics strategy can be investigated in function of corporate strategy "expressing the guideline of the operation of the company, its objectives and the method for attaining them" (Chikán [2008] p. 187.) which in the opinion of Halley and Guilhon [1997] is weak or non-existent. In the context of planning, the small and medium-sized enterprises considered the competitiveness-enhancing effect of logistics to be the

strongest, and they introduced logistics strategies with the idea of acquiring a competitive edge. The SMEs reached professional-level logistics through the stages of pre-logistics, interest in logistics, and the initial level (Kummer [1995]). There are several stages of logistics – proactive, reactive and emerging - based on the attitude of the owner-manager and the firm's dependence on the environment (Halley and Guilhon [1997]). The authors warn that small firms shall not be forced to include logistics among their strategic concerns, and logistics strategy cannot be assigned to the categories of good or bad.

Research on the appearance and co-ordination of logistics in the organisation unfortunately fails to go beyond the relevant, rather weak, conclusions of contingency theory concerning organisation size, but it provides empirical corroboration for the latter. Logistics usually does not appear at the SMEs in a formalised way, and if it does, it is dispersed (Kummer [1995]; Roy et al. [2002]; Gelinas and Bigras [2004]). SMEs treat the logistics tasks at a low level of the organisational hierarchy (Berr et al. [1990]; Kummer [1995]; Roy et al. [2002]; Paik et al. [2009]) say that the decision-making rules are unclear (Kummer [1995]), partial tasks are co-ordinated informally (Heinrich and Felhofer [1985]). The qualification of SMEs employees who usually fulfil several functions, logistics included; it is usually weak (Evans et al. [1990]; Tempel and Meißner [2002]; Ellegaard [2009]); they have low-level schooling (Presutti [1988]; Berr et al. [1990]; Harrington [1995]; Gelinas and Bigras [2004]), although surveys suggesting the contrary exist as well (Halley and Guilhon [1997]).

According to Klaus [2009] the investigation of the instrumentation of logistics goes back to the work of Babbage and Taylor. Given the high data and computational demands of the logistics activity, the IT instruments have received most attention; they are spreading also among the SMEs, especially their cheaper and simpler versions due to the relevant high investment demand (Halley and Guilhon [1997]; Pearson and Semeijn [1999]; Roy et al. [2002]; Gelinas and Bigras [2004]; Szabó [2005]; Vízhányó [2006]; Solakivi et al. [2009]; Gelei and Nagy [2010]). Kummer [1995] was the only researcher who studied the traditional logistics methods, and he found that route planning, ABC analysis and facility layout planning were the most frequent. Désaulniers and Bigras [1998] identified five key strategies of logistics alliances: economies of scale, access to distribution network, delivery of special transportation,

knowledge of the local market and production for the export markets. Other authors also proposed logistics co-operation as a means for coping with the problems due to the small size of the SMEs (Finley [1984]; Hudson and McArthur [1994]; Chikán et al. [2007]), although this did not work out in practice due to the motivations of the owner-managers being different from the rational model based on profit maximisation (Morrisey and Pittaway [2004]; Tóth [2009]). According to the researches, SMEs are active in international purchasing (Scully and Fawecett [1994]; Quayle [2002c]; Overby and Servais [2005]), and the Six Sigma Method can also be applied to them (Nabhani and Shokri [2009]).

3. Research hypotheses

My Thesis studies in more depth the logistics practice of Hungarian small and medium-sized enterprises. The reason for that is that although the SMEs have moved into the foreground of politics, their logistics function has hardly been examined so far. I think that, as with large companies, the exploration and improvement of the logistics of the SMEs might contribute to ameliorating their performance and hence to easing the duality of the Hungarian economy. My research goes beyond the previous surveys in that it applies more advanced methods of mathematical statistics and it tests the hypotheses on a representative sample.

The crucial question of my research is whether SME logistics is a corporate function of secondary importance, requiring no further research, or a neglected activity which, if treated properly, may enhance SME performance. The relevant literature suggests that many sub-areas of the logistics of small and medium-sized enterprises need to be explored yet, but for practical reasons (e.g. comparability, quantification) and due to the limits of my research I focused on the outsourcing, costs and organisational components of SME logistics.

My research, based on the small and medium-sized enterprises as units of observation, is partly a descriptive and partly an explanatory cross-sectional study.

Morrissey and Pittaway [2004] studied the procurement behaviour of small and medium-sized enterprises and noted that the SMEs shall not be treated as a homogenous group. My first hypothesis concerns the variables (contingency factors) influencing the following logistics features of the small and medium-sized enterprises:

- the rate of the partial and total costs of logistics, respectively, to the total costs of the SMEs;
- the outsourcing rates of the various logistics sub-activities.

The experts of this field have proposed many contingency factors for this purpose, most frequently company size (Kummer [1995]; Hong et al. [2004a]; Hong et al. [2004b]; Vízhányó [2006]; Ivanaj and Masson Franzil [2006]; Ojala [2007]; Solakivi et al. [2009]; Solakivi et al. [2010]) which, according to Bardi and Tracey [1991], is not

always an obvious choice. Other factors included sector/branch affiliation, production type (Hong et al. [2004]) or the attitude of the owner-manager (Arbaugh [2003]). The factors concerned have been studied at theoretical level or based on a non-representative sample so far. Considering the above, I assumed that basically two contingency factors had an impact on the total/partial cost rates and on the outsourcing rates of small and medium-sized enterprises, company size and branch affiliation, and I examined their effects separately.

H1a: The rates of partial and total logistics costs, respectively, to the total corporate costs of Hungarian small and medium-sized enterprises are influenced most by company size and branch affiliation.

H1b: The outsourcing rates of logistics sub-activities of Hungarian small and medium-sized enterprises are influenced most by company size and branch affiliation.

My second hypothesis was meant to test demand expansion, significant but difficult to exploit, generated by the logistics outsourcing of Hungarian small and medium-sized enterprises. The confirmation of that hypothesis would partly deny the claim that logistics outsourcing can offer but minor growth opportunities to logistics service providers, as is suggested by the "Lieb series" and "Langley series" based on the investigation of large companies.

H2: The transportation and warehousing demand of Hungarian SMEs implies significant latent demand for the domestic transportation and warehousing service provider enterprises.

My third hypothesis was meant to explore the reasons underlying SME logistics outsourcing and their associations. Previous researches on this topic expressed few conclusions, of which three should be noted here:

1. According to Halley and Guilhon [1997], logistics seems to be a core competence of small businesses; according to Bentzen et al. [2000], the same is not true for medium-sized enterprises.
2. According to Kállay and Imreh [2004], low outsourcing rates are due primarily to excessive relative transaction costs. The same was corroborated by van den Berg [2009], Finley [1984] and supported by the co-operation proposals to reach the level of economies of scale (Hudson and McArthur [1994]; Désaulniers and Bigras

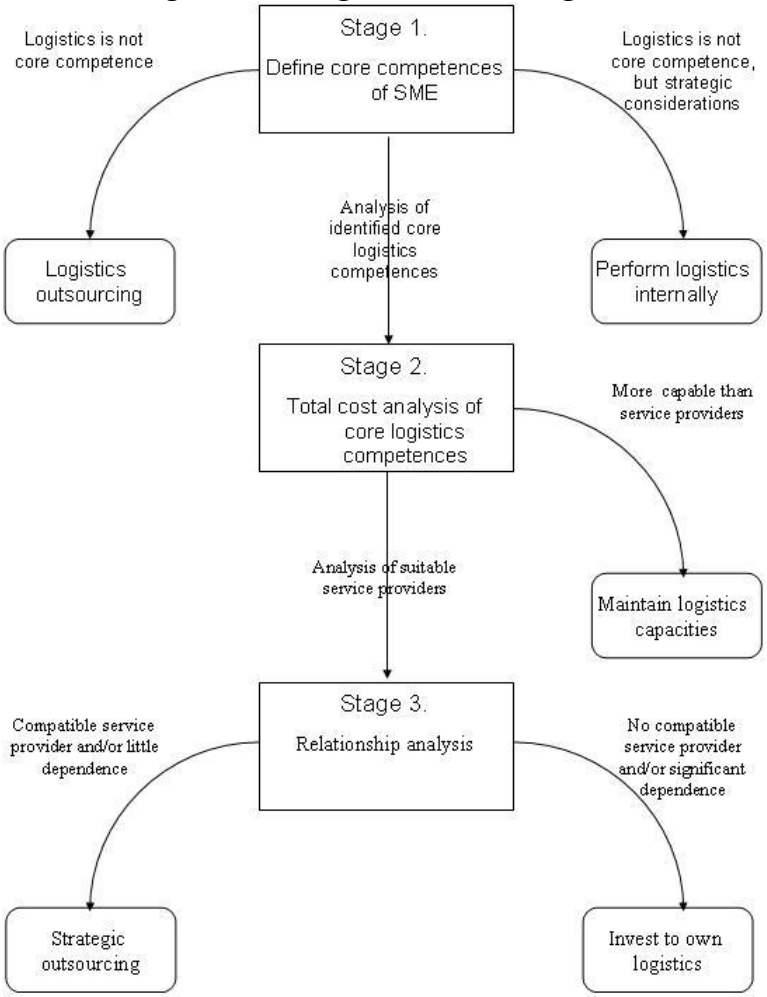
[1998]; Chikán et al. [2007]); However, according to the case studies, the proposals concerned do not work in practice (Morrissey and Pittaway [2004]; Tóth [2009]).

3. Based on the researches and the theoretical background, SME logistics outsourcing is motivated primarily by the needs for cost reduction, focus on the core competence and flexibility (Uhlig and Gelinas [1994]; Vízhányó [2006]).

My next move was to examine the applicability of a version of McIvor's general outsourcing model adapted to SME logistics, as shown in Figure 18. Contrary to the original model, this version does not include the evaluation of the relevant value chain activities, and simplifies the inherent dangers to dependence on the service providers.

I tested only the branches characterised by a major logistics outsourcing ratio, most interesting for the service providers.

Figure 18: Decision-making model of logistics outsourcing



Source: Compiled by the Author based on McIvor [2000].

H3a: The rate of Hungarian medium-sized enterprises considering their logistics sub-activities their core competences is lower than the corresponding rate of micro and small enterprises, and in the context of outsourcing, the former are less seldom faced with high transaction costs.
H3b: Hungarian small and medium-sized enterprises outsource logistics activities primarily to reduce costs, to focus on the core competences and to enhance flexibility.
H3c: McIvor's model can be applied to the determination of the outsourcing of individual logistics sub-activities by Hungarian small and medium-sized enterprises.

My fourth hypothesis concerns the criteria for evaluating the performance of third-party logistics service providers mentioned in the SME surveys (Evans et al. [1990]; Pearson and Semeijn [1999]) and case studies (Futakfalvi [2007]; Nagy [2008]; Tóth [2009]), assuming that the SMEs take a rational decision in this area.
H4: Hungarian small and medium-sized enterprises judge the performance of their logistics service providers in terms of cost reduction, service quality and problems incurred.

The fifth hypothesis is about the relationships between the company performance/success of small and medium-sized enterprises – based on their self-evaluation – and the efficiency/performance of their logistics system, and their performance and the quality of third party logistics services, respectively. Some researches found that certain logistics components correlated with corporate performance (Lea et al. [1996]; Orfanos et al. [2010]), whereas others, e.g. Töyli et al. [2008] and Solakivi et al. [2011], declared that there was no statistically observable positive relationship between logistics and corporate (financial) performance.
H5a: There is no association between the performance of Hungarian SMEs and the efficiency of their logistics systems.
H5b: There is no association between the performance of Hungarian SMEs and the quality of the third party logistics services they use.

My sixth hypothesis concerned whether the various managers of Hungarian SMEs actually considered the fields of logistics-type operation (procurement, logistics, inventory management) to be of secondary importance for the success of the operation of the company as a whole. Based on the SME procurement researches, higher in

number than those on logistics, and on the survey by Kummer [1995], procurement is likely to be given priority, albeit its significance (Quayle [2002a]; Quayle [2002b]) lags behind that of the other functions - although Vörösmarty et al. [2010] refuted the last statement.

H6: The logistics concept of managers of Hungarian SMEs gives priority to procurement; the significance of procurement, inventory management and logistics falls short of that of the other functional sub-areas.

4. Research methodology

I applied quantitative analysis to test my research hypotheses. I chose as the method of my research the questionnaire-based survey, the most frequent form in the social sciences, ideal for the description and detailed analysis of the features of a big population, and also for generalisation, depending on the topic (Babbie [1999]). According to Malhotra [2002], the questionnaire survey is to express the information being sought in the form of adequate questions; it is to motivate the respondent to co-operate, and to minimise the response errors. Since the questions are asked in an identical way, such surveys are characterised by excessive standardisation, low validity and high reliability.

4.1. Databases used for the research

I used two databases for the research:

- "Survey of the situation of enterprises, 2009" (data collection: September-October 2009): the main advantage of this survey is its representativeness and large sample size. The disadvantages of the sample derive from the same circumstances: the number of larger-size SMEs is low and some statistics are sensitive to large sample size. This database, limited exclusively to Hungarian small and medium-sized enterprises, does not allow comparison with large companies, and it is based on a relatively low number of questions, 68 in all.
- "In competition with the world, 2009" (data collection from April to November 2009): the survey contains data for SMEs as well as large companies and hence it supplements the previous database. Its sample is smaller and it is not representative, but it includes also large companies, studied in much greater depth. Contrary to the database of "Survey of the situation of enterprises", its predecessors (dating from 1996, 1999, 2004, respectively) also contained questions about logistics.

4.1.1. "Survey of the situation of enterprises, 2009"

To support the Hungarian reports drawn up on the situation of small and medium-sized enterprises from 1996 on, from 2002 on, questionnaire-based surveys were made, covering a representative sample of almost two thousand small and medium-sized enterprises. The sample itself was based in 2009 on Complex Céghírek (Complex Company News) for corporate enterprises and the database of the Central Data Processing and Registration Office of the Ministry of Interior for individual entrepreneurs. The survey was conducted in Budapest and in four Hungarian counties (Békés, Hajdú-Bihar, Győr-Moson-Sopron, Somogy), selected so as to provide a good representation of counties in different positions. The random sample was generated by the staff members of the Ministry for National Development and Economy with the SPSS statistical program, proportionally with the territorial distribution of enterprises. To avoid excessive representation, a smaller number of elements was selected from the relatively more homogenous circle of individual entrepreneurs (sole proprietors). The standard error of the subsamples at 95% reliability level was max. ± 2.04 for individual entrepreneurs and ± 1.33% for corporate enterprises. Given the low efficiency of mail-based surveys (6-15% response rate), the more expensive personal interview solution was chosen to enhance reliability (NFGM [2009]). To compensate for the difficulties of choosing addresses based on the registers, in 2009 the interviewers were provided two extra samples compiled for this purpose for identifying additional enterprises with similar characteristics, instead of having to rely on their own acquaintances. The sample distribution of the survey of 2009 is shown in Table 15.

Table 15: "Survey of the situation of enterprises, 2009" by economic branch and headcount (no.)

	0 person	**1-9 persons**	**10-49 persons**	**50-249 persons**	**Total**
Agriculture	39	37	5	2	83
Manufacture	26	29	10	3	68
Energy supply	11	6	0	1	18
Construction	110	74	10	1	195
Trade	281	315	16	4	616
Services	283	190	14	2	489
Community services	362	154	14	5	535
Total	1 112	805	69	18	2 004

Source: Compiled by the Author.

I was offered the possibility to integrate into the survey of 2009 a limited number of questions concerning SME logistics, which I designed in the same way for every organisation.[54] I drew up the questions concerned based on earlier researches, in consideration of the demand of comparability, modelled for the most on the questions in "Finland State of Logistics", Finland being a small, open economy like Hungary, where the survey was carried out several times on a large sample and, what is more, the last one at a time close to our survey. Furthermore, similar questionnaires were used also in eight areas of the countries of the Baltic Sea Region (Estonia, southern part of Finland, Hamburg, Latvia, Lithuania, Mecklenburg-Western Pomerania, Pomerania, Östergötland, St. Petersburg). I also solicited the opinion of Hungarian logistics experts on the questions to be included in the survey.

Apart from restricting the research relative to the Finnish and Baltic researches exclusively to logistics costs and outsourcing, the main differences were the following:

- I chose total costs as the reference base for logistics costs, because that was easier to use in the estimations than sales revenues, the most frequent indicator, the use of which was avoided anyway in the questionnaire of the "Survey of the situation of enterprises".
- Assuming that the lower values would predominate in outsourcing, for the level of logistics outsourcing, I built the category limit of max. 5% into the survey.

I avoided using the word "logistics" directly, due to its diverse interpretations in previous researches (Kummer [1995]; Szabó [2005]; Vízhányó [2006]), confirmed also in the trial testing of the questionnaire with five micro enterprises (for the final version, see Annex No. 1). Instead, I subdivided logistics according to TEÁOR, the Standard Classification of Industrial Activities, into transportation, cargo handling, warehousing, storage, packaging, forwarding, well-understood by the respondents, which

- solved the issue of the diverse interpretations of logistics by dividing it into several activities/functions defined relatively precisely, without overlaps;
- promoted international comparability, TEÁOR being harmonised at European level with the other statistical classification systems (e.g. NACE, ISIC).

[54] In the Finnish and Baltic research surveys, manufacturing, commercial and logistics service provider enterprises completed partly different questionnaires.

4.1.2. "In competition with the world, 2009"

Data collection in 1996 under the "In competition with the world" research programme launched by the Department of Corporate Economics of Budapest University of Economics was followed in 1999 by an essentially identical questionnaire and in 2004 by one upgraded with many new questions and basically identical with the latest one dating from 2009. I used for my research the last one, based on data collection from April to November 2009. Following cleaning, data originating from a total of 1246 senior managers (general director, head of the marketing, production and financial areas, respectively), 300 of the original 313 companies remained in the database; the distribution of the companies concerned is shown in Table 16:

Table 16: Distribution of the sample of the survey "In competition with the world, 2009" by economic branch and headcount (no.)

	0 person	**1-9 persons**	**10-49 persons**	**50-249 persons**	**250+ persons**	**Total**
Agriculture	0	0	4	8	1	13
Manufacture	1	5	26	80	15	127
Energy supply	0	0	0	3	3	6
Construction	0	4	6	14	4	28
Trade	1	10	13	29	4	57
Services	3	13	15	20	16	67
Community services	0	0	0	2	0	2
Total	5	32	64	156	43	300

Source: Compiled by the Author.

The production/services questionnaire included 19 questions on logistics and supply chain management, the trade/marketing questionnaire 6 on logistics services, and the financial one 1 on stock rotation/stockpiling. Moreover, each questionnaire examined intra-organisational relations, including the weight of logistics in the success of the company overall and its effect on other functions.

4.2. Research methods

I used the IBM PASW/SPSS 18.0. computer programme to test the research hypotheses: I defined the SMEs exclusively by headcount, considering those with fewer than 10 employees micro enterprises, those with 10-50 small, and those with 50-250 medium-sized enterprises. I did not exclude from the survey enterprises with no employees, since

they have not been studied so far and they might offer results laying the bases of further researches (e.g. logistics practice of the population).

The variables and methods used to test my hypotheses are summed up in Table 17, and the results will be exposed in detail in the following chapter.

Table 17: Methods applied by the research

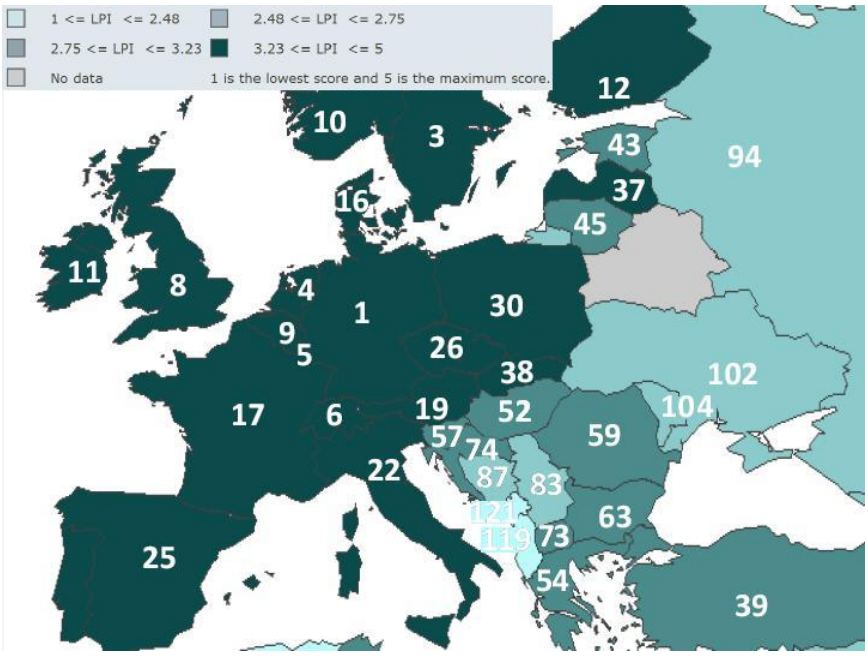
Hypothesis	Databases and variables	Methods
-	"Survey of the situation of enterprises, 2009" Variables related to Questions 5, 13, 30, and to Questions 3, 4, 7, 23, 26-29, 51 on county, settlement type Variables related to Questions 5, 17, 30, and to Questions 3, 4, 7, 23, 26-29, 51 on count, settlement type. „In competition with the world, 2009" research Questions A1, A8, K51d-i. and K52a-c.	Descriptive statistics, factor analysis, variance analysis, Kruskal-Wallis, Mann-Whitney tests
H1a **H1b**	"Survey of the situation of enterprises, 2009" Variables related to Questions 5, 13, 30, and Questions 3, 4, 7, 23, 26-29, 51 on county, settlement type Variables related to Questions 5, 17, 30, and to Questions 3, 4, 7, 23, 26-29, 51 on county, settlement type	Cross-table analyses
H2	"Survey of the situation of enterprises, 2009" Variables related to Questions 4, 13a-b, 17a-b Corporate Database of the National Tax and Customs Administration – 2009 Net sales revenues, total cost and expenditure data	Descriptive statistics (mean calculation)
H3a **H3b** **H3c**	"Survey of the situation of enterprises, 2009" Variables related to Questions 18c, 19b, 19g, 30 Variables related to Questions 18, 19 Variables related to Questions 17a, 17b, 17c and 18-19	Cross-table analyses, scaling Binary logistic regression
H4	"In competition with the world, 2009" Variables related to Questions A1, A8, K55, K56	Factor analysis
H5a **H5b**	"In competition with the world, 2009" Variables related to Questions A1, V14j, V15 Variables related to Questions A1, V15, K52, K54s	Cluster analysis and cross-table analysis
H6	"In competition with the world, 2009" A1 variables and Variables related to Question M1 from all 4 questionnaires addressed to managers	Paired-samples T-test and Wilcoxon test

Source: Compiled by the Author.

5. Research findings

Data collection for the two surveys used in the Thesis took place in 2009, which was not an average year due to the economic crisis: according to the Hungarian Central Statistical Office, the Hungarian GDP shrank that year by 6.8% (at current prices), and the indicators concerning the logistics of Hungarian enterprises indirectly (e.g. Baltic Dry Index, BVL logistics indicator[55]) were also at their nadir. According to the World Bank Logistics Performance Index, a measure of logistics competitiveness accepted by in ever wider circles, introduced at that time, Hungary's previous position deteriorated to 52nd position.

Figure 19: Rank order of European countries based on the Logistics Performance Index, 2009



Source: Based on Arvis et al. [2010]

Before testing the research hypotheses, I examined the logistics variables of the "Survey of the situation of enterprises, 2009", which had not been analysed in detail previously. Besides the descriptive statistics of logistics cost levels and outsourcing rates, I examined their distributions, significant differences by independent variable, and their correlations.

[55] According to the Hungarian Central Statistical Office, in 2009, 23.22% of Hungarian foreign trade related to Germany.

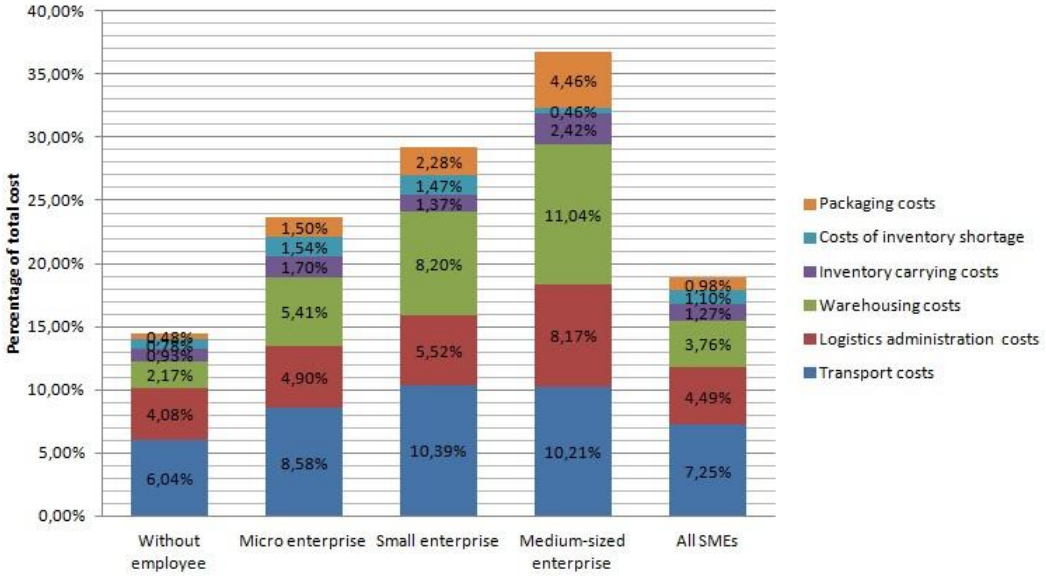
5.1. Examination of the logistics cost level and outsourcing variables of the "Survey of the situation of enterprises, 2009" database

5.1.1. Logistics cost levels

In answer to (open) Question 13 of the "Survey of the situation of enterprises, 2009", the small and medium-sized enterprises indicated the rate of their logistics sub-costs[56] one by one, in per cent of their total costs. I calculated their total logistics costs by aggregating these values, defining the capital cost component of the stock storage facility as the product of the purchase-price-based annual average value of stocks and of the average interest rate of the National Bank of Hungary for 2009[57].

In 2009, the average rate of the total logistics costs of Hungarian SMEs to their corporate total costs was 18.86%, with the transportation, logistics administration and the warehousing costs, respectively, contributing the biggest shares. The costs of logistics administration excelled. This was just the inverse of the rule of thumb, i.e. the bigger the enterprise, the smaller the logistics costs[58], but the number of small and of medium-sized enterprises was relatively low within the sample.

Figure 20: Logistics cost levels of Hungarian SMEs by company size, 2009



Source: Compiled by the Author

[56] Transportation and cargo handling, warehousing, storage (operation of own/third party warehouse facility), packaging, annual value of stocks (at purchase price), order executed due to inventory shortage, lower-level production/service.

[57] Value: 8.63%. The year 2009 was chosen because under the questionnaire the SMEs estimated their costs for that period.

[58] However, contrary to that rule based on sales revenue, here total cost was regarded as the reference base.

The cost rates of Hungarian SMEs probably increased under the effect of the economic and financial crisis, since according to Questions K51d-i of "In competition with the world, 2009", every component of the logistics sub-costs increased in the three years preceding the survey. Table 18 shows the average values of the sub-costs of logistics expressed on a five-point scale (significant decrease (1) … significant increase (5)) is shown in Table 18.

Table 18: Average values of the changes of certain logistics sub-costs measured on a 5-point Likert scale in the three years before 2009

	Transportation cost	**Warehousing cost**	**Inventory carrying cost**	**Other logistics costs**
Micro enterprise	3.31	3.75	3.66	3.41-3.56
Small enterprise	3.74	3.54	3.45	3.26-3.41
Medium-sized enterprise	3.65	3.50	3.49	3.30-3.36
Total	3.63	3.54	3.50	3.33-3.38

Source: Compiled by the Author.

According to the "Survey of the situation of enterprises, 2009" database, 43.86% of Hungarian SMEs indicated no total costs of logistics, but their sub-cost rates were much higher than those indicated above.[59] This confirms the earlier assumptions and findings that small and medium-sized enterprises are hardly/not at all aware of their logistics costs (Tempel and Meißner [2002]; Virum [1994]). According to their self-declarations, almost one fifth of SMEs in trade, agriculture and manufacture had no logistics costs at all, and more than half of respondent enterprises in the services sector expressed the same opinion. The results in manufacture were identical with the ones expected on the basis of earlier researches (Berr et al. [1990]; Campos-Garcia et al. [2011]).

[59] 58.98% of SMEs indicated no logistics administration costs; 62.52% indicated no inventory carrying costs, 63.32% no transportation costs, 74.05% no warehousing costs, 85.53% no packaging costs and 90.22% none related to inventory shortage.

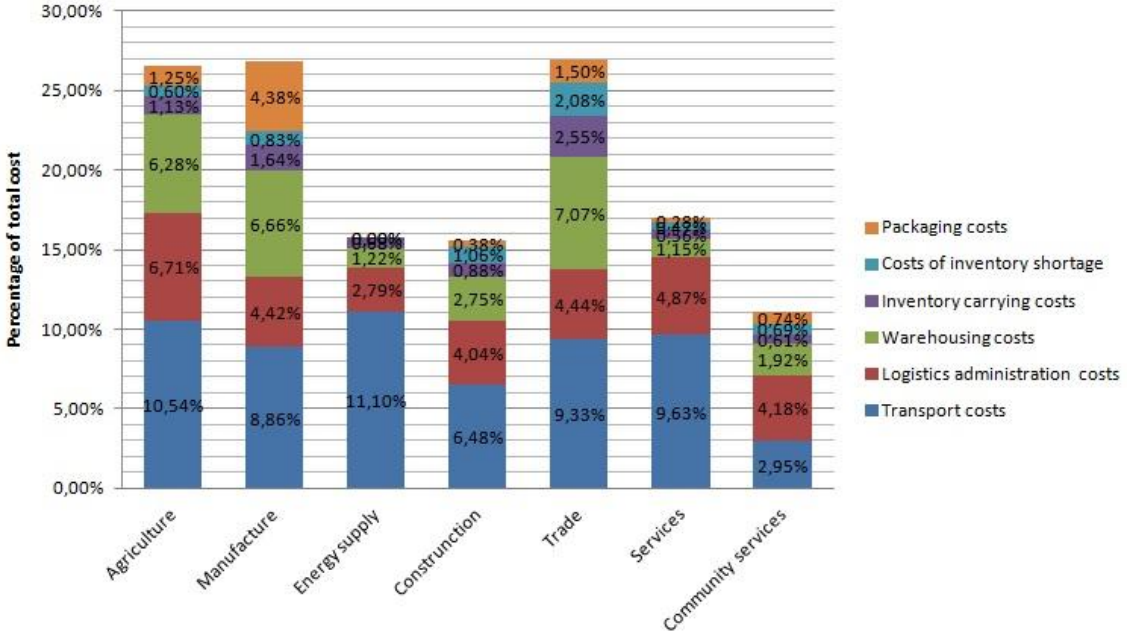
Table 19: Hungarian SMEs reporting zero logistics total costs by branch and company size

	0 employee	Micro enterprise	Small enterprise	Medium-sized enterprise	Total
Agriculture	28.21%	16.22%	20.00%	0.00%	21.69%
Manufacture	34.62%	17.24%	10.00%	0.00%	22.06%
Energy supply	27.27%	50.00%	-	100.00%	38.89%
Construction	54.55%	28.38%	20.00%	100.00%	43.08%
Trade	22.42%	19.68%	18.75%	25.00%	20.94%
Service	59.36%	41.58%	35.71%	0.00%	51.53%
Community services	73.48%	64.29%	57.14%	20.00%	69.91%
Total	52.16%	34.16%	28.99%	22.22%	43.86%

Source: Compiled by the Author.

In terms of branch distribution, total logistics costs were highest in commerce, manufacture and agriculture, and lowest in the community services.

Figure 21: Logistics cost levels of Hungarian SMEs by branch, 2009



Source: Compiled by the Author.

I explored the relationships of the six partial costs of logistics by factor analysis. This was feasible thanks to the sample size of the "Survey of the situation of enterprises, 2009" (at least 4-5-times larger than that of the variables and minimum 50-100) and its other features[60]. I used principal component analysis, with VARIMAX rotation, where

[60] E.g. validity of content, and correlation and anti-image matrices in the analysis and Bartlett's test also confirm that.

the Kaiser-Meyer-Olkin (KMO) index of sampling adequacy was 0.631, which qualifies as mediocre (Ketskeméty et al. [2011] p. 239.). Factor analysis identified 2 factors, explaining 43.64% of the total variance. Therefore, I considered it more expedient[61] to keep analysing the constituent costs (sub-costs) of logistics separately. For both factors containing three cost components each (warehousing, inventory carrying, packaging and transportation, inventory shortage, administration), the eigenvalues were greater than 1.

The total and partial cost rates of logistics measured on a full metric scale including also enterprises with 0 employee in the "Survey of the situation of enterprises, 2009" database:

- showed non-normal distribution, as indicated visually by the histograms (see Annex No. 3), and the rejection of the normality hypotheses of the Kolmogorov-Smirnov tests, although the latter are sensitive to large samples (1000+ elements) (Sajtos and Mitev [2007] p. 118.);
- according to Levene's tests (see Annex No. 3.), the condition of the homogeneity of variance was not met, except for transportation and logistics administration costs[62].

Besides the differences in total and partial cost rates identified in the "Survey of the situation of enterprises, 2009" by company size[63] and branch[64], I looked for differences also on the basis of the other 11 variables in the database. These were the following: geographical location[65], main place of sale[66], distinctive features relative to competitors[67], age of the No.1. leader of the SME[68], school qualification of the No.1. leader[69], sex of the same, age of the SME[70], whether the SME is engaged in co-

[61] In social sciences, a variance ratio of 60% is already acceptable (Sajtos and Mitev [2007], p. 260.).
[62] Distribution by company size.
[63] Staff of 0; 1-9; 10-49, or 50-249. Classification based on Question 30e of the "Survey of the situation of enterprises, 2009".
[64] Agriculture, manufacture, energy supply, construction, trade, service or community service. Classification based on Question 5 of the " Survey of the situation of enterprises, 2009".
[65] Counties Békés, Győr-Moson-Sopron, Hajdú-Bihar, Somogy, respectively, or Budapest. Based on the County question of the "Survey of the situation of enterprises, 2009".
[66] To this settlement; not to this settlement, but within the county; without the county, but in Hungary; or: abroad. Based on Question 7 of the "Survey of the situation of enterprises, 2009".
[67] Lower price, better quality, wider choice, more up-to-date technology, better contact with clients, flexible payment, payment on time, observation of transportation deadlines, or other. Based on Question 26 of the "Survey of the situation of enterprises, 2009".
[68] Ages below 25; 25-35; 36-45; 46-55; 55+, respectively. Based on Question 28 of the "Survey of the situation of enterprises, 2009".
[69] College, university degree; GCSE, secondary vocational school qualification; 8-year primary school + skilled worker training; max. 8-year primary school or less. Based on Question 29 of the " Survey of the situation of enterprises, 2009".

operation, whether it is a corporate or individual enterprise, position of the enterprise[71] and type of the settlement[72] where it operates. I examined variance homogeneity in each case with Levene's tests. If it was met, then with variance analysis (ANOVA), if not and the variable (e.g. distinctive features relative to competitors) had at least there criteria, then I examined the differences with the Kruskal-Wallis[73] tests. If the zero hypothesis concerning homogeneity of the Kruskal-Wallis tests was rejected, I proceeded with the examination in case of heteroscedasticity for the pair or the binary/dichotomous variables (e.g. SME leader's sex, man or woman) with the Mann-Whitney tests.

According to the Kruskal-Wallis tests and the one-criterion variance analyses, the total and the constituent costs of logistics, respectively, are not homogeneous by company size and branch affiliation at the significance level of 5%. This means that there was at least one significantly different partial criterion in each case. As for the other variables, the position of the enterprise was homogenous for 1 cost component, its geographical location, settlement type, the qualification of the No.1. leader and the distinctive features relative to competitors, respectively, were homogenous for 2 cost components, the main place of sale for 3, and the age of the No.1. leader and of the SME, respectively, for 5 cost components. The last means that there was no significant difference in the groups created this way (e.g. in regard of warehousing costs, whether the No.1. leader was younger than 25, aged 25-35, 36-45, 46-55 or 55+). Note in connection with the results that the high number of elements in the subsamples of the "Survey of the situation of enterprises, 2009" could in itself be conducive to significant differences.

[70] Founded before 1995; 1995 to 2000; 2001 to 2005; or 2006 or later. Classification based on Question 3 of the "Survey of the situation of enterprises, 2009".
[71] Good, mediocre or bad. Based on Question 51 of the "Survey of the situation of enterprises, 2009".
[72] Capital, county seat, town or village. Classification based on the Question "Name of the settlement" in the "Survey of the situation of enterprises, 2009".
[73] The partial samples may be regarded as independent; the variances are by and large identical, therefore, I did not use the Jonckheere-Terpstra test.

Table 20: Significance levels of the differences in the total and constituent costs of logistics according to the given criterion[74]

	Logistics total cost	Transportation cost	Warehousing cost	Packaging cost	Inventory carrying costs	Inventory shortage cost	Logistics administration cost
Company size	.000	.002*	.000	.000	.000	.000	.000
Branch	.000	.000	.000	.000	.000	.000	.000
Geographical location	.001	.000	.142	.764	.008	.002	.000
Main place of sales	.000	.000	.334*	.267	.027	.524	.000
Distinctive features relative to competitors	.000	.000	.000	.001	.045*	.907*	.894*
Age of No.1. leader	.354	.038	.614*	.338	.785*	.764*	.008
School qualification of No.1. leader	.011*	.000	.000	.002	.000	.232	.069
Age of SME	.201*	.289*	.206*	.007	.000	.411	.570*
Current situation of SME	.000	.035	.025	.114*	.000	.000	.000
Settlement type	.000	.000	.048	.964*	.256	.011	.000

*: Significance levels of ANOVA F test, or else of Kruskal-Wallis tests.

Source: Compiled by the Author.

I shall only highlight the extreme values of the results of the ANOVA and Mann-Whitney tests comparing pairs and warranting few general statements. Significant variances were found in the breakdown

- *by branch*, where the transportation costs of the community service branch were lower than those of the other branches; the packaging costs of manufacture were higher, the inventory carrying costs of the service sector were lower and those of trade higher than those;
- *by geographical location*, in the transportation costs of Békés county and in the logistics administration costs of Somogy county relative to all other counties under study;
- *by main sales site*, in sales within the settlement or the county, where the transportation and total logistics costs, respectively, were the lowest. This partly confirmed the results of the "Finland State of Logistics" survey of 2008, but it was

[74] Values lower than 0.05 (5% significance level) mean that the zero hypothesis concerning homogeneity must be discarded.

in contradiction with those of 2005 (Solakivi et al. [2009]), and also those of the Norwegian researchers (Lea et al. [1996]).

- *by distinctive feature relative to competitors*, in that the "strategy" of offering an ample choice implied higher warehousing costs than any other feature;
- as for the question concerning *the position of the enterprise*, "improves" meant the lowest, "does not change" the medium-level and "deteriorates" the highest logistics administration and total costs. SMEs in a deteriorating position faced higher warehousing, inventory carrying and shortage costs than any other category of entities;
- *by settlement type*, in that the transportation costs and logistics total costs of SMEs operating in villages were higher than those of their peers located in any other type of settlement (town, county seat, capital). The shortage costs of SMEs operating in county seats were higher than those of entities in any other category.

As for the dichotomous variables:

- The partial and total logistics costs of SMEs led by men[75] were lower than those of SMEs led by women, with an insignificant difference only in the packaging, inventory carrying and logistics administration costs.
- Participation in co-operation[76] was usually concurrent with higher costs[77]. The difference was significant only for inventory shortage and logistics administration costs.
- Every logistics sub-cost and the logistics total costs of corporate enterprises[78] was higher than that of individual ones, although the difference was not significant for the transportation, inventory shortage and logistics administration costs, respectively.

Unfortunately, the average logistics costs levels of Hungarian SMEs were not comparable with those covered by the foreign papers due to the differences in methodologies; moreover, the latter usually published only average cost rate figures. The average cost rates of the logistics of manufacturing, trading and service provider enterprises (see Annex No. 3) were higher than those indicated under earlier SME

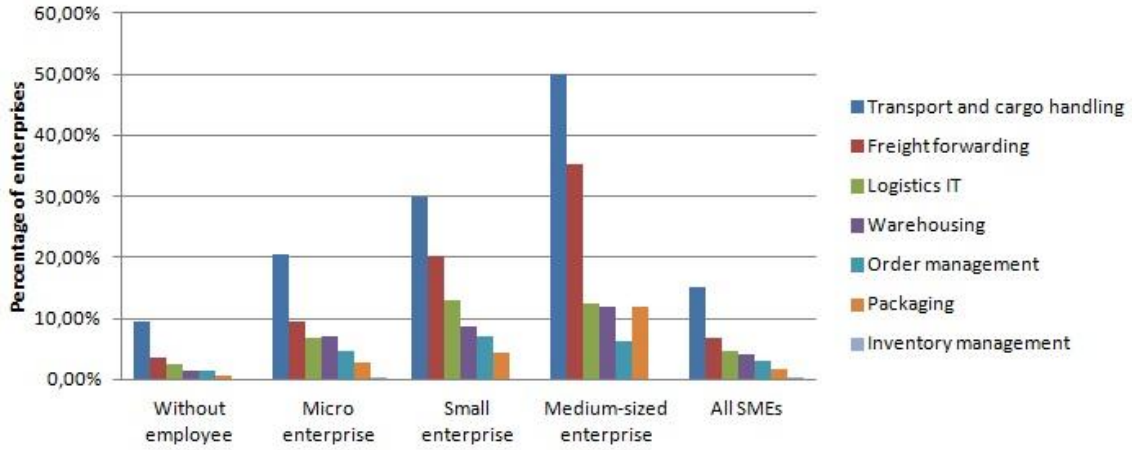
[75] Based on Question 27 of the "Survey of the situation of enterprises, 2009".
[76] Based on Question 23 of the "Survey of the situation of enterprises, 2009".
[77] Except for the warehousing and packaging costs, where it was lower.
[78] Based on Question 4 of the "Survey of the situation of enterprises, 2009".

logistics researches (Bagchi and Virum [2000]; Szabó [2005]; Vízhányó [2006]; Ojala et al. [2007]; Hovi and Hansen [2010]; Solakivi et al. [2010]; Campos-Garcia et al. [2011]), and the gap was even wider for large companies (ELA and A.T. Kearney [2009]). The total logistics cost rates of Hungarian manufacturing SMEs were closest to the Mexican data (Campos-Garcia et al. [2011]), but in the absence of the appropriate data, nothing can be said of the significance of either these data or the previously mentioned ones.

5.1.2. Logistics outsourcing ratios

Under Question 17 of the "Survey of the situation of enterprises, 2009", the SMEs could indicate in the logistics outsourcing list whether they outsourced transportation and cargo handling, warehousing/storage, packaging, forwarding, order management, inventory management and the necessary IT systems[79]. As shown in Figure 22, outsourcing was most marked for the transportation and cargo handling activities at 15.03%. This was followed by forwarding at a rate of 6.69%, logistics IT at 4.68%, warehousing at 4.00%, order management at 3.07%, packaging at 1.80% and inventory management at 0.15%. The Hungarian SMEs outsourced decisively the simpler logistics sub-activities; the high outsourcing rate of freight forwarding mirror the findings of Murphy et al. [1995] and of Pearson and Semeijn [1999]

Figure 22: Rate of SMEs outsourcing logistics, by company size, 2009



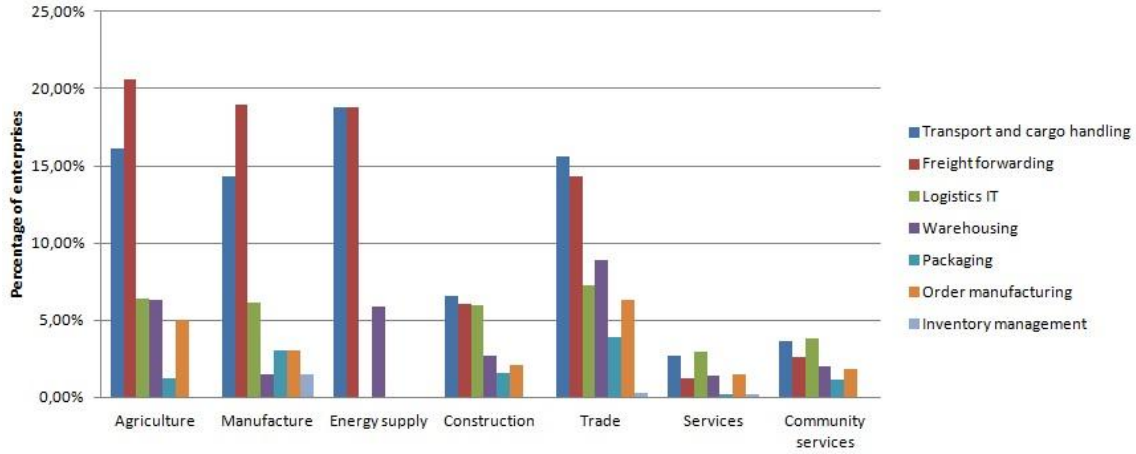
Source: Compiled by the Author.

[79] Possible answers: not done; max. 5%; more than 5%, but max. 25%; more than 25%, but max. 50%; more than 50%, but max. 75%; more than 75%. Note that outsourcing is generally measured in percentage terms (e.g. "Lieb series", "Langley series"), with some exceptions (e.g. Armstrong reports) (Ashenbaum et al. [2005]).

Almost half of outsourcing Hungarian SMEs in the sample outsourced several sub-activities simultaneously, most frequently transportation/forwarding (29.35%), transportation/warehousing (7.07%), transportation/warehousing/forwarding (7.07%) and forwarding/logistics IT (4.35%) (for the rest, see Annex No. 3).

Considering every logistics sub-activity, the rate of outsourcing was highest in agriculture, manufacture and commerce, and lowest in services and community services.

Figure 23: Rate of SMEs outsourcing their logistics activities, by branch, 2009



Source: Compiled by the Author.

Question K52 of the survey "In competition with the world, 2009" also examined transportation/freight forwarding, warehousing and inventory management, but only by yes-and-no questions. Outsourcing rates higher than in the "Survey of the situation of enterprises, 2009" sample were found there, as shown in Table 21. The significant difference is probably attributable to the higher proportion of manufacture and of enterprises of a larger size within the sample.

Table 21: Outsourcing of logistics sub-activities, based on the database of "In competition with the world, 2009"

	Micro enterprise	**Small enterprise**	**Medium-sized enterprise**	**SME, total**
Transportation, forwarding	57.14%	70.73%	73.79%	70.91%
Warehousing	33.33%	31.71%	20.59%	25.00%
Inventory management	28.57%	24.39%	16.67%	20.12%

Source: Compiled by the Author.

In order to explore the relationships between the logistics sub-activities suitable for outsourcing included in the "Survey of the situation of enterprises, 2009" database, I made a principal component analysis with the Varimax rotation procedure as with the case of the partial costs. The value of the Kaiser-Meyer-Olkin adequacy index was 0.751, i.e. middling (Ketskeméty et al. [2011] p. 239.). Factor analysis identified 2 factors, which explain 57.85% of the total variance. (For both factors, the eigenvalue was greater than 1.) Based on the rotated component matrix, transportation and forwarding ended up in one factor and the other sub-activities in the other. The first confirms the survey carried out among 300 Hungarian logistics enterprises showing that, among the logistics services, transportation and forwarding are the most likely to be linked (Bank et al. [2010] p. 65.).

Table 22: Rotated component matrix of logistics outsourcing levels

	Component 1	**Component 2**
Transportation and cargo handling	.129	.846
Warehousing, storage	.579	.323
Packaging	.858	.102
Forwarding	.202	.788
Inventory management	.830	.011
Order management	.607	.223
Logistics IT	.553	.235

Source: Compiled by the Author.

In view of the results of the factor analysis, in what followed, I kept examining the outsourcing of the logistics sub-activities separately. I did not analyse inventory management, however, since its outsourcing occurred only in a few cases and so it could have distorted the results.

The outsourcing(s) of specific logistics sub-activities[80]:

- did not show normal distribution, as indicated visually by the histograms (see Annex No. 3.), and by the rejection of the normality hypotheses of the Kolmogorov-Smirnov tests;
- according to Levene's tests (see Annex No. 3.), the condition of variance homogeneity[81] was not met.

[80] Variance homogeneity exists, for example, for inventory management.
[81] In a breakdown by company size.

I examined the differences occurring in the outsourcing of logistics sub-activities with a method similar to that applied for logistics costs (ANOVA, or Kruskal-Wallis and/or Mann-Whitney tests). Company size, branch, main sales site and distinctive features relative to competitors all proved to be heterogeneous for all logistics sub-activities; geographical location and school qualification of the No.1. leader were homogeneous for one outsourcing component each; the current situation of the SME and settlement type for 2 outsourcing components each; the age of the No.1. leader was homogenous for 4 outsourcing components. Every logistics outsourcing component proved to be homogenous for the age of the SME.

Table 23: Significance levels of the variances of logistics outsourcings by a given criterion

	Transportation outsourcing	**Warehousing outsourcing**	**Packaging outsourcing**	**Forwarding outsourcing**	**Order management outsourcing**	**Logistics IT outsourcing**
Company size	.000	.000	.000	.000	.000	.000
Branch	.000	.000	.000	.000	.000	.018
Geographical location	.000	.000	.000	.922*	.000	.000
Main sales site	.000	.000	.001	.000	.000	.000
Distinctive features relative to competitors	.000	.000	.009	.009	.008	.008
Age of No.1. leader	.177	.022	.035	.104	.479	.746*
School qualification of No.1. leader	.027	.238	.012	.005	.013	.000
Age of SME	.126	.717	.199	.735	.900	.219
Current situation of SME	.630*	.000	.006	.430	.005	.030
Settlement type	.640*	.000	.000	.305	.000	.000

*: Significance levels of ANOVA F test, or else of Kruskal-Wallis tests

Source: Compiled by the Author.

Again, I highlighted only the extreme values based on the results of the ANOVA and Mann-Whitney tests comparing pairs and these, too, warranted but few general statements. Significant difference was found in a breakdown

– *by branch*, where the low-level forwarding outsourcing rates of services and community service differed from those of every other branch;

- *geographical location*, where the order management, warehousing and packaging outsourcing rates of Budapest-based SMEs were higher than those of the SMEs in the countryside, and transportation outsourcing by the SMEs of Somogy county were lower than the corresponding value for entities located elsewhere;
- *by settlement type*, where the warehousing, packaging, order management and logistics IT outsourcing rates of SMEs from the capital were higher than those of SMEs in the countryside.

As for the binary variables:

- The logistics outsourcing rates of SMEs led by men were higher than those of SMEs headed by women, but the gap was significant only for transportation, warehousing and forwarding.
- Participation in co-operation was concurrent with lower outsourcing rates. The difference was significant only for transportation, forwarding and logistics IT outsourcing.
- The logistics outsourcing rates of corporate enterprises were higher than those of individual ones, which was significant in every case.

Unfortunately, for the reasons mentioned already in connection with the cost levels, the outsourcing rates of Hungarian SMEs were not comparable with similar figures indicated in the domestic (Vízhányó [2006]; Teleki et al. [2009]) and the foreign papers (e.g. "Lieb series and "Langley series"[82]). The results of the two databases used by me have led to contradictory conclusions: "In competition with the world, 2009" provided data matching those expected on the basis of previous research, whereas "Survey of the situation of enterprises, 2009" yielded lower values, but nothing can be said about the significance of the latter.

5.1.3. Logistics costs rates vs. outsourcing rates

I examined the interaction of logistics costs and outsourcing with Pearson's correlation coefficients. I compared the total costs of logistics with the outsourcing of every sub-activity, but for the sub-costs, I only analysed those referring to identical sub-activities, in pairs (e.g. transportation cost vs. transportation outsourcing).

[82] According to the paper, in Europe in 2009, 91-92% of transportation, 72% of warehousing, 57% of forwarding and 34% of logistics IT was outsourced (Langley and Capgemini, 2009, p. 12).

Table 24: Pearson's correlations of certain logistics costs and outsourcing levels

	Logistics, total cost	**Transportation cost**	**Warehousing cost**	**Packaging cost**
Transportation outsourcing	.328	.281	-	-
Warehousing outsourcing	.184	-	.247	-
Packaging outsourcing	.155	-	-	.252
Forwarding outsourcing	.192	-	-	-
Order management outsourcing	.159	-	-	-
Logistics IT outsourcing	.122	-	-	-

Source: Compiled by the Author.

The correlation was significant in every case. From among the variables, there was mediocre positive correlation between transportation outsourcing and transportation cost and the total costs of logistics, and between warehousing outsourcing and total warehousing costs, packaging outsourcing and packaging costs, and weak positive correlation between the rest of the items. I did also a restricted study covering agriculture, manufacture and commerce only, which yielded similar, albeit lower values (see Annex No. 3).

5.2. Examination of Hypotheses H1

According to Hypotheses H1, company size and branch are the two most important contingency factors of the rates of logistics costs and outsourcing, respectively; to examine them, I used Questions 3-5, 7, 13, 17, 23, 26-30 and 51 of the "Survey of the situation of enterprises, 2009". The measurement scales of these variables are nominal or ordinal. I did not use variance analysis for the examination of the variables in the survey due to the violation of normality and variance homogeneity, despite the F test being robust. Instead, I applied scale transformation and chose one of the most frequently applied multi-variate methods, cross-table analysis. I transformed the logistics sub-cost and outsourcing rates down/into 3-3 categories: 0% ("does not know" answers were also assigned here), 0-50% and higher than 50%. This reduced the chance that the expected values of the cells of the cross-tables be lower than 5, the chi-square test being sensitive to that[83]. There is no "best" association measure, but by using the same index, closer relationships can be shown (Füstös et al. [2004] p. 80.). I examined the association between an independent nominal or ordinal variable and a dependent interval one with the eta statistics[84]; the relevant results are shown in Table 25. The choice of eta was justified by its being the only SPSS-generated indicator measuring association between an independent category variable and an interval-level dependent variable.

[83] According to a stricter version of the criterion, the cross-table cannot be considered reliable if this is true for any of its cells, but according to the less strict one, max. 20% of cells are allowed to be like that (Sajtos and Mitev [2007] p. 154.).

[84] Value from 0 to 1, the first referring to independence, the latter to a deterministic relationship.

Table 25: Eta values of factors affecting logistics costs and outsourcing

	Transportation cost	**Warehousing cost**	**Packaging cost**	**Inventory carrying cost**	**Inventory shortage cost**	**Administration cost**	**Logistics total cost**	**Transportation outsourcing**	**Warehousing outsourcing**	**Packaging outsourcing**	**Forwarding outsourcing**	**Order management outsourcing**	**Logistics IT outsourcing**
Company size	**.229**	**.267**	**.197**	**.207**	**.106**	**.214**	**.186**	**.191**	**.153**	**.092**	**.180**	**.119**	**.125**
Branch	**.291**	**.193**	**.120**	**.176**	.053	**.209**	**.257**	**.182**	.060	*	**.166**	.045	.062
Geographical location	.084	*	*	*	.051	.031	.023	.063	.064	.047	*	.064	.051
Main sales site	.193	*	*	*	*	.088	.150	.127	**.145**	.052	.118	.067	.113
Distinctive features relative to competitors	.106	.027	.022	.000	*	.037	.079	.063	.022	*	.092	.059	.056
Age of No.1. leader	*	*	*	*	*	.087	*	*	*	*	*	*	.030
School qualification of No.1. leader	.109	.056	.000	.097	*	.073	.142	.067	*	*	*	*	.086
Age of SME	.039	.051	.028	.064	*	.053	.059	*	*	*	*	*	*
Settlement type	.099	.032	*	*	*	.082	.143	*	.112	**.093**	*	**.122**	*
Current situation of SME	*	*	*	.029	*	.045	.062	*	.100	*	*	.070	*
Corporate or individual enterprise	.149	.145	.108	.112	**.076**	.140	.119	.131	.084	.075	.109	.096	**.121**
No.1. leader is a man or a woman	.162	.099	*	.051	*	.107	.099	.118	.063	*	.086	*	*
Engaged in cooperation or not	.063	*	*	*	*	.094	.094	.103	*	*	.146	*	.105

*Independent according to the chi-square, hence the eta is not indicated.

Source: Compiled by the Author.

The etas applied to the total sample of the "Survey of the situation of enterprises, 2009" confirmed that company size and branch affiliation were the two most important contingency factors, except for the cost rates of inventory shortage, and of warehousing, packaging, order management and logistics IT outsourcing. Inventory shortage costs and logistics IT outsourcing were influenced most by the corporate or individual nature of the enterprise beside company size, and the outsourcing of packaging and order management by the type of the settlement. The outsourcing of warehousing was most strongly explained by the main sales site together with company size. That is, the 13 partial hypotheses were not confirmed in five cases, that is, from the point of view of the total costs of logistics and the partial cost levels and outsourcing, company size is

actually the most important contingency factor, and branch is that only for part among them.

Let me note that, on the basis of the etas, these associations were rated weak-mediocre, and they came to be down-rated even further when I restricted the examination to the branches characterised by the highest total logistics cost levels and outsourcing rates, i.e. agriculture, manufacture and commerce (see Annex No. 3). In the latter case, the role of branch affiliation – the database contains but two classifications at the depth of the TEÁOR code – was almost totally repressed, and the explanatory role of co-operation together with the main sales site and the type of the settlement gathered strength. Furthermore, the occurrence of independence between the explanatory and the explained variable has increased significantly.

5.3. Examination of Hypothesis H2

Hypothesis H2 was about the significant latent demand generated by the transportation and warehousing needs of Hungarian SMEs. In the examination, I exploited the representative nature of the sample of the "Survey of the situation of enterprises, 2009" to determine the transportation and warehousing demand of the entities concerned, using the following:

- The total cost and expenditure[85] data for 2009 of every SME which filed corporate tax returns (National Tax and Customs Administration [2011]).
- The transportation and warehousing cost and outsourcing values of corporate enterprises. I did not use those of individual entrepreneurs who submit no corporate tax returns. I determined transportation and warehousing by the sum of the products of the rates by category and of the middle of the bands (value ratio), assuming that the levels and values of outsourcing indicated in the answers were proportional with one another.

I determined the demand and outsourcing by the following formulae developed by myself:

$$D_{SMEtr} = TC_{SME} * c_{tr}$$

[85] This contains only material-type expenditures (e.g. material costs, value of mediated services, purchase price value of goods sold, value of other services, value of services used, banking costs, insurance fees), the personnel-type expenditures (e.g. wage costs, personnel-type payments), depreciation and other expenses (e.g. tax-type expenses).

$$D_{SMEw} = TC_{SME} * c_w$$

$$v_{tr} = \frac{1}{n}\sum_{i=1}^{l} tr.out_i$$

$$v_{w} = \frac{1}{n}\sum_{j=1}^{m} w.out_j$$

Where,

- D_{SMEtr}, D_{SMEw}: the cargo handling and warehousing/storage demand of corporate SMEs;
- TC_{SME}: the total cost of corporate SMEs in the year of the sampling, which attained HUF 28855.719 billion in 2009[86] (Nemzeti Adó- and Vámhivatal [2011]);
- $c_{tr,}$ c_w: arithmetic mean of the transportation and cargo management, and warehousing and storage costs of the SMEs in the sample (c_{tr}=0,0725; c_w=0,0376), which I determined on the basis of Questions 13a-b) of the "Survey of the situation of enterprises, 2009";
- $v_{tr,}$ v_w: value ratio of transportation and cargo handling on the one hand and warehousing and storage on the other;
- l, m: number of SMEs outsourcing transportation and cargo handling; warehousing and storage in the sample;
- n: number of enterprises in the sample;
- $tr.out_{i,}$ $w.out_j$: per cent of transportation/cargo handling and of warehousing/storage realised by third party service providers in the case of the corporate SME (none 0.0; max. 5%: 0.025; max. 25%: 0.15; max. 50%: 0.375; max. 75%: 0.625; more than 75%: 0.875). I determined that on the basis of Questions 17a-b) of the database of the "Survey of the situation of enterprises, 2009".

On the basis of the above, in 2009, the demand of Hungarian SMEs for

- transportation/cargo handling (D_{SMEtr}), that is, the maximum market size generated by these functions attained HUF 2092.040 billion, of which 6.75% (v_{tr}) was outsourced, that is, activities worth HUF 141.213 billion were performed by third

[86]In 2009, the total net turnover of SMEs was HUF 27624.072 billion (Nemzeti Adó- and Vámhivatal, [2011]), and the GDP at current prices totalled HUF 26747.7 billion according to the Hungarian Central Statistical Office. This makes the logistics cost levels measured cost-proportionally convertible to some extent. The cost levels, not low anyway, introduced in Section 5.1.1 would be higher by 4.46% on average net-turnover-proportionally and by 7.88% GDP-proportionally.

party service providers. As for the remaining demand of HUF 1950.827 billion, on the other hand, the SMEs concerned satisfied that themselves, and it corresponded to 1.97 times the 2009 sales revenue of all Hungarian corporate enterprises doing freight forwarding and cargo handling as main activity[87], that is, that was the size of the latent freight forwarding demand;

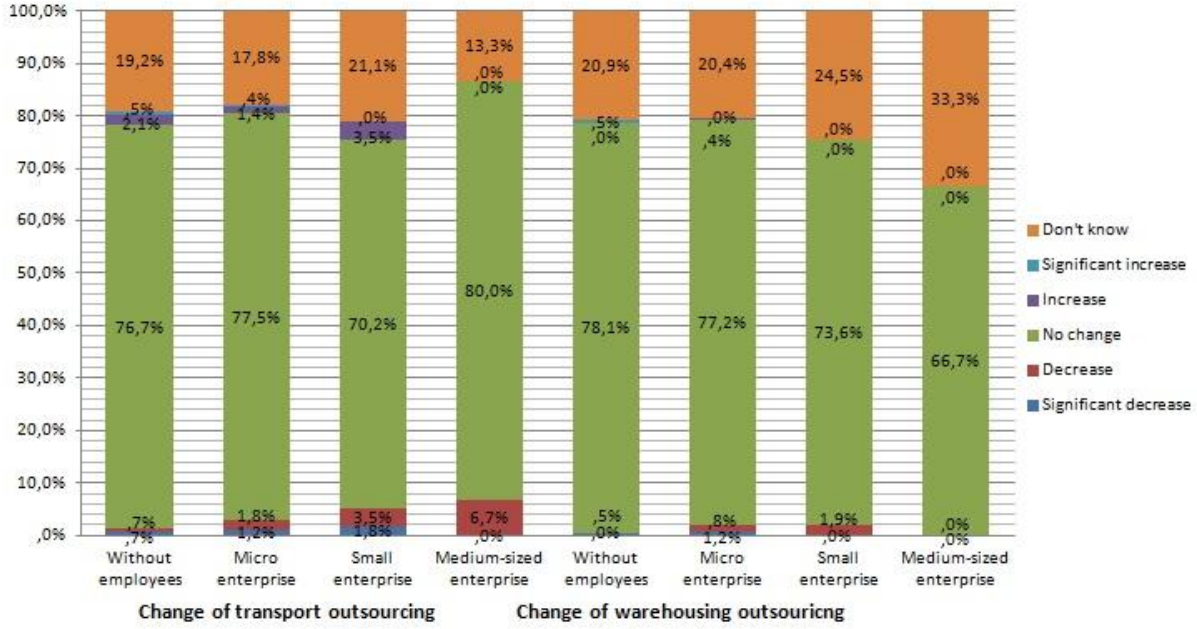
– warehousing/storage demand (D_{SMEw}), that is, a market of the size of HUF 1084.975 billion could have been realised, of which 0.8% (v_w), i.e. HUF 8.680 billion was outsourced, while the SMEs concerned met the remaining demand of HUF 1076.295 billion themselves. The latter figure corresponds to 3.53 times the 2009 sales revenue of Hungarian corporate enterprises doing warehousing and storage as main activity[88], that is, the latent warehousing demand and the consequent market expansion would have been of that size.

It is not easy for the service providers to exploit that potential, since a relatively large proportion of SMEs regard logistics as a core competence (see later under Hypothesis H3a). Furthermore, according to the answers to Question 17 of the "Survey of the situation of enterprises, 2009" querying prospective change in transportation and warehousing outsourcing in the following five years, at least 2/3 of respondents in every enterprise size category expected no change at all. This, together with the "does not know" answers corresponds to a "status quo" ratio in excess of 91%. Note that the research "In competition with the world, 2009" yielded similar results: 88.48% of the surveyed SMEs did not plan to outsource transportation/forwarding, and 92.07% warehousing in the following three years, albeit the initial outsourcing rates were higher there than under the "Survey of the situation of enterprises, 2009".

[87] TEÁOR'08 49.20 freight rail transport, 49.41 freight transport by road, 49.42 removal services, 49.50 transport via pipeline, 50.20 sea and coastal freight water transport, 50.40 inland freight water transport, 51.21. freight air transport and 52.24. cargo handling. According to data communicated by the National Tax and Customs Administration, the 2009 net sales revenue of corporate enterprises with that main activity totalled HUF 991.645 billion.

[88] TEÁOR'08 52.10. warehousing, storage. According to the data communicated by the National Tax and Customs Administration, the 2009 net sales revenue of corporate enterprises with that main activity totalled HUF 304.745 billion.

Figure 24: Change of transportation and warehousing outsourcing by SMEs in the five years following 2009



Source: Compiled by the Author.

The total logistics costs of Hungarian corporate SMEs could also be determined by a method similar to the previous one. In 2009, the total logistics costs of domestic corporate small and medium-sized enterprises was HUF 6143.734 billion, corresponding to 21.94% of corporate total costs, 22.24% of their sales revenues and 22.97% GDP-proportionally. This can be regarded as very high indeed compared to the results of the previous researches (e.g. King [2010][89]; Solakivi et al. [2010][90]), considering especially that the figures contained the logistics costs of neither the large enterprises nor the individual ones. This high level of the total costs of logistics might encourage the Hungarian administration to set targets similar to the Finnish ones, as even a 3.4% decrease of the total logistics costs would make savings on a par with the trimming of the administrative burdens of the enterprises feasible[91]. According to Kummer [1995], the effect of such rationalisation is limited, and it may be conducive to the loss of options for increasing consumer value.

[89] In 2009, they estimated the South African logistics costs at 14.7% of the GDP.
[90] In 2009, they estimated the Finnish logistics costs at 8.7% of the GDP.
[91] According to a paper by Deloitte [2010], HUF 208 billion could be saved by reducing the administrative burdens of enterprises.

5.4. Examination of Hypotheses H3

On the basis of the "Survey of the situation of enterprises, 2009", I examined the logistics outsourcing decisions of Hungarian SMEs through my Hypotheses H3:

- Hypothesis H3a queried whether SMEs of different sizes considered logistics a core competence and what transaction costs they faced when outsourcing this activity.
- Hypothesis H3b assumed that logistics outsourcing was driven by the wish to reduce costs, focus on the core competences and enhance flexibility.
- Hypothesis H3c assumed that McIvor's model could be adapted to logistics outsourcing of Hungarian SMEs.

Respondents could give the answers "yes", "no", "does not know" to Questions 18 and 19 of the "Survey of the situation of enterprises, 2009" querying the reasons of outsourcing transportation, warehousing and packaging. The answers were contradictory, as indicated also by the cross-table of answers concerning the cost implications of outsourcing and its Cramer V[92] value of 0.599.

Table 26: Answers to reducing the costs of logistics activities

		The costs related to these activities are not reduced by outsourcing		
		Yes	**No**	**Does not know**
The costs related to these activities decrease	**Yes**	62	119	3
	No	455	965	62
	Does not know	15	10	304

Source: Compiled by the Author.

The answers to the questions concerning the improvement or deterioration of service quality yielded a similar result at a Cramer V value of 0.611. Therefore, for such control questions, I regarded as indicative the answers to the questions asked directly. The outsourcing arguments showed strong associations by pair, the strongest one being dependence on the service provider and the difficulty of checking serviced quality. The examination narrowed to the circle of agriculture, manufacture and commerce produced similar results (see Annex No. 3).

[92] The association is quite strong, but the maximum value of the Cramer V is 1.

Table 27: Cramer V values showing the association of outsourcing arguments by pair

	18b	**18c**	**18d**	**18e**	**18f**	**18g**	**18h**	**19a**	**19b**	**19c**	**19d**	**19e**	**19f**	**19g**	**19h**	**19i**
18a: Geographical spread	.714	.696	.707	.699	.684	.704	.697	.608	.607	.608	.569	.604	.585	.600	.613	.601
18b: Quality improvement	-	.751	.769	.756	.705	.732	.729	.619	.607	.605	.574	.611	.590	.609	.624	.608
18c: Cost reduction		-	.744	.722	.699	.699	.713	.609	.605	.599	.574	.608	.591	.608	.624	.605
18d: Flexible capacity			-	.741	.740	.719	.712	.621	.611	.610	.578	.612	.594	.626	.638	.618
18e: Need for external expertise				-	.696	.722	.725	.611	.611	.610	.582	.609	.599	.611	.626	.608
18f: Focus on core competence					-	.696	.699	.615	.610	.618	.582	.623	.594	.624	.635	.612
18g: Buyer expects it						-	.781	.608	.610	.609	.578	.614	.601	.606	.616	.605
18h: Supplier expects it							-	.613	.610	.613	.580	.615	.605	.606	.618	.610
19a: Loss of control								-	.774	.811	.733	.778	.686	.794	.824	.824
19b: Transportation/ warehousing/packaging are core competences									-	.785	.747	.778	.690	.746	.770	.758
19c: Costs do not decrease										-	.727	.808	.698	.780	.791	.780
19d: Our expertise is better											-	.727	.689	.717	.740	.742
19e: Quality decline												-	.694	.776	.791	.777
19f: Does not know how to use it													-	.681	.700	.709
19g: Hidden costs														-	.827	.820
19h: Increasing dependency															-	.876
19i: Difficulties of evaluation and control																-

Source: Compiled by the Author.

I aggregated the outsourcing of transportation, warehousing and packaging figuring separately in Question 17 of the "Survey of the situation of enterprises, 2009" into yes/no categories, assigning them to the "yes" category if any of the three activities was outsourced. I examined the reliability of the scale created by aggregation by Cronbach's alpha. That value was 0.778, indicating acceptable reliability based on internal consistency.

I narrowed the examination to agriculture, manufacture and commerce, since the rate of outsourcing of transportation, warehousing and packaging was highest in these

branches. This measure reduced also the size of the sample, to which the chi-square statistics is sensitive.

Hypothesis H3a actually comprised two parts: the examination of the core competences and of the increasing transaction costs.

– The reliability[93] of assignment to the category of core competences was indicated by the fact that only 34 of the 70 enterprises whose main activity included transportation, warehousing, post, telecommunications considered transportation, warehousing and packaging that. 42.65% of manufacturing SMEs, 33.33% of agricultural ones and 24.67% of commercial ones considered transportation, warehousing and packaging their core competences. As shown in Table 28, 28.5% of micro enterprises, 41.9% of small ones and 33.3% of medium-sized ones regarded transportation, warehousing and packaging core competencies, but the two variables depended on each other according to Pearson's chi-square statistics above the significance level of 5.7%. Based on the values of the standardised corrected residues, between -2 and +2 with only one exception, nothing can be said for certain about significant associations within the cross-table. Hence the hypothesis is not confirmed. Let me note that the association of the two variables was significant already at 5% for every branch – probably due to the effect of the larger sample size -, but there the column percentages of the medium-sized enterprises (35.3%) exceeded those of both the small ones (32.9%), and of the micro enterprises (24.4%).

[93] Due to the limits of the questionnaire format, it could be investigated only in the context of yes/no questions, far from the four-phase operationalisation proposed by Beumer et al. [2009] which examines whether the competency is valuable, rare, difficult to copy and lasting.

Table 28: Hungarian agricultural, manufacturing and commercial SMEs regarding transportation, warehousing and packaging their core competences

			Transportation, warehousing and packaging are core competences		
			Yes	**No**	**Does not know**
Number of employees	**0 person**	**Number (%)**	84 (24.4%)	200 (58.1%)	60 (17,4%)
		Corr. residues	-1.6	-.5	2,8
	1-9 persons	**Number (%)**	108 (28.5%)	229 (60.4%)	42 (11,1%)
		Corr. residues	.8	.7	-2,0
	10-49 persons	**Number (%)**	13 (41.9%)	16 (51.6%)	2 (6,5%)
		Corr. residues	1.9	-.9	-1,2
	50+ persons	**Number (%)**	3 (33.3%)	6 (66.7%)	0 (0,0%)
		Corr. residues	.4	.5	-1,2
	Total (%)		208 (27,3%)	451 (59.1%)	104 (13.6%)

Source: Compiled by the Author.

– I determined the growing transaction costs through the aggregation of variables 18c and 19g of the "Survey of the situation of enterprises, 2009" (combined presence of cost growth and hidden costs), the Cronbach's alpha of which was 0.800. By examining this aggregate variable in a way similar to the previous one I found that dependence was true already at a 5% significance level among the agricultural, manufacturing and commercial enterprises, but micro, small and medium-sized enterprises hardly differed in this respect (the respective rates being 29.1%, 29.0% and 33.3%, respectively). All branches considered, the occurrence rate was almost identical for micro and small enterprises (26.0% and 23.9%), but the value produced for medium-sized enterprises was much higher at 41.2%.

Table 29: Change of the transaction costs of Hungarian SMEs active in agriculture, manufacture and commerce

			Change of transactions costs			
			Decreasing	**Increasing**	**None**	**Does not know**
Number of employees	**0 person**	**Number (%)**	20 (5.8%)	69 (19.9%)	185 (53.5%)	72 (20,8%)
		Corr. residues	-1.2	-3.0	1.2	2,7
	1-9 persons	**Number (%)**	28 (7.3%)	111 (29.1%)	188 (49.3%)	54 (14,2%)
		Corr. residues	.3	2.6	-1.0	-1,9
	10-49 persons	**Number (%)**	5 (16.1%)	9 (29.0%)	15 (48.4%)	2 (6,5%)
		Corr. residues	2.0	.5	-.3	-1,6
	50+ persons	**Number (%)**	1 (11.1%)	3 (33.3%)	4 (44.4%)	1 (11,1%)
		Corr. residues	.5	.6	-.4	-,5
	Total (%)		54 (7,0%)	192 (25.0%)	392 (51.1%)	129

Source: Compiled by the Author.

That is, my Hypothesis H3a was confirmed but partly, and the examination cannot be regarded as reliable since max. 20% of the cells could have had an expected value of less than 5 (Sajtos and Mitev [2007] p. 154.), and this condition was not met in any of the cases. It seems that, with the growth of their size, a growing number of agricultural, manufacturing and commercial micro and small enterprises regarded transportation, warehousing and packaging their core competences, but in the category of medium-sized enterprises, the tendency changed. This is probably attributable to higher specialisation and more intensive concentration on the core competence. As for the transaction costs implied by the outsourcing of logistics activities, on the other hand, in all probability, the medium-sized enterprises were not big enough either to reach the level of economies of scale.

To test Hypothesis H3b, I chose transportation-warehousing-packaging outsourcing in the "Survey of the situation of enterprises, 2009" as independent, and the reasons for it as dependent variables, and then I examined the association also vice versa. I did that because the answers did not make it clear whether the SMEs decided on outsourcing vs. in-house activity based on the relevant advantages and drawbacks, or whether they

reconsidered such decisions based on previous outsourcing experiences (e.g. they realised the disadvantages). Dependence between the arguments for and against outsourcing and its use or avoidance was significant based on Pearson's chi-square in every case. There is no "best" association measure, but it is possible to demonstrate closer association by applying an identical indicator (Füstös et al. [2004] p. 80.). I used primarily Cramer's V for the Hypotheses H3 since the arguments for and against the outsourcing of logistics are nominal variables, the resulting 3*3 cross-tables are symmetrical and the value of the still feasible contingency coefficient seldom attains 1 (Sajtos and Mitev [2007] p. 151.). The values of Cramer's V applied to examine Hypothesis H3b ranged as follows:

Table 30: Strength of the association between logistics outsourcing and its reasons in the circle of agricultural, manufacturing and commercial SMEs

Arguments for outsourcing	**Cramer V**	**Arguments against outsourcing**	**Cramer V**
Geographical spread	.255	Loss of control	.176
Quality improvement	.326	Transportation, warehousing, packaging are core competences	.190
Cost decrease	.391	Costs do not decrease	.177
Flexible capacity	.395	Better expertise	.171
Need for external expertise	.262	Does not know how to use it	.174
Focus on core competence	.317	Quality decrease	.171
Buyer expects it	.241	Hidden costs	.192
Supplier expects it	.273	Growing dependence	.204
		Difficulties of evaluation and control	.173

Source: Compiled by the Author.

With the exception of growing dependence, the association between the arguments against logistics outsourcing and its rate was weak, and based on the arguments in favour of it, it was of medium strength. Flexible capacity and cost decreased carried the strongest explanatory power, followed by quality improvement and focus on the core competences. Hence Hypothesis H3b was partly confirmed but, as compared to what was expected, quality improvement appeared as an important new criterion in the explanations of logistics outsourcing. The four main factors themselves explained

outsourcing to a small extent only: based on Goodman and Kruksal's tau, at 3.3-6.6%, and based on the uncertainty coefficients, at[94] 5.9-9.7%.

I examined Hypothesis H3c concerning the applicability/adaptability of McIvor's model with two-variable logistic regression. I chose as dependent variable the binary variable created by aggregating transportation-warehousing-packaging outsourcing based on Question 17 of the "Survey of the situation of enterprises, 2009" described already, and as independent variable the arguments for and against outsourcing contained in its Questions 18 and 19. The multi-collinearity and database-of-at-least-60-elements conditions of logistic regression (Sajtos and Mitev [2007] p. 354.) were met. In Phase 1 of the analysis, I got a 70.8% reference value due to the low outsourcing rate, which shows that, in case of random categorisation, one could have told whether the SME did the transportation-warehousing-packaging activity itself with that certainty. The Wald statistics used for estimating the parameters was significant. As for the independent variables not brought in into the analysis yet, 6 contrary arguments showed no significant effects in themselves, as can be seen in Table 31.

Table 31: Individual effects of the reasons of logistics outsourcing

Step 0	**Score**	**df**	**Sig.**
Geographical spread	21.912	1	.000
Quality improvement	61.962	1	.000
Cost decrease	99.921	1	.000
Flexible capacity	103.368	1	.000
Need for external expertise	29.586	1	.000
Focus on core competences	63.144	1	.000
Buyer expects is	15.879	1	.000
Supplier expects it	30.291	1	.000
Loss of control	4.243	1	.039
Transportation, warehousing, packaging are core comp.	.237	1	.626
Cost increase	.231	1	.631
Better expertise	1.342	1	.247
Service quality would not improve	1.030	1	.310
Does not know how to use it	.076	1	.783
Hidden costs	14.977	1	.000
Increasing dependence	13.090	1	.000
Difficulties of evaluation and control	2.338	1	.126
Overall statistics	166.125	17	.000

Source: Compiled by the Author.

[94] The capacity of the independent variable to forecast the dependent one is expressed in per cent (Sajtos and Mitev [2007]). I did not use the lambda, of a similar meaning, due to its robustness (similarly also to the present case, its value is often zero).

In Phase 2 of the analysis, upon entering the independent variables of the "Survey of the situation of enterprises, 2009", the entire model became significant; their combination explained 26.9% of the variance of the dependent variables based on the Nagelkerke R^{95} square. All in all, the arguments for and against outsourcing improved the correct determination of the presence or absence of outsourcing to a minor extent only, by 6.6 percentage points. According to the table showing the combined effect of all variables, cost decrease, flexible capacities, focusing on the core competences, hidden costs and the difficulties of evaluation/control remained significant; based on its Exp(B) value, the last one would obviously not improve the estimate.

[95] I used that because the Cox & Snell R square (the value of which was 18.8%) underestimates the real value (Sajtos and Mitev [2007] p. 357.).

Table 32: Combined effects of the reasons of logistics outsourcing

Step 1	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Geographical spread	.697	.369	3.574	1	.059	2.009	.975	4.140
Quality improvement	.286	.347	.680	1	.410	1.332	.674	2.630
Cost decrease	1.143	.274	17.413	1	.000	3.136	1.833	5.365
Flexible capacity	1.039	.262	15.676	1	.000	2.826	1.690	4.727
Need for external expertise	.095	.430	.048	1	.826	1.099	.473	2.556
Focus on core competences	.514	.227	5.137	1	.023	1.672	1.072	2.608
Buyer expects is	.101	.453	.050	1	.823	1.106	.455	2.688
Supplier expects it	.525	.492	1.139	1	.286	1.691	.644	4.435
Loss of control	.111	.290	.146	1	.702	1.117	.633	1.973
Transp., warehousing, packaging are core competences	-.275	.267	1.060	1	.303	.760	.450	1.282
Cost increase	-.486	.276	3.104	1	.078	.615	.358	1.056
Better expertise	.264	.289	.835	1	.361	1.302	.739	2.293
Service quality would not improve	.283	.270	1.096	1	.295	1.327	.781	2.253
Does not know how to use it	-.243	.340	.513	1	.474	.784	.403	1.526
Hidden costs	.544	.277	3.864	1	.049	1.723	1.002	2.963
Increasing dependence	.282	.300	.886	1	.347	1.326	.737	2.388
Difficulties of evaluation and control	-.878	.345	6.469	1	.011	.415	.211	.818
Constant	-1.563	.132	140.835	1	.000	.209		

Source: Compiled by the Author.

It can be established on the basis of the above that McIvor's outsourcing model can be applied to the outsourcing of the transportation, warehousing and packaging activities of Hungarian agricultural, manufacturing and commercial SMEs in a modified form only. The role of focusing on the core competences and – transaction/hidden costs included – of prospective cost decrease was confirmed, but the role of dependence was not; instead, flexibility ought to be examined. By the way, the lead role of flexibility was confirmed also by a later Hungarian survey, albeit there the logistics service providers were asked what their customers expected of them (Bank et al. [2010]). In terms of explanatory power, the role of cost decrease was the strongest, followed by flexibility, hidden costs and, finally, focus on the core competences.

5.5. Examination of Hypothesis H4

According to Hypothesis H4, Hungarian SMEs judge the performance of their third party logistics service providers on the basis of service quality and problems incurred. For testing this hypothesis, I used the survey "In competition with the world, 2009", where the enterprises were to indicate on a five-point scale (1: least important; 5: most important) the weight they assigned to the various criteria (variables K55-K56) when assessing the performance of external logistics service providers. It was not obvious whether the hypothesis ought to be tested by exploratory or confirmatory factor analysis. Because of this duality, the complexity of confirmatory factor analysis and its absence from SPSS, I examined the factor structures produced on the basis of the 17 criteria separately, with every explorative method available in SPSS, that is:

- from among the factor extraction methods, by principal component analysis (PCA), unweighted least squares (ULS) and generalised least squares (GLS) methods, the maximum likelihood method (ML), by principal axis factoring (PAF), the alpha and the image methods;
- every orthogonal (varimax, quartimax, equamax) and non-orthogonal rotation method (direct oblimin and promax);
- the substitution of missing data listwise, pairwise and with the mean substitution method.

The sample was suitable for factor analysis thanks to its size (it exceeded at least 4-5 times that of the variables, and it had minimum 50-100), the Bartlett test and its meritorious KMO value (0.815). I applied the Kaiser criterion (consideration of factors with eigenvalue of min. 1.0). In principle axis factoring and image analysis only listwise and mean substitution, whereas in the case of the generalised least squares, maximum likelihood and alpha extraction methods only the last one produced results[96]. In the decisive majority of the cases, 4 factors were produced. The factor structures, produced by at least 5 methods, are shown in Table 33.

[96] With the listwise method, the local minimum was not found even after 9999 iterations or communality rose above 1; with the pairwise method, the correlation matrix had not positive definite.

Table 33: Factor structures produced with at least 5 different methods

Rotated factors and variables included in them	Applied solution		
	Factor extraction method	**Treatment of missing values**	**Factor rotation method**
Factor Structure I Factor 1 (K56A-K56H) Factor 2 (K55D-K55I) Factor 3 (K55A-K55C) Factor 4 (K55J, K56I)	PC	mean substitution	varimax, oblimin, quartimax, equamax and promax
	ULS	pairwise	equamax and promax
	ULS	mean substitution	varimax, oblimin, equamax and promax
	GLS		
	ML		oblimin, equamax and promax
	PAF		varimax, oblimin, equamax and promax
	Alfa		
Factor Structure II Factor 1 (K56A-K56I) Factor 2 (K55D-K55J) Factor 3 (K55A, K55C) Factor 4 (K55B)	PC	listwise	varimax, oblimin, quartimax and promax
		pairwise	varimax, quartimax and promax
	ULS	listwise	quartimax
	PAF		
Factor Structure III Factor 1 (K56A-K56I) Factor 2 (K55B, K55D, K55E, K55G, K55J) Factor 3 (K55A, K55C, K55F, K55H, K55I)	Image	mean substitution	varimax, equamax and promax
		listwise	
Factor Structure IV Factor 1 (K56A-K56I) Factor 2 (K55A, K55C-K55I) Factor 3 (K55B) Factor 4 (K55J)	ULS	mean substitution	quartimax
	GLS		
	ML		
	PAF		
	Alfa		
Factor Structure V Factor 1 (K56A-K56I) Factor 2 (K55D, K55E, K55G, K55H, K55J) Factor 3 (K55A, K55C, K55F, K55I) Factor 4 4 (K55B)	ULS	listwise	varimax and promax
	PAF		varimax, equamax and promax

Source: Compiled by the Author.

On the basis of the most frequently occurring Factor Structure I, produced by a total of 26 different methods, the factors are as follows:

– The problems (Variables K56A-K56I), including inadequate information exchange, commitment (of the company itself and the service provider), product knowledge, consumer knowledge, control mechanism, imprudent contracting, and lack of time.

Note that in all of the most frequently occurring factor structures, the problems co-occur.

- Stock availability, correct invoicing, delivery of value added services, contact person, quality of information provided and number of damages (Variables K55D-K55I). I named this factor the "service quality" factor.
- Cost decrease, transportation deadline decrease, enhanced transportation precision (Variables K55A-K55C). I named this factor the "cost decrease/fast-and-precise transportation" factor.
- The other elements (Variables K55J, K56I).

On the basis of the above, Hypothesis 4 is mainly confirmed, that is, Hungarian SMEs judge the performance of their logistics service providers based on the problems, service quality and cost decrease, although the last one was supplemented with the criteria of fast and precise transportation, and a separate "other" factor has also appeared.

5.6. Examination of Hypotheses H5

To test Hypotheses H5 concerning the association between logistics (in-house or third party) and corporate performance, I used the survey "In competition with the world, 2009". First of all, I assigned corporate performance into clusters based on the self-evaluation (Variables V15) of the company managers of the SMEs in the sample. The company managers could evaluate the performance of their company relative to the industrial average on a five-point scale (below average quality – lead quality) in terms of return on sales, return on equity, market share, technological quality, management, product/service quality and other success criteria. I did not examine the outlier elements separately to prepare for the cluster analysis, because the selected Likert scale made their occurrence low. The scales were identical, so there was no need for standardisation either, nor for excluding a variable due to pairwise correlations under 0.9 (Sajtos and Mitev [2007]).

I did the clustering first with the hierarchical method. With Ward's method, by using the method of squared Euclidean distance, the dendrogram (see Annex No. 3), the elbow criterion and practical considerations, I came to the conclusion that the "ideal" number of clusters was 3, and that it was expedient to exclude the other success criteria, because more than twice as many cases could be assigned to the clusters this way. Then

I defined the 3 clusters with K means clustering, and labelled them "leader", "better-than-average performer" and "stagnant".

In Step 2 of the analysis, I compared the performance clusters so defined with the self-evaluated performance/efficiency of the logistics system (Variable V14j), and with the rating of the average quality of logistics services contracted out by the commercial manager (Variable K54). I examined the latter only among the enterprises which had actually outsourced one of their logistics sub-activities. I used cross-table analysis to do the test, considering the variables ordinal. I transformed the performance/efficiency of the logistics system and the average quality of the logistics services being used into 3 categories each, reducing thereby the occurrence of values of less than 5 in the cells.

The average quality of contracted logistics services and the performance clusters were independent according to the chi-square test, but the association with the performance/efficiency of the logistics system was significant, although only at the significance level of 5.1%. Choosing the performance cluster as independent variable, the Somers' D[97] was 0.184, whereas in the reciprocal case a value of 0.167 was attained, indicating weak association. Based on the values of at least 2 of the corrected standardised residuals, there was significant association between the following:

1. below-average logistics system efficiency and stagnating/lagging corporate performance, and
2. above-average logistics system efficiency and leader company performance.

[97] This choice was warranted by the fact that I regarded the performance clusters as having an ordinal scale and the Somers' D can be used for cross-tables of any size. Its value can be between -1 and +1; values close to 1 signal strong, those close to 0 weak correlation or lack of correlation (Sajtos and Mitev [2007], p. 145.).

Table 34: Associations between the corporate performance clusters and the efficiency of the logistics system

			Efficiency of the logistics system			Total
			Under-average	Medium-level	Above-average	
Corporate performance	Stagnating, lagging	Number	14	41	26	81
		Corrected residues	2.0	.5	-1.8	
	Above-average performer	Number	8	44	32	84
		Corrected residues	-.8	.9	-.4	
	Lagging behind	Number	3	20	28	51
		Corrected residues	-1.5	-1.5	2.5	

Source: Compiled by the Author.

Hence the H5 Hypotheses were confirmed partly. There was no association between the performance of small and medium-sized enterprises and the quality of their third party logistics services, but the efficiency/performance of the logistics system and corporate performance did associate, albeit only at a significance level of 5.1%. In evaluating the results, however, one must take into consideration that, contrary to the previous researches, the rating of corporate and logistics performance was based here on the self-evaluation of the managers, not on financial and logistics indicators.

5.7. Examination of Hypothesis H6

Hypothesis H6 concerned the logistics concept of the managers of Hungarian SMEs, that is, whether it was procurement-centred and whether they regarded such functions as being of secondary importance.

In the survey "In competition with the world, 2009", the general director, commercial financial and production managers of the enterprises indicated on a 5-point Likert scale the contribution of 18 sub-areas of operation[98] to the success of the operation of the entire company (Variables M1). Since the samples were related, I compared procurement, logistics and inventory management in companies of identical sizes with paired-sample t tests, and with Wilcoxon tests if it was not.

[98] Upper management, commerce/marketing, controlling, research-development, organisational development, sales, procurement, logistics, inventory management, HR management, accounting, finances, wage management, quality assurance, information management, strategic planning.

Table 35: Contribution of procurement, inventory management and logistics to the success of the company overall, by company size, according to the various company managers

		General director	Commercial manager	Financial manager	Production manager	Mean
Micro enterprise	**Procurement**	3.71	4.00^°	4.00	3.77	3.89
	Inventory management	3.69	3.58*	3.94	3.66	3.70
	Logistics	3.47	3.56*	3.65	3.69	3.67
Small enterprise	**Procurement**	3.83^°	3.98	4.27°	4.18^°	4.13^°
	Inventory management	3.45*	3.71	4.00°	3.52*	3.80*
	Logistics	3.51*	3.74	3.55*^	3.60*	3.77*
Medium-sized enterprise	**Procurement**	4.09^°	4.18^°	4.11^°	4.28^°	4.18^°
	Inventory management	3.86*°	3.80*	3.92*°	3.96*°	3.91*°
	Logistics	3.61*^	3.69*	3.53*^	3.72*^	3.62*^
Large company	**Procurement**	3.64	3.91	4.03^	4.03°	3.88^
	Inventory management	3.23°	3.68	3.56*	3.70	3.47*
	Logistics	3.71^	3.61	3.79	3.73*	3.65

*significantly different from the procurement value
^ significantly different from the inventory management value
° significantly different from the logistics value
Source: Compiled by the Author.

In regard of the first half of Hypothesis H6 concerning the priority of procurement:

- SME managers rated the contribution of procurement to the success of the company overall highest, with only one exception, which confirmed that procurement enjoyed priority in the logistics concept of Hungarian small and medium-sized enterprises.
- The managers of micro enterprises considered the contribution of the three areas to the success of the company overall significantly homogenous; only the commercial managers gave priority to procurement over the other two subareas. At small enterprises, this approach was typical of the general director and of the production and to some extent the financial manager. At medium-sized enterprises, the priority order of every manager was procurement-inventory management-logistics, with no significant difference in a single case. Large companies exhibited a more integrated approach and relegated inventory management into the background. Hence it can be stated on the basis of the presence of significant differences that, with the exception of micro enterprises, Hungarian SMEs are typically characterised by the absence of

logistics integration. In the circle of micro enterprises, the difference is probably explained by the co-existence of the various functions due to their small size ("embryonic integration").

The other half of Hypothesis H6 referred to the relative importance of the three logistics subareas (procurement, logistics, inventory management) as compared to the other 15 areas of operation. I examined their rank order among the micro, small, medium-sized and large enterprises, respectively, and among their managers, also separately. For reasons of space, the tables containing the results are shown in Annex No. 3. I applied the paired-samples t test in case of normality established by the Kolmogorov-Smirnov tests and the Wilcoxon test in other cases. The rank order positions shown in the table below do not mirror the actual situation exactly (viz. the mean value given for the logistics sub-activities was at least 3.23), that is, in the opinion of the executives, inventory management and logistics figured among the lowest-ranking components of the success of the company overall, with only R&D and organisational development rated lower.

Table 36: Minimum and maximum position of the contribution of logistics subareas to success according to the managers' ratings, by company size

	Micro enterprises	**Small enterprises**	**Medium-sized enterprises**	**Large companies**
Procurement	6-11. (8.[99])	4-10. (6.)	5-7. (6.)	7-14. (10.)
Logistics	13-16. (14.)	12-14. (14.)	13-14. (13.)	12-15. (15.)
Inventory management	8-14. (13.)	9-15. (13.)	9-10. (10.)	14-16. (16.)

Source: Compiled by the Author.

The actual situation is better reflected by the rank order by significant difference, that is, functions which do not differ significantly are given the same position. For, the values given by the company managers did not always differ significantly from one another. Although the rank order reconstructed on the basis of the significant differences (items which did not differ were given identical serial numbers) is more positive (see Table 37), it does not alter the fact that SME managers generally rated R&D and organisational development lower than the logistics sub-activities in terms of their contribution to success of the organisation.

[99] In brackets: average position.

Table 37: Contribution to success of logistics sub-activities: minimum and maximum positions based on the ratings of company managers, by company size

	Micro enterprises	**Small enterprises**	**Medium-sized enterprises**	**Large companies**
Procurement	1-5. (4.)	3-5. (6.)	3-5. (3.)	2-7. (5.)
Logistics	4-7. (5.)	8-10. (9.)	9-12. (12.)	5-7. (6.)
Inventory management	4-9. (4.)	3-11. (9.)	6-8. (8.)	4-13. (8.)

Source: Compiled by the Author.

Thesis findings

My research which was based on the most extensive review so far of the scientific literature on the logistics practice of small and medium-sized enterprises focused on logistics costs and outsourcing. Some interesting results were provided already by the descriptive statistical analysis of the "Survey of the situation of enterprises, 2009" covering almost two thousand SMEs:

- I found that 43.86% of Hungarian small and medium-sized enterprises reported zero logistics total costs, and for the logistics sub-activities, the corresponding rate was min. 58.98%. The logistics costs rate of SMEs – in particular those with a higher number of employees – was higher than expected on the basis of the previous domestic and international researches, and it was most akin to the Mexican values. Within the average total logistics cost rate of 18.86% typical of Hungarian SMEs, transportation and warehousing and, unexpectedly, administration costs had the largest shares. Hungarian SMEs acted against the rule of thumb that the bigger the enterprise, the smaller the rate of its logistics costs. However, as expected, the highest average total logistics cost rates were found in the branches of agriculture, manufacture and commerce.
- I came to contradictory conclusions concerning the levels of logistics outsourcing of Hungarian SMEs. According to the "Survey of the situation of enterprises, 2009", the level of logistics outsourcing was relatively low: 15.03% of Hungarian small and medium-sized enterprises outsourced transportation/cargo handling; 6.69% freight forwarding; 4.68% logistics IT; 4.00% warehousing/storage; 3.07% order management and 1.80% packaging. Third party inventory management was so rare I excluded it from the further investigations. On the basis of the research "In competition with the world, 2009", however, transportation/freight forwarding was outsourced by 70.91% of respondent SMEs; warehousing by 25.00% and inventory management by 20.12%. The difference may be due to the higher proportion of manufacturing and larger-size SMEs in the latter sample. Based on the sample of the "Survey of the situation of enterprises, 2009", almost half of Hungarian SMEs subcontracting logistics outsourced several sub-activities simultaneously, most frequently transportation/forwarding (29.35%), transportation/warehousing (7.07%); transportation/warehousing/forwarding (7.07%) and forwarding/logistics IT (4.35%).

– As for the interaction between the respective costs of the logistics sub-activities and of the outsourcing activity, I found medium-level correlation between transportation outsourcing and transportation costs/total costs of logistics; and between the outsourcing and the costs of warehousing and the outsourcing and costs of packaging, and weak correlation in the rest of the cases.

In connection with Hypotheses H1, I demonstrated by using the "Survey of the situation of enterprises, 2009" database and cross-table analyses that, except for inventory shortage, company size and branch affiliation were the two most important contingency factors, from the point of view of the transportation, warehousing, packaging, inventory carrying, inventory shortage and logistics IT cost levels and their respective rates within the total costs of logistics. As for Hypothesis H1b concerning the outsourcing rates of the six types of logistics sub-activities, the same was true only for transportation and forwarding, whereas for warehousing, the priority role of branch affiliation was taken over by the main sales site; for the outsourcing of packaging and order management by the type of the settlement; and for the outsourcing of logistics IT by the corporate or individual nature of the enterprise. The associations between the contingency factors and the logistics cost ratios on the one hand and the outsourcing levels on the other proved to be weak/mediocre, and their strength decreased even further when I narrowed the scope of the investigation to the agricultural, manufacturing and commercial SMEs, where the dependence relationship actually disappeared in several cases.

In testing Hypotheses H2 I exploited the representative nature of the database of the "Survey of the situation of enterprises, 2009" to demonstrate that corporate small and medium-sized enterprises had a significant transportation and warehousing demand. Currently, the relevant activities of the enterprises themselves correspond to 1.97 times the market of the enterprises focusing on freight forwarding as their core competence, and 3.53 times that of enterprises focusing on warehousing. I demonstrated, moreover, that the demand increment was latent, since at least 7/8 of the enterprises under study expected (could implement) no change in this area in the following years.

The method I applied to test Hypothesis H2 revealed also that the total logistics costs of Hungarian corporate small and medium-sized enterprises attained HUF 6143.734 billion in 2009. This corresponds to a GDP-proportional rate of 22.97%, very high indeed in comparison with the corresponding rates in the Finnish and South African researches,

referring to approximately the same dates (8.7% and 14.7%, respectively), especially considering the fact that the first contains neither the values of large companies, nor those of individual enterprises.

To test Hypotheses H3 by investigating the arguments for and against the outsourcing of transportation, warehousing and packaging, respectively, I broke with the frequency analyses applied so far in SME logistics outsourcing researches, and used cross-table analyses and binary logistic regression instead. Based on the database of the "Survey of the situation of enterprises, 2009":

a) I demonstrated that the arguments for and against logistics outsourcing were not fully consistent and also that 42.65% of Hungarian manufacturing SMEs, 33.33% of agricultural ones and 24.67% of commercial ones regarded transportation, warehousing and packaging as their core competences. Micro and small enterprises in the said branches tended to regard transportation, warehousing and packaging their core competences to a growing extent with the growth of their size, but for medium-sized enterprises the tendency changed due probably to more marked specialisation and more intensive concentration on the core competence. On the basis of the transaction costs of logistics outsourcing it seemed that even medium-sized enterprises were not big enough to attain the economies of scale limit.
b) I found weak association, with one exception, between the logistics outsourcing level of SMEs and the arguments against outsourcing, and medium-level association with the arguments in favour of outsourcing. In regard of the outsourcing of transportation, warehousing and packaging by the SMEs, flexible capacity and cost decrease carried the strongest explanatory power, followed by quality improvement and focusing on the core competences. Besides cost decrease, focusing on the core competences and flexible capacity as explanatory factors assumed in Hypothesis H3b, quality improvement appeared as an important new criterion explaining logistics outsourcing. Nevertheless, the four factors in themselves explained the outsourcing of transportation, warehousing and packaging to a small extent only.
c) The testing of Hypothesis H3c demonstrated that McIvor's model can only be applied to the outsourcing of the transportation, warehousing and packaging activities of Hungarian manufacturing, agricultural and commercial SMEs in a modified way. The roles of focusing on the core competences and of cost reduction - transaction costs included – were confirmed, but that of dependence was not;

instead, flexibility ought to be studied. In terms of explanatory power, the motivating role of cost decrease was strongest, followed by flexibility, hidden costs and the core competences.

As for Hypotheses H4, I demonstrated that Hungarian SMEs judged the performance of their logistics service providers on the basis of problems incurred, service quality, cost reduction/transportation and "other" factors by applying all factor analyses methods available in the SPSS statistical programme package to the data of "In competition with the world, 2009".

On the basis of the data of "In competition with the world, 2009", I found no association between the performance and logistics services of small and medium-sized enterprises. Corporate performance and the efficiency/performance of the logistics systems, on the other hand, did correlate, albeit only at a significance level of 5.1%. This association proved to be weak and, what is more, corporate performance had a stronger effect on logistics than vice versa. There was significant association between under-average logistics system efficiency and stagnating/lagging corporate performance on the one hand and above-average logistics system efficiency and leading corporate performance. These results, however, must be interpreted in consideration of the fact that the evaluation was based on the self-evaluation of company managers, not on financial and logistics indicators.

By testing Hypothesis H6 with paired-sample t tests and Wilcoxon tests based on the data of "In competition with the world, 2009" I confirmed that the logistics concepts of the managers of Hungarian SMEs was driven by procurement and, with the exception of micro enterprises, the entities concerned were characterised by the absence of logistics integration. It was demonstrated that company managers rated logistics very low indeed, together with inventory management, in terms of contribution to the success of the company overall, and they gave lower ratings only to R&D and organisational development.

On the basis of the above, the answer to the research question is, unfortunately, that the managers of Hungarian small and medium-sized enterprises consider logistics a secondary function. Nevertheless, the efficiency of the logistics systems of SMEs and

their corporate performance correlate, if only weakly, and this gives some hope that this secondary status will change in the future.

I think that future research should pay special attention to agricultural SMEs beside the manufacturing and commercial ones. There are still many virgin areas in the investigation of the logistics practice of SMEs, of which in my opinion the logistics aspects of the internationalisation of the SMEs, the use of the traditional instruments, and the research of logistics co-operation seem the most promising. Hopefully, other PhD candidates will also find this area full of challenges worthy of research, and we shall not have to wait another twenty years for a thesis on this topic.

Annexes

Annex No. 1: Questions of "Survey of the situation of enterprises, 2009" used in the Thesis

serial number

1 – main address
2 – supplementary address

Survey of the situation of enterprises

September – October 2009

Voluntary responding

Settlement name: in Budapest, District: | | |

County:
01 – Budapest
04 – Békés County
08 – Győr-Moson-Sopron County
09 – Hajdú-Bihar County
14 – Somogy County

I hereby declare that the data managed and recorded by me are true; I treat them confidentially and disclose them only to persons competent in the research.

Interviewer's signature: | | | | | |

interviewer's id. no.

START OF THE INTERVIEW: day ……. month ……2009, hour: minute

Ministry for National Development and Economy
Enterprise Promotion Department

3. When was your enterprise created? (year of foundation)

In the year .....

9 – Does not know X –

4. What is the legal form of the enterprise?

1 – individual enterprise
2 – general partnership
3 – limited partnership
4 – limited liability company
5 – public limited company
6 – co-operative
7 – other
9 – does not know X –

5. Name your main activity!

WRITE IT DOWN AND GIVE THE CODE AS WELL

1 ANSWER ONLY

01 – Agriculture, game, forestry, fishing
02 – Mining
03 – Manufacture
04 – Electricity, gas, steam, water supply
05 – Construction industry
06 – Trade, repair
07 – Accommodation and catering
08 – Transportation, warehousing, post, telecommunications
09 – Financial intermediation
10 – Real estate, business services
11 – Education
12 – Health care, social provision
13 – Other public, personal services
99 – Does not know X –

7. What is the main destination of the sales (services) of your enterprise?

1 – To this settlement (where its seat is registered),
2 – not to this settlement, but within the county,
3 – outside the county, but within Hungary, or
4 – abroad?

NB! BUDAPEST IS NOT PART OF PEST COUNTY, SO FOR BUDAPEST-BASED INTERVIEWS, DO NOT USE CODE 2! SEE THE GUIDE!

9 – Does not know X –

13. Approximately what per cent of your costs were spent this year on the following items?

	%
a. Transportation and cargo handling	%
b. Warehousing, storage (operation of own warehouse or use of such service)	%
c. Packaging	%
d. Annual average value of stocks (at purchase price)	%
e. Failed order, lower production/service delivery due to inventory shortage	%
f. Administration of the above activities	%

17. What per cent of the following activities is currently provided to you by <u>external service providers</u>: maximum 5%; more than 5, but maximum 25%; more than 25, but maximum 50%; maximum 75% or more than 75%?
AFTER THE ANSWER IS GIVEN: In the 5 years to come, how will that proportion change? 1 = strong decline; 5 = strong increase. (Of course, the interim scores may also be used.)

ASK BY LINE →	EXTERNAL SERVICE PROVIDERS CURRENTLY								CHANGE IN NEXT 5 YEARS						
	none	max. 5%	max. 25%	max. 50%	max. 75%	75+ %	Does not know		GRADE 1 = strong decline 5 = strong increase					Does not know	
a. Transportation and cargo handling	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X
b. Warehousing, storage	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X
c. Packaging	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X
d. Forwarding	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X
e. Order management	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X
f. Inventory management	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X
g. IT systems needed for the above activities	0	1	2	3	4	5	9	X	1	2	3	4	5	9	X

18. In your opinion, which of the following arguments are in favour of the <u>outsourcing</u> of the transportation, warehousing, cargo handling, packaging activities?

	yes	no	Does not know	
a. Your enterprise is spreading (geographically).	1	2	9	X
b. The quality of these activities is improved by having recourse to an external service provider.	1	2	9	X
c. The costs related to these activities will decrease.	1	2	9	X
d. Your enterprise needs flexible service capacities.	1	2	9	X
e. Your enterprise needs external expertise in regard of these activities.	1	2	9	X
f. Your enterprise focuses exclusively on its core competences.	1	2	9	X
g. Your buyers expect you to involve an external service provider.	1	2	9	X
h. Your suppliers expect you to involve an external service provider.	1	2	9	X

19. And which of the following arguments are against the <u>outsourcing</u> of the transportation, warehousing, cargo handling, packaging activities?

	yes	no	Does not know	
a. Outsourcing implies loss of control over the processes concerned.	1	2	9	X
b. The above activities are among the core competences of your enterprise.	1	2	9	X
c. Outsourcing would not reduce the costs related to these activities.	1	2	9	X
d. Your enterprise is in command of higher expertise concerning the above activities than the service providers.	1	2	9	X
e. The outsourcing of the above activities would imply no essential improvement in service quality.	1	2	9	X
f. Your enterprise does not know how to have recourse to the services listed above.	1	2	9	X
g. Outsourcing these activities implies hidden costs.	1	2	9	X
h. Your dependence on the service provider would increase through the outsourcing of the above activities.	1	2	9	X
i. It would be difficult to evaluate and control service quality.	1	2	9	X

23. Do you co-operate with another enterprise/other enterprises in the following areas?

	yes	no	Does not know	
a. joint procurement	1	2	9	X
b. joint sales	1	2	9	X
c. joint production	1	2	9	X
d. joint development	1	2	9	X
e. joint applications	1	2	9	X

26. **What is the distinctive feature of your enterprise relative to the enterprises of your competitors?**

SEVERAL ANSWERS ARE POSSIBLE

01 – lower price
02 – higher quality
03 – bigger choice
04 – more advanced technology
05 – better customer contacts
06 – flexibility
07 – punctual payment
08 – observation of transportation deadlines
09 – other difference, namely:
.....……
00 – there is no difference
99 – Does not know X –

27. **Is the No.1. leader of the enterprise a man or a woman?**

1 – man 2 – woman X –

FOR INDIVIDUAL ENTERPRISES: THE ENTREPRENEUR

28. When was the No.1. leader of the enterprise born?

FILL IT IN, THEN

in the year 1 9 …….
99 – Does not know X –

1 – younger than 25
2 – 25 – 35-year-old
3 – 36 – 45-year-old
4 – 46 – 55-year-old
5 – 55+
X –

29. What school qualification does the No.1. leader of the enterprise (individual entrepreneur, representative, managing director, director) have?

1 – college, university
2 – general secondary school/vocational sec. school qualification
3 – 8-year primary school + skilled worker training
4 – 8-year primary school
5 – less than 8-year primary education
9 – Does not know X –

30. Beside the <u>owner(s),</u> how many persons does the enterprise employ at the moment?

	headcount	
a. as main-job-holder employee?	person(s)	
b. as second-job-holder (outworker, part-time, pensioner) employee?	person(s)	
c. helping family member?	person(s)	
d. external employee in entrepreneur status who works exclusively or mostly for this company?	person(s)	
ADD UP and **ASK**: **total:**	person(s)	**employees, excl. of owners**

51. All in all, how do you judge the current position of your enterprise?

1 – Good,
2 – mediocre or
3 – bad?

9 – Does not know X –

Annex No. 2: Questions of "In competition with the world, 2009" used in the Thesis

IN COMPETITION WITH THE WORLD, 2009 – research programme

Corvinus University of Budapest
Institute of Business Economics
COMPETITIVENESS RESEARCH CENTER
1093 Budapest, Fővám tér 8.
T: (1) 482 5569 F: (1) 482 5290
versenykepesseg@uni-corvinus.hu
www.versenykepesseg.uni-corvinus.hu

DIRECTOR GENERAL and STAFF
BASIC PIECES OF INFORMATION CONCERNING THE COMPANY

A1. Average statistical headcount of the company in 2008: ……. person(s)

A8. Main activity of the company based on the first two digits of the TEÁOR'08 code:
……

I. SITUATION and STRATEGY OF THE COMPANY

V14.

a) What quality did the company attain in the areas characterising its activity in 2005-2008 relative to its strongest competitor?

If the company is active in several business lines, please provide your answers for the most significant one among them. If it has no domestic competitor, compare your company to the quality which may be regarded as typical among the lead foreign companies of the industry.

Basis of comparison: b) □ whole company or □ dominant business line

c) □ domestic competitor or □ leading foreign companies

	a) Our performance relative to our main competitor: much weaker				much better
			basically identical		
a) Cost efficiency	1	2	3	4	5
b) Market share	1	2	3	4	5
c) Technological quality	1	2	3	4	5
d) Product quality	1	2	3	4	5
e) Width of product selection	1	2	3	4	5
f) Competitive prices	1	2	3	4	5
g) Transportation accuracy	1	2	3	4	5
h) Flexibility of customer demand satisfaction	1	2	3	4	5
i) Flexibility of the production system	1	2	3	4	5
j) Efficiency of the logistics system	1	2	3	4	5

k)	Shortness of the transportation deadline	1	2	3	4	5
l)	Flexible response to changing consumer needs	1	2	3	4	5
m)	Quality of production activity	1	2	3	4	5
n)	Strategic alliances with main partners	1	2	3	4	5
o)	Corporate image	1	2	3	4	5
p)	Degree of organisation of distribution channels	1	2	3	4	5
q)	Creditworthiness	1	2	3	4	5
r)	Level of receivables	1	2	3	4	5
s)	Solvency	1	2	3	4	5
t)	Quality of consumer services	1	2	3	4	5
u)	Lobbying at state administration agencies	1	2	3	4	5
v)	Sale to the state or to budgetary organs	1	2	3	4	5
w)	Capacity to forecast market changes	1	2	3	4	5
x)	Appearance on export markets	1	2	3	4	5
y)	Ethic conduct	1	2	3	4	5
z)	Environmental (ecological) awareness	1	2	3	4	5
aa)	Introduction of basic materials of adequate quality	1	2	3	4	5
bb)	Reliable basic material supply	1	2	3	4	5
cc)	Capacity exploitation	1	2	3	4	5
dd)	Qualification of employees	1	2	3	4	5
ee)	Use of innovative sales incentive methods	1	2	3	4	5
ff)	Quality, well-prepared managers	1	2	3	4	5
gg)	Up-to-date decision-making/functioning methods	1	2	3	4	5
hh)	Level of R&D expenditure	1	2	3	4	5
ii)	Introduction to the market of new products	1	2	3	4	5
jj)	Efficiency of organisational structure	1	2	3	4	5
kk)	Integrated corporate IT system	1	2	3	4	5
ll)	Quality of the management information system	1	2	3	4	5

V15. Please evaluate the performance of your company or (in case of several lines of business) of your priority line of business (in domestic comparison) according to the following:

1 – well below the industrial average
2 –lagging a little behind the industrial average
3 – similar to the industrial average
4 – somewhat better than the industrial average
5 – representing lead quality in the industry

a)	Profit as a proportion of sales revenue	1	2	3	4	5
b)	Return on equity	1	2	3	4	5
c)	Market share (based on the sales revenue)	1	2	3	4	5
d)	Technological quality	1	2	3	4	5
e)	Management	1	2	3	4	5
f)	Product/service quality	1	2	3	4	5
g)	Other priority success criterion, namely:	1	2	3	4	5

V61. What is the position in the organisational hierarchy of your company of the responsible managers of the following special areas? Possible answers:

1 – general director
2 – deputy general director
3 – managing director
4 – division head
5 – department head
6 – group leader
7 – other, viz.:.....

a)	Marketing	□	i)	Inventory management	□
b)	Controlling	□	j)	Cost management	□
c)	Research development	□	k)	HR management	□
d)	Organisational development	□	l)	Accounting	□
e)	Production	□	m)	Finance	□
f)	Sales	□	n)	Wage management	□
g)	Procurement	□	o)	Quality assurance	□
h)	Logistics	□	p)	Information management	□
			q)	Strategic planning	□

MI. ORGANISATIONAL RELATIONS

M1. Indicate on the scale below the actual weight carried by the specific areas of operation in the success of the operation of the company overall at your company.
(1- little significance, 5- decisive factor)

a)	Upper management	1 2 3 4 5	j)	Inventory management	1 2 3 4 5
b)	Trade/Marketing	1 2 3 4 5	k)	Cost management	1 2 3 4 5
c)	Controlling	1 2 3 4 5	l)	HR management	
d)	Research development	1 2 3 4 5	m)	Accounting	1 2 3 4 5
e)	Organisational	1 2 3 4 5	n)	Finance	1 2 3 4 5
	development	1 2 3 4 5	o)	Wage management	1 2 3 4 5
f)	Production	1 2 3 4 5	p)	Quality assurance	1 2 3 4 5
g)	Sales	1 2 3 4 5	q)	Information management	1 2 3 4 5
h)	Procurement	1 2 3 4 5	r)	Strategic planning	1 2 3 4 5
i)	Logistics				

TRADE, MARKETING
VIII. LOGISTICS SERVICES

K51. Please describe the tendency experienced at your company in the past three years. (1- significant decline, 3 – no change, 5 – significant increase.)

a) basic material stocks 1 2 3 4 5
b) stock of semi-finished goods..... 1 2 3 4 5
c) stock of finished goods and products.....1 2 3 4 5
d) transportation costs.....1 2 3 4 5
e) inventory carrying costs……1 2 3 4 5
f) warehousing costs..... 1 2 3 4 5
g) co-ordination costs related to the logistics system..... 1 2 3 4 5
h) costs of information system related to the logistics system..... 1 2 3 4 5
i) HR costs related to the logistics system 1 2 3 4 5

K52. Does your company currently employ external logistics service provider companies to have the logistics activities performed, and what activities does it plan to outsource in the next 3 years?

		a) Currently	b) Plan
a)	transportation, forwarding.....	□	□
b)	warehousing.....	□	□
c)	inventory management.....	□	□
d)	delivery of value added services, e.g. labelling ……	□	□
e)	delayed assembly ……	□	□
f)	supply chain co-ordination.....	□	□
g)	call centre operation to treat remote customer contacts …	□	□

h) customs administration…… □ □
i) tracking of consignments …… □ □
j) management consulting…… □ □

K54. Please evaluate the general quality of logistics services ought from external partners. (1 – very low level, 2 – still acceptable, 3 – medium-level, 4 - good, 5 - excellent)

1 2 3 4 5

K55. What importance dies your company assign to the following criteria in the evaluation of the performance of external service providers? (Indicate the importance of each factor on the scale below. 1 –least important, 5 – most important)

a) cost decrease..... 1 2 3 4 5
b) decrease of the promised transportation 1 2 3 4 5
deadlines..... 1 2 3 4 5
c) higher transportation accuracy..... 1 2 3 4 5
d) stock availability..... 1 2 3 4 5
e) correct invoicing..... 1 2 3 4 5
f) delivery of value added services …… 1 2 3 4 5
g) quality if contact person …… 1 2 3 4 5
h) quality of information supplied …… 1 2 3 4 5
i) number of damages ……. 1 2 3 4 5
j) other, namely .....

K56. If you use logistics services provided by external partners, please name the problems incurred while using them. (Please evaluate the significance of each problem on a five-point scale: 1 – negligibly small, 5 – causes outstanding problems)

a) inadequate information exchange 1 2 3 4 5
b) inadequate level of commitment on behalf of your own company 1 2 3 4 5
c) inadequate level of commitment on behalf of the service provider company …… 1 2 3 4 5
d) inadequate product knowledge at the external partner 1 2 3 4 5
e) inadequate consumer knowledge at the external partner 1 2 3 4 5
f) imprudent contracting 1 2 3 4 5
g) inadequate control mechanism of the company 1 2 3 4 5
h) lack of time to develop the relationship and co-operation 1 2 3 4 5
i) other, namely 1 2 3 4 5

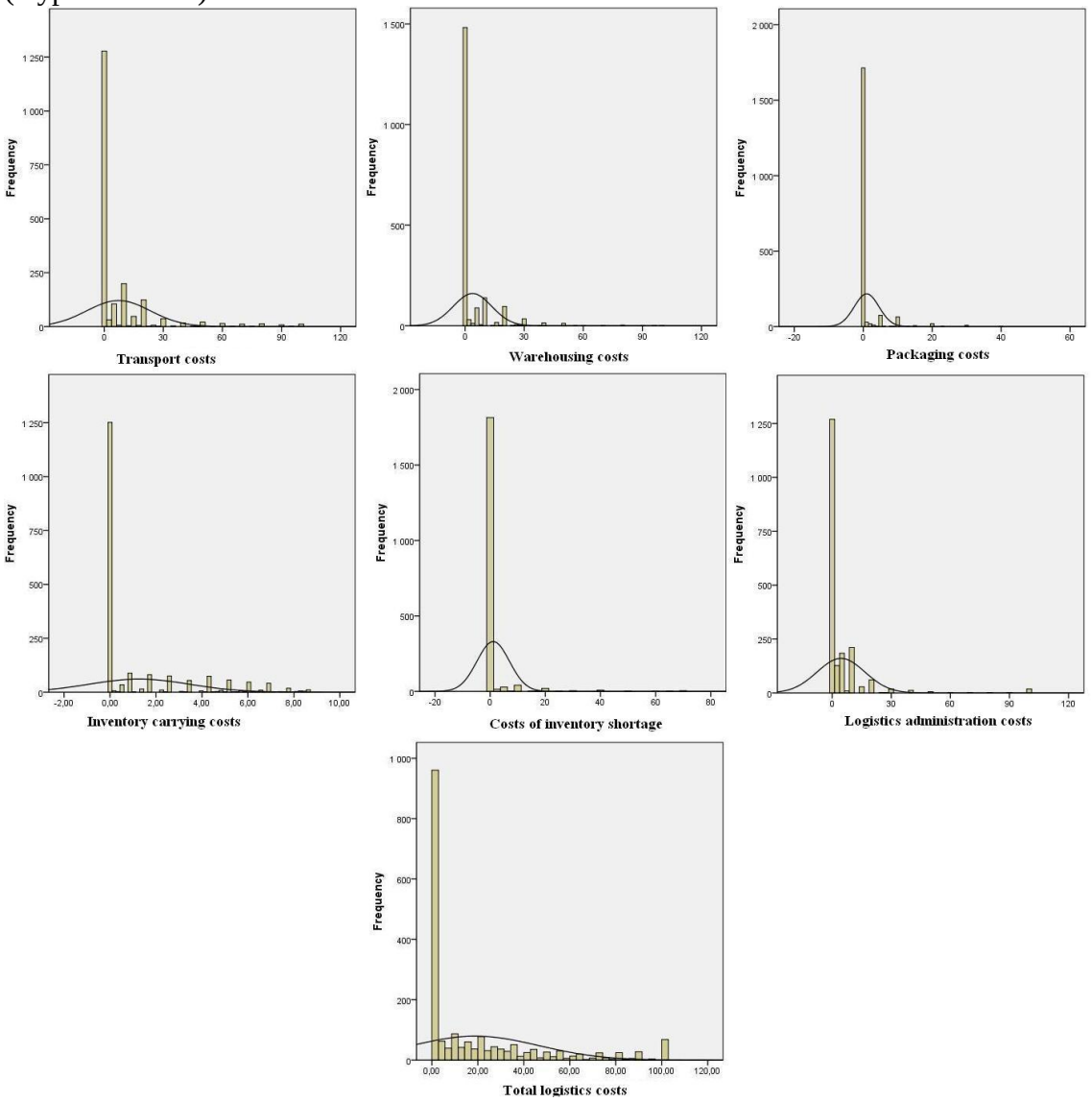
Annex No. 3: Figures and tables outside the main text of the Thesis

Table 38: Variations of logistics functions of Hungarian SMEs being outsourced?? outsourcing more than one logistics functions

Variation of outsourced logistics activities	Ratio
transportation-forwarding	29.35%
transportation-warehousing	7.07%
transportation-warehousing-forwarding	7.07%
forwarding-logistics IT	4.35%
transportation-forwarding-logistics IT	3.80%
transportation-warehousing-packaging-order management-logistics IT	3.80%
transportation-logistics IT	3.26%
order management-logistics IT	3.26%
warehousing-order management-logistics IT	3.26%
transportation-warehousing-packaging-forwarding-order management-logistics IT	2.72%
transportation-order management	2.17%
forwarding-order management	2.17%
transportation-packaging-forwarding	2.17%
transportation-warehousing-forwarding-logistics IT	2.17%
transportation-warehousing-order management	1.63%
transportation-forwarding-order management	1.63%
transportation-order management-logistics IT	1.63%
warehousing-forwarding-order management	1.63%
transportation-warehousing-packaging-forwarding	1.63%
transportation-warehousing-order management-logistics IT	1.63%
transportation-forwarding-order management-logistics IT	1.63%
transportation-packaging	1.09%
warehousing-logistics IT	1.09%
transportation-warehousing-packaging-order management	1.09%
transportation-warehousing-packaging-logistics IT	1.09%
transportation-warehousing-forwarding-order management	1.09%
warehousing-order management	0.54%
packaging-logistics IT	0.54%
transportation-warehousing-packaging	0.54%
forwarding-order management-logistics IT	0.54%
warehousing-packaging-forwarding-logistics IT	0.54%
packaging-forwarding-order management-logistics IT	0.54%
transportation-warehousing-packaging-forwarding-order management	0.54%
transportation-warehousing-packaging-forwarding-inventory management	0.54%
transportation-warehousing-packaging-inventory management-logistics IT	0.54%
transportation-packaging-forwarding-order management-logistics IT	0.54%
transportation-packaging-forwarding-inventory management-logistics IT	0.54%
transportation-warehousing-packaging-forwarding-order management-inventory management-logistics IT	0.54%

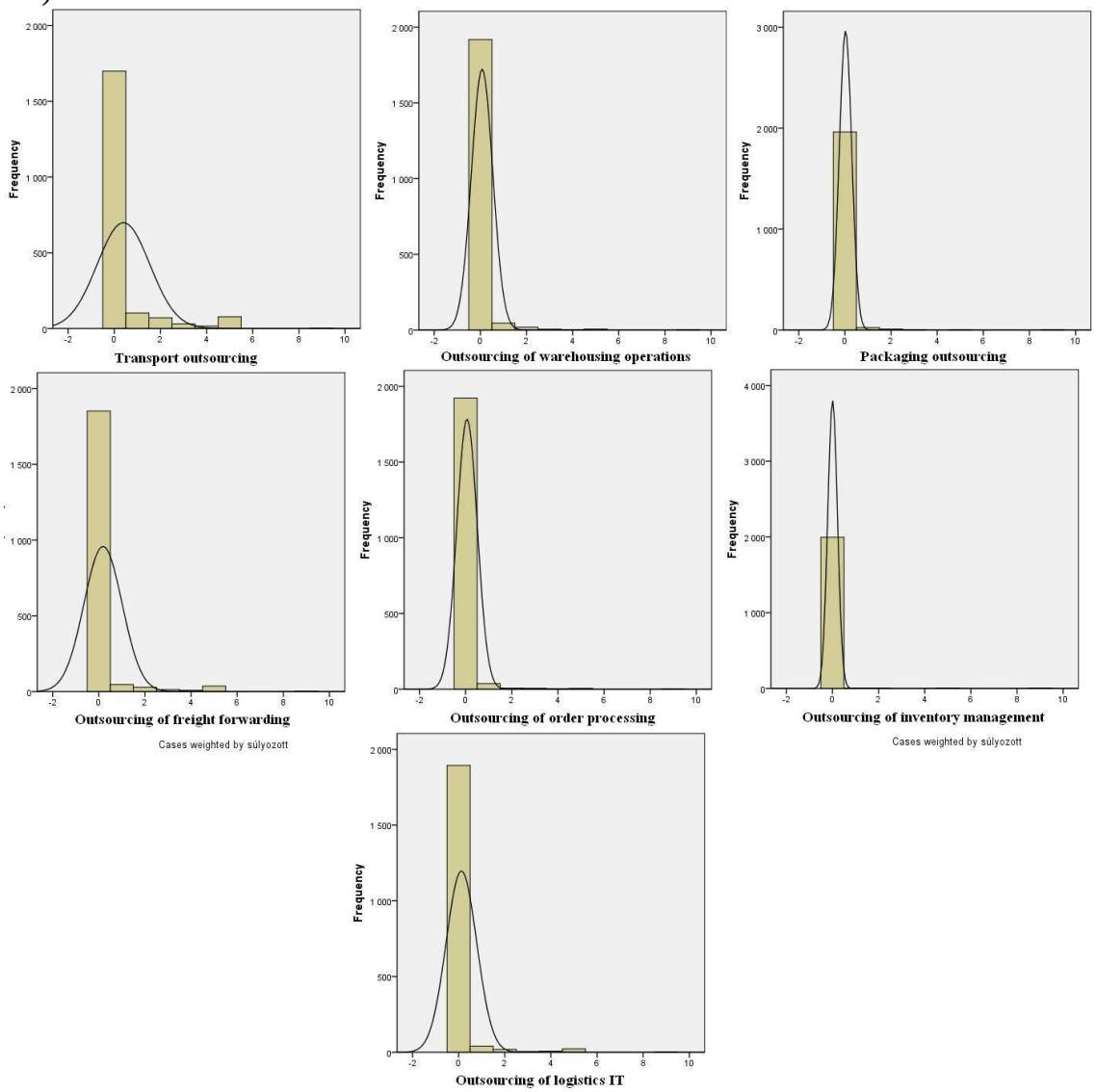
Source: Compiled by the Author

Figure 25: Histograms of partial and total logistics costs with normal distribution (Hypothesis H1)



Source: Compiled by the Author

Figure 26: Histograms of logistics outsourcing with normal distribution (Hypothesis H1)



Source: Compiled by the Author

Table 39: Pearson's correlation of certain logistics costs and outsourcing levels of agricultural, manufacturing and trading SMEs

	Logistics total cost	**Trans-portation cost**	**Warehousing cost**	**Packaging cost**
Transportation outsourcing	.302	.298	-	-
Warehousing outsourcing	.163	-	.205	-
Packaging outsourcing	.148	-	-	.203
Forwarding outsourcing	.197	-	-	-
Order management outsourcing	.157	-	-	-
Logistics IT outsourcing	.127	-	-	-

Source: Compiled by the Author

Table 40: Significance levels of Levene's test of logistics costs and outsourcing (Hypothesis H1)

	Company size	Branch	Geographical location	Main sales site	Distinctive features relative to competitors	Age of No.1. leader	School qualification of No.1. leader	Age of SME	Current situation of SME	Corporate of individual enterprise	No.1. leader is a man or a woman	Engaged in a cooperation or not	Settlement type
Transportation cost	.098	.000	.000	.000	.000	.000	.000	.290	.048	.849	.000	.361	.000
Warehousing cost	.000	.000	.000	.076	.000	.077	.005	.056	.002	.000	.005	.286	.006
Packaging cost	.000	.000	.027	.000	.000	.000	.000	.000	.114	.000	.235	.614	.777
Inventory carrying cost	.000	.000	.000	.004	.060	.588	.000	.002	.000	.000	.173	.059	.006
Inventory shortage cost	.000	.000	.000	.008	.117	.136	.000	.035	.010	.550	.004	.000	.000
Administration cost	.867	.006	.003	.000	.121	.009	.015	.609	.001	.001	.934	.013	.003
Logistics total cost	.000	.000	.001	.000	.004	.002	.117	.955	.003	.000	.000	.758	.033
Transportation outsourcing	.000	.000	.000	.000	.000	.006	.000	.002	.630	.000	.000	.000	.083
Warehousing outsourcing	.000	.000	.000	.000	.000	.000	.000	.041	.000	.000	.000	.000	.000
Packaging outsourcing	.000	.000	.000	.000	.020	.003	.000	.001	.000	.000	.010	.531	.000
Forwarding outsourcing	.000	.000	.472	.000	.000	.011	.000	.011	.002	.000	.000	.000	.011
Order management outsourcing	.002	.000	.000	.000	.000	.783	.000	.892	.019	.000	.003	.000	.000
Inventory management outsourcing	.012	.029	.040	.223	.363	.140	.001	.045	.000	.593	.746	.676	.019
Logistics IT outsourcing	.000	.000	.000	.000	.000	.106	.000	.000	.003	.000	.876	.038	.000

Source: Compiled by the Author

Table 41: Eta values of factors affecting logistics costs and outsourcing (agriculture, manufacturing industry and trade (Hypothesis H1)

	Transportation cost	**Warehousing cost**	**Packaging cost**	**Inventory carrying cost**	**Inventory shortage costs**	**Administration cost**	**Logistics total cost**	**Transportation outsourcing**	**Warehousing outsourcing**	**Packaging outsourcing**	**Forwarding outsourcing**	**Order management outsourcing**	**Logistics IT outsourcing**
Company size	.148	**.242**	**.162**	**.115**	*	**.178**	**.110**	**.156**	**.153**	*	**.184**	*	**.168**
Branch	*	*	.003	**.149**	*	.104	*	.109	*	*	*	*	*
Geographical location	**.164**	*	*	*	**.072**	.044	.066	.108	.089	**.064**	*	.103	.093
Main sales site	.117	*	*	.102	**.086**	*	*	.135	.213	*	.152	.097	.113
Distinctive features relative to competitors	*	*	*	*	*	*	*	*	*	*	.108	**.109**	.133
Age of No.1. leader	*	*	*	*	*	**.133**	*	*	*	*	*	*	*
School qualification of No.1. leader	.060	*	.006	.014	*	*	*	.118	*	*	.166	*	.154
Age of SME	*	*	*	*	*	*	*	*	*	*	*	*	*
Settlement type	*	,044	*	*	.035	.024	*	*	**.191**	**.126**	*	**.196**	*
Current situation of SME	*	*	*	.006	*	*	*	*	.154	*	*	.077	*
Corporate of individual enterprise	.139	**.164**	**.080**	*	*	*	.097	.156	.089	*	.096	.100	.148
No.1. leader is a man or a woman	**.167**	.096	*	*	*	.101	*	.120	*	*	.095	*	*
Engaged in cooperation or not	.140	*	*	.081	*	.095	**.108**	**.198**	*	*	**.214**	.090	**.159**

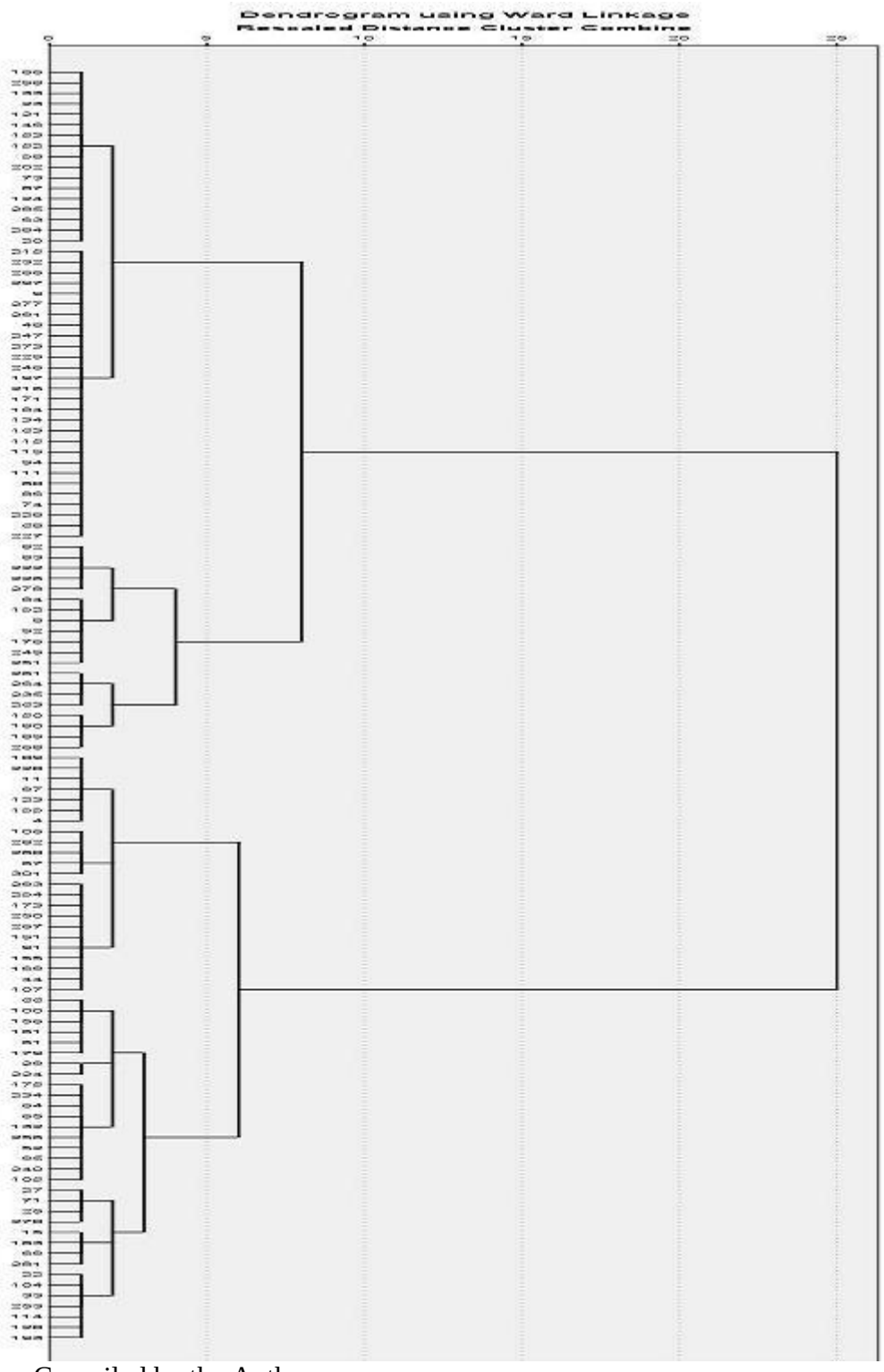
Source: Compiled by the Author

Table 42: Cramer V values showing the association of outsourcing arguments by pair among agricultural, manufacturing and trade SMEs (Hypothesis H3)

	18a	**18b**	**18c**	**18d**	**18e**	**18f**	**18g**	**18h**	**19a**	**19b**	**19c**	**19d**	**19e**	**19f**	**19g**	**19h**	**19i**
18a: Geographical location	-	.707	.686	.677	.686	.665	.686	.679	.562	.578	.579	.538	.575	.543	.566	.588	.546
18b: Quality improvement		-	.739	.764	.748	.688	.713	.727	.569	.578	.580	.533	.587	.555	.563	.595	.558
18c: Cost reduction			-	.738	.701	.695	.674	.703	.566	.582	.574	.535	.579	.554	.566	.593	.549
18d: Flexible capacity				-	.729	.736	.706	.700	.568	.576	.568	.544	.580	.555	.579	.591	.561
18e: Need for external expertise					-	.680	.715	.716	.577	.587	.587	.554	.580	.565	.575	.597	.555
18f: Focus on core competence						-	.670	.682	.567	.572	.579	.534	.574	.543	.576	.599	.555
18g: Buyer expects							-	.743	.560	.574	.584	.542	.587	.559	.559	.578	.553
18h: Supplier expects								-	.572	.576	.586	.547	.585	.569	.563	.587	.565
19a: Loss of control									-	.765	.787	.698	.753	.631	.768	.778	.791
19b: Transportation/warehousing/packaging are core competences										-	.767	.726	.770	.642	.724	.732	.715
19c: Costs do not decrease											-	.692	.796	.650	.758	.749	.740
19d: Our expertise is better												-	.698	.628	.668	.700	.705
19e: Quality decline													-	.651	.741	.754	.750
19f: Does not know how to use it														-	.625	.654	.656
19g: Hidden costs															-	.783	.783
19h: Increasing dependency																-	.838
19i: Difficulties of evaluation and control																	-

Source: Compiled by the Author

Figure 27: Dendrogram of performance clusters (Hypothesis H5)



Source: Compiled by the Author

Table 43: Contribution of operations of micro enterprise to success of the company overall and by various company managers (Hypothesis H6)

MICRO ENTERPRISE	General director (rank)	General director (mean)	Comm. manager (rank)	Comm. manager (mean)	Fin. manager (rank)	Financial manager (rank)	Prod. manager (rank)	Production manager (rank)	Total (rank)	Total (mean)
A: Upper management	1.	4.31^{defhijklmopq}	1.	4.31^{cdeijlpq}	3.	4.24^{dijlr}	2.	4.23^{deijpq}	1.	4.22^{cfijlq}
B: Trade/marketing	2.	4.26^{cdehijlmnopq}	3.	4.16^{cdeijlpq}	5.	4.06^{dg}	3.	4.20^{dehijpq}	2.	4.22^{cdefhijlq}
C: Controlling	9.	3.77^{bd}	16.	3.32^{acfghkmnor}	15.	3.69^{dgkn}	15.	3.59^{dglmn}	15.	3.59^{abdkno}
D: R&D	18.	3.12^{abcfgklnor}	18.	3.06^{abfghiklmnopqr}	18.	3.25^{abcfghijklmnopqr}	18.	3.14^{abcfgklmnor}	18.	3.19^{bcgo}
E: Organisational development	17.	3.45^{abk}	17.	3.29^{abfghkmor}	17.	3.48^{gkn}	16.	3.36^{abgklmnor}	17.	3.39^{bno}
F: Production	8.	3.79^{ad}	4.	4.03^{cdeij}	12.	3.78^{fgk}	11.	3.76^{d}	12.	3.74^{abg}
G: Sales	3.	4.11^{dhijq}	5.	4.03^{cdeij}	1.	4.39^{bcdefhijlmpqr}	1.	4.27^{cdehijpq}	3.	4.15^{dfijq}
H: Procurement	11.	3.71^{abgk}	6.	4.00^{cdeij}	7.	4.00^{dgk}	10.	3.77^{bg}	8.	3.89^{bkn}
I: Logistics	16.	3.47^{abgk}	15.	3.56^{abdfghk}	16.	3.65^{adgk}	13.	3.69^{abg}	14.	3.67^{abgk}
J: Inventory management	12.	3.69^{abgk}	14.	3.58^{abfghkor}	8.	3.94^{adgk}	14.	3.66^{abgkn}	13.	3.70^{abn}
K: Cost management	4.	4.08^{adehijmnpq}	2.	4.16^{cdeijlpq}	2.	4.30^{cdefhijlmqr}	6.	4.00^{dekq}	4.	4.11^{chilqr}
L: HR	10.	3.72^{abdk}	11.	3.68^{abdk}	10.	3.88^{adgk}	7.	3.97^{cdeq}	9.	3.80^{abkn}
M: Accounting	13.	3.66^{abk}	10.	3.84^{cde}	9.	3.91^{dgk}	5.	4.04^{cdeq}	6.	3.96
N: Finance	6.	3.81^{bd}	9.	3.87^{cd}	4.	4.15^{cde}	4.	4.10^{cdejq}	5.	4.03^{cehjlq}
O: Wage man.	7.	3.80^{abd}	7.	4.00^{cdejpq}	6.	4.03^{d}	8.	3.96^{deq}	7.	3.94^{cdeq}
P: Quality assurance	14.	3.57^{abk}	12.	3.61^{abdko}	11.	3.84^{dg}	12.	3.71^{abg}	10.	3.78^{q}
Q: Information management	15.	3.54^{abgk}	13.	3.58^{abdkor}	14.	3.77^{dgk}	17.	3.36^{abgklmnor}	16.	3.49^{abgkmo}
R: Strategic planning	5.	3.86^{d}	8.	4.00^{cdejq}	13.	3.77^{adgk}	9.	3.86^{deq}	11.	3.75^{k}

a, b, c, …., p, q, r: difference at 5% significance rate in comparison with the given operation (e.g. upper management)
Source: Compiled by the Author

Table 44: Contribution of operations of small enterprises to the success of the company overall according to various company managers (Hypothesis H6)

SMALL ENTERPRISE	General director (rank)	General director (mean)	Comm. man. (rank)	Comm. manager (mean)	Fin. man. (rank)	Financial manager (rank)	Prod. man. (rank)	Prod. manager (rank)	Total (rank)	Total (mean)
A: Upper management	1.	4.71^{g}	2.	4.43^{bfgno}	2.	4.54^{gn}	1.	4.53^{bgn}	1.	4.56^{bg}
B: Trade/marketing	3.	4.26^{fmn}	4.	4.28^{afghkmnop}	6.	4.12^{fhjkmnop}	4.	4.25^{afghno}	3.	4.42^{agno}
C: Controlling	15.	3.30^{ijlpq}	16.	3.43^{eijq}	15.	3.51^{filpqr}	16.	3.25^{eijq}	16.	3.55^{ilq}
D: R&D	18.	2.51	18.	2.85^{e}	18.	2.74^{e}	18.	2.47	18.	2.82
E: Organisational development	17.	2.89^{q}	17.	3.13^{cd}	17.	2.94^{d}	17.	3.20^{cijqr}	17.	3.21
F: Production	5.	4.15^{bhkmnor}	6.	4.15^{abghklmnopqr}	11.	3.70^{bcijklmopqr}	7.	4.02^{bhklmnop}	9.	4.03^{abhijklmnopqr}
G: Sales	2.	4.55^{a}	1.	4.45^{abfno}	1.	4.63^{a}	2.	4.47^{abn}	2.	4.55^{ab}
H: Procurement	9.	3.83^{fkmop}	10.	3.98^{bfijklmpqr}	4.	4.27^{bjkmno}	5.	4.18^{bfkmno}	6.	4.13^{fkmop}
I: Logistics	12.	3.51^{cjkmq}	14.	3.74^{chjlqr}	14.	3.55^{cflpqr}	13.	3.59^{cejlmpqr}	14.	3.77^{cfjlpqr}
J: Inventory management	13.	3.45^{cikmq}	15.	3.71^{chilqr}	9.	4.00^{bfhklmnopq}	15.	3.51^{ceilqr}	13.	3.80^{filpqr}
K: Cost manag.	8.	3.91^{fhijlnop}	8.	4.14^{bfhlmnpr}	5.	4.16^{bfhjmnop}	8.	3.98^{fhlmnop}	7.	4.13^{fhmnop}
L: HR	14.	3.36^{ckmq}	11.	3.94^{fhijkmpqr}	12.	3.67^{cfijpqr}	11.	3.72^{fijkmpqr}	11.	3.84^{cfijpqr}
M: Accounting	6.	3.94^{bfhijlnpr}	7.	4.14^{bfhklnpqr}	7.	4.08^{bfhjkop}	9.	3.92^{fhiklpr}	8.	4.12^{fhkopr}
N: Finance	4.	4.18^{bfkm}	5.	4.24^{abfgkmop}	3.	4.29^{abhjko}	3.	4.25^{abfghko}	4.	4.32^{bfko}
O: Wage man.	7.	3.93^{fhkr}	3.	4.35^{abfgn}	8.	4.06^{bfhjkmnp}	6.	4.12^{bfhkn}	5.	4.23^{bfhkmn}
P: Quality assurance	11.	3.54^{chkmr}	9.	4.10^{bfhklmnr}	10.	3.83^{bcfijklmoqr}	10.	3.88^{fiklmr}	10.	3.94^{fhijklmq}
Q: Information management	16.	3.04^{ceijl}	13.	3.79^{cfhijlmr}	13.	3.59^{cfijlpr}	14.	3.56^{ceijlr}	15.	3.72^{cfijlpr}
R: Strategic planning	10.	3.63^{fmop}	12.	3.94^{fhijklmpq}	16.	3.44^{cfilpq}	12.	3.62^{eijlmpq}	12.	3.83^{fijlmq}

a, b, c, …., p, q, r: difference at 5% significance rate in comparison with the given operation (e.g. upper management)
Source: Compiled by the Author

Table 45: Contribution of operations of medium-sized enterprises to success of the company overall and by various company managers (Hypothesis H6)

MEDIUM-SIZED ENTERPRISE	General director (rank)	General director (mean)	Comm. manager (rank)	Comm. manager (mean)	Fin. manager (rank)	Financial manager (rank)	Prod. manager (rank)	Production manager (rank)	Total (rank)	Total (mean)
A: Upper management	1.	4.79	1.	4.69	1.	4.69	1.	4.71[g]	1.	4.71
B: Trade/marketing	4.	4.30[fkn]	5.	4.21[fhk]	7.	4.03[fhjkmnop]	4.	4.29[fhkn]	5.	4.18[fhkn]
C: Controlling	15.	3.57[ilq]	16.	3.39[q]	15.	3.33[iqr]	15.	3.55[iq]	15.	3.43[q]
D: R&D	18.	2.69	18.	2.75	18.	2.41	18.	2.74	18.	2.59
E: Organisational development	17.	2.98	17.	2.97	17.	2.82	17.	3.01	17.	2.85
F: Production	5.	4.16[bhkno]	3.	4.29[fghk]	10.	3.90[bhjmop]	5.	4.29[bhk]	4.	4.22[bghk]
G: Sales	2.	4.45	2.	4.40[fk]	2.	4.37[kn]	2.	4.56[a]	2.	4.44[f]
H: Procurement	7.	4.09[fno]	6.	4.18[bfkn]	5.	4.11[bfkmno]	6.	4.28[bfk]	6.	4.18[bfkno]
I: Logistics	14.	3.61[cl]	13.	3.69[jlmpr]	13.	3.53[clr]	14.	3.73[clmpr]	13.	3.62[lr]
J: Inventory management	10.	3.86[mopr]	10.	3.80[imnopr]	9.	3.92[bfmop]	9.	3.96[lmnopr]	10.	3.91[mop]
K: Cost management	3.	4.30[bfn]	4.	4.28[bfgh]	3.	4.27[bghn]	3.	4.36[bfh]	3.	4.32[bfh]
L: HR	13.	3.64[ci]	14.	3.62[ir]	12.	3.57[ir]	12.	3.83[ijmpr]	14.	3.61[ir]
M: Accounting	11.	3.85[jpr]	11.	3.80[ijopr]	8.	4.01[bfhjop]	11.	3.90[ijlopr]	11.	3.90[jop]
N: Finance	6.	4.11[bfhko]	7.	3.99[hiop]	4.	4.24[bghk]	7.	4.07[bjop]	7.	4.10[bho]
O: Wage man.	8.	3.98[fhjnpr]	8.	3.94[jmnpr]	6.	4.07[bfhjm]	8.	4.02[jmnp]	8.	4.03[hjmnp]
P: Quality assurance	9.	3.87[jmor]	9.	3.93[ijmnor]	11.	3.88[bfjm]	10.	3.93[ijlmnor]	9.	3.94[jmo]
Q: Information management	16.	3.41[c]	15.	3.40[c]	16.	3.24[c]	16.	3.48[c]	16.	3.32[c]
R: Strategic planning	12.	3.84[jmop]	12.	3.80[ijlmop]	14.	3.45[cil]	13.	3.79[ijlmp]	12.	3.71[il]

a, b, c, …., p, q, r: difference at 5% significance rate in comparison with the given operation (e.g. upper management)
Source: Compiled by the Author

Table 46: Contribution of operations of large companies to success of the company overall and by various company managers (Hypothesis H6)

LARGE COMPANY	General director (rank)	General director (mean)	Comm. manager (rank)	Comm. manager (mean)	Fin. manager (rank)	Financial manager (rank)	Prod. manager (rank)	Production manager (rank)	Total (rank)	Total (mean)
A: Upper management	1.	4.81^{g}	1.	4.72	1.	4.71^{fgk}	1.	4.76^{k}	1.	4.70^{g}
B: Trade/marketing	5.	4.08^{cfiklnopqr}	4.	4.09^{cfghklmnopr}	9.	4.09^{cfhijlmnopqr}	6.	4.05^{cfhijlmnopqr}	6.	3.98^{cfhijklmnopqr}
C: Controlling	9.	3.89^{bhijlmnopqr}	10.	3.75^{bfhijlmnopqr}	12.	3.85^{bhijlmopqr}	12.	3.78^{bhijlmnopqr}	12.	3.79^{bhijlmnopqr}
D: R&D	18.	2.86^{e}	18.	2.87^{e}	18..	2.76^{e}	18.	3.00	18.	2.84
E: Organisational development	17.	3.20^{dhjm}	17.	3.26^{dij}	17.	3.15^{dj}	17.	3.38^{ij}	17.	3.15^{j}
F: Production	4.	4.31^{bgkpr}	5.	4.06^{bcghijklmnopr}	4.	4.36^{abgklnop}	4.	4.22^{bghklmnpqr}	4.	4.27^{bgknpr}
G: Sales	2.	4.43^{afk}	3.	4.23^{bfhkno}	2.	4.56^{afknp}	3.	4.38^{fkp}	2.	4.39^{afknp}
H: Procurement	14.	3.64^{ceijlmnopqr}	7.	3.91^{bcfgijklmnopqr}	11.	4.03^{bcilmnopqr}	7.	4.03^{bcfjlmnopqr}	10.	3.88^{bcilmnopqr}
I: Logistics	12.	3.71^{bchlmnopqr}	15.	3.61^{cefhjlmnopq}	14.	3.79^{bchjlmoqr}	14.	3.73^{bcejlmnopqr}	15.	3.65^{bchjlmnoqr}
J: Inventory management	16.	3.23^{cehm}	14.	3.68^{cfgilmnopqr}	16.	3.56^{bceiqr}	16.	3.70^{bcehilmnoqr}	16.	3.47^{bceilmnqr}
K: Cost management	3.	4.31^{fgp}	2.	4.25^{bfghn}	3.	4.56^{afg}	2.	4.57^{afg}	3.	4.39^{bfg}
L: HR	7.	3.91^{bchinopqr}	9.	3.77^{bcfhijmnopqr}	10.	4.09^{bcfhilnopqrr}	10.	3.83^{bcfhijmnopqr}	9.	3.90^{bchijmnopqr}
M: Accounting	15.	3.57^{cehijoqr}	13.	3.71^{bcfghijlopqr}	8.	4.09^{bchilopqr}	11.	3.81^{bcfhijlnopqr}	11.	3.79^{bchijloqr}
N: Finance	10.	3.83^{bchilopqr}	6.	3.97^{bcfghijklopqr}	5.	4.32^{bfghlopqr}	8.	3.95^{bcfhijlmopqr}	7.	3.95^{bcfghijlopqr}
O: Wage man.	13.	3.71^{bchilmnpqr}	8.	3.84^{bcfghijlmnpqr}	7.	4.21^{bcfhilmnpq}	9.	3.86^{bchijlmnpqr}	8.	3.92^{bchilmnpqr}
P: Quality assurance	6.	4.03^{bcfhiklnoqr}	11.	3.72^{bcfhijlmnoqr}	6.	4.26^{bcfghlmno}	5.	4.11^{bcfghilmnoqr}	5.	4.05^{bcfghlnor}
Q: Information management	11.	3.79^{bchilmnopq}	16.	3.53^{chijlmnopr}	13.	3.82^{bchijlmnor}	13.	3.78^{bcfhijlmnopr}	14.	3.70^{bchijlmnor}
R: Strategic planning	8.	3.91^{bcfhilmnopq}	12.	3.72^{bcfhjlmopq}	15.	3.74^{bchijlmnr}	15.	3.72^{bcfhijlmnopq}	13.	3.72^{bcfhijlmnopq}

a, b, c, …., p, q, r: difference at 5% significance rate in comparison with the given operation (e.g. upper management)
Source: Compiled by the Author

Annex No. 4.: Abbreviations being used in the Thesis

Abbreviations	Content
3PL	Third-party logistics
BVL	German Logistics Association
EDI	Electronic Data Interchange
ERP	Enterprise Resources Planning
DEM	German Mark
HR	Human resource
ISIC	International Standard Industrial Classification
INCOTERMS	International Commercial Terms
JIT	Just in time
KPI	Key performance indicator
NACE	Statistical Classification of Economic Activities in the European Community
ROA	Return on assets
RFID	Radio Frequency Identification
SME	Small- and medium-sized enterprises
SCOR	Supply Chain Operation Reference
TEÁOR	Hungarian unified sectoral classification system of economic activities
V4	Visegrad Four countries (Czech Republic, Hungary, Poland, Slovakia)

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