Statistical Analysis of Companies' Logistics Systems

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Abstract: - COVID-19, officially SARS-CoV-2, which originated in China in December 2019, has fundamentally disrupted globalization and economic growth. The strain on supply chains is difficult to manage, and it is expected that the problems can only be resolved once the pandemic is over, which could lead to a further increase in economic and globalization growth. Consumer goods reach the final consumer through supply chains and supply networks, and these supply chains are increasingly playing a role in fostering collaborative relationships across international companies. As a result, companies are becoming stronger, more developed, and growing. Logistics is an important part of a company's operations, managing the flow of materials. The development and positioning of logistics within a company have a major impact on the company's performance, its role in the supply chain, and its competitiveness. Advanced, large companies now consider the senior manager responsible for material flow processes to be the head of the supply chain within their company, as the process from raw material to consumer must be managed and controlled as a whole. Performance must also be assessed in context, recognizing the differences between companies that give them a competitive advantage or disadvantage. In addition, the aim is to develop sustainable logistics at the company level, which will be achieved in companies that pay particular attention to the strategic role of logistics within the company. The use of statistical methods to analyze these relationships is not common in business practice, but it can provide important information and can also be a major aid to future decision-making.

Key-Words: - Logistics, Supply Chain Management, Globalization, Company Performance, Statistical Analysis, Service and Manufacturing sectors.

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1 Introduction

A recent questionnaire survey of 210 managers or company directors responsible for logistics in companies (domestic and international) operating in Hungary. The questionnaire contained a total of 168 questions, covering different groups of issues, all of which were related to the supply chain or the logistics activities of the company. The aim was to assess the mindset of domestic companies and the position of logistics as an organizational unit within the company, providing a basis for comparison with similar parameters of successful companies operating in the international arena. Previous research has also emphasized that sustainable logistics development can be achieved in companies that pay particular attention to the strategic role of logistics within the organization, [1]. Using this questionnaire survey, the study seeks to answer the question: how can companies be grouped when comparing their competitiveness or the development of their logistics area according to different criteria, and can significant differences be detected in the development of the logistics area and the market position of the company among companies operating in similar industries? This topic has been touched upon by many international researchers. For

example, based on [2], Firms can be categorized according to their adoption of either aggressive or robust logistics approaches, revealing notable distinctions in logistics advancement and market standing across comparable sectors, as observed in both the United States and China. Also, [3], mentioned that companies can be sorted based on how they manage their operations to stay competitive. Notable variations in logistics growth and market position can be noticed among companies operating in the same industries.

Clustering analysis is used in [4], to analyze how the various industries and firms in Colombia can be more competitive and productive. The results indicate that diversification of industries has to be done to obtain a better balance of payments and GNP for the country.

In addition, high-quality logistics standards play a crucial role in overcoming challenges for businesses, especially in transportation and storage. For that, [5], explored in his article how logistics performance relates to entrepreneurship rates in certain European Union countries.

The study, [6], analyzed the current situation and future outlook of the logistics service providers in Central Vietnam, provided managerial implications for competitive logistics strategies, and discussed the status and prospects of logistics providers in Tianjin, China, following which sharp differences have been outlined in logistics development and the position of the respective markets in similar industries.

Just like, [7], article highlighting the link between customer retention strategies and business performance, [8], also pointed out that Customer Relationship Management (CRM) is one of the fastest-growing areas in IT, offering users the ability to understand their customers globally and prioritize them in business operations, aiming to identify the essential conditions for achieving positive business performance outcomes when implementing CRM technology.

The study, [9], examined methods for creating cost-efficient supply chains through hybrid strategies and suggests a combined manufacturing and logistics model to establish the necessary infrastructure. From another angle, [10], article describes a hybrid approach that combines various methods to assess and choose competitive suppliers within a supply chain. This method allows purchasers to consider both single and multiple sourcing options by calculating a supplier score that takes into account qualitative and quantitative factors affecting supply chain performance.

In [11], SPSS 20.0 analysis software was utilized to discover notable variances in the effects of two restrictive discount promotion strategies on customer satisfaction. Similarly, in this study, the SPSS statistical software package was selected to analyze the questionnaire responses.

2 Problem Formulation

2.1 Research Concept, Theoretical Underpinning of Empirical Research

Before going into the topic, it is worth highlighting why research is important. The results of the research can provide interesting information, especially for company managers and logistics or supply chain managers. The approach of the research topic will reveal the logistics areas of the companies, their systems, and their interrelationship with the company's performance, results, and competitiveness. We will also answer the question of whether significant differences between the logistics areas can be detected between the generally understood production sector and service providers, and whether a company characteristic can be evaluated jointly. By applying the method of analysis, we seek to find out to what extent the majority of the answers to the questionnaire are related to the performance of the companies, i.e., to what extent their logistics area contributes to the competitiveness of the company.

The models we have chosen provide relevant results supported by literature and research history, but it is important to note that we are talking about a method that is less used in practice. In his research, [12], highlights that SPSS software package users combine predictive analytics with their business knowledge to gain insights into critical customer acquisition and retention, up-selling and cross-selling, and optimization of their business processes. Liu points out that simplified, fast, and accurate statistical results are achieved through principal component regression analysis, which provides the basis for the research findings, [13].

The research was based on in-depth interviews with company managers and their questionnaire responses, and the SPSS statistical software package was chosen to analyze the questionnaire responses. Before carrying out the data analysis, it was decided to analyze the Manufacturing and Services sectors separately, and the responses from the Public Administration sector are not evaluated in this paper. Accordingly, respondents were classified into three groups, distinguishing:

1. the productive sector,
2. the services sector and
3. groups of managers representing the public sector and public administration.

2.1.1 Hypotheses

H1: There are significant differences in the quality of logistics activities between the manufacturing and service sectors.
H2: The merging of the management of logistics activities indicates a greater role for logistics within the organization.
H3: The level of quality of logistics service providers has an impact on the level of service provided by a manufacturing or trading company.
Expected results:

The study gives us an opportunity to understand the reasons for the differences between companies in supply chains and to draw conclusions. These will help us to answer the following questions:
- How important is it for companies to have a logistics area at the management level in their operations? And we will see whether there is a significant difference between the manufacturing and service sectors in this respect.
- In terms of service quality, it is not expected that there will be any relevant differences between sectors, as everyone needs to ensure maximum quality as part of the supply chains.
- In terms of the market position of companies, we expect that those companies for which logistics is an important and prominent part of their operations, logistics contributes to competitiveness, as evidenced by the company's results.

2.2 The Supply Chain, the Chain of Material Flows in Companies

For this research, it is important to understand how the supply chain works to understand the situation of companies in the sectors under study, based on the following factors:
- Competitiveness dimensions
- The importance of logistics in the company
- Quality of service
- Strength of market role

As supply chain companies contribute to a large extent to meeting the expectations of consumers, supply chain actors jointly achieve the final output, i.e., jointly contribute to meeting the needs of the customer. Within supply networks, it is not a question of competition between one or more companies engaged in similar activities. Supply chains, supply networks compete, and new supply chains are created alongside them. These processes and changes have been analyzed by several domestic, [14], and international, [15], [16], [17], [18], studies, and it has been found that the actors, together, are the performance of the supply chain. In addition to all this, lead firms and their global supply chains compete with each other, [19], strengthening their competitiveness through globalization, further increasing the expectation of superior performance, in order to achieve good service quality. The majority of the companies involved are experiencing the integration effect, or 'internationalization', as most of their suppliers or customers are abroad. The International Monetary Fund (IMF) defines economic globalization as a historical process of innovation and technological development. It mainly refers to the movement of goods, services, and capital across borders, [20]. The study, [21], also find that the Hungarian "Generation X" and "Generation Y" explicitly prefer the development of digital logistics services to speed up processes, which will keep pace with globalization and improve the competitiveness of the company.

Not only the companies participating in the research, but all market players can compete with large companies through their service quality, flexibility, and efficiently and economically operated processes. Logistics service quality is a part of the services closely related to the products sold, which logistics "produces". The customer can directly perceive and evaluate the seller's logistics performance through the logistics service level, [22]. Complete industries have been created to ensure the continuity of production and service, despite space and time constraints. The most important area is logistics, which is a micro-economic approach to the four value drivers of product value. However, the subject is not only addressed by supply chain experts, but also receives important attention in related functional areas, such as marketing or finance. This topic is also elaborated on [23] in their research paper "Advertising and quality improving strategies in a supply chain when facing potential crises",. The retail sector is one of the most important actors in the supply chain, as it is the starting point of the "Whiplash effect", which causes one of the biggest inventory problems in the supply chain, tying up capital and resources. This is mentioned in [24] in his manuscript "The Bullwhip Effect in Rule-Based Supply Chain Planning Systems: case-based simulation at a hard good retailer",. The relationship between competitiveness and supply chain is elaborated by several international researchers, e.g.,

[25], [26], [27], [28], among others, without using statistical data analysis. So, there is a lot of work on understanding and further enhancing the success of companies, but the data analysis method is not or very rarely used.

2.3 Professional Dimensions

The research and its results show that in practice, there is no method of analysis that looks at companies in context. The results of the study shed light on aspects of the profession that are hitherto unknown phenomena, a new tool and opportunity for practice that could change the way logistics researchers and practitioners think about logistics to a great extent. The research does not present a new method, but draws attention to the use of a less-known and less-applied, but explicitly results-oriented tool. Of course, this research topic is not company-specific but presents supply chain relationships based on real company information, but the general results of the method reveal industry-independent relationships. The result and necessity of the research, as well as its approach, are of key importance, as market restructuring, changes in the global market situation, and the need for accelerated responsiveness driven by digitalization can serve as tools for market adaptation and maintaining competitiveness. The relevance of applying this methodology was already emphasized in [29], who regarded it as a critical factor in analyzing supply chain processes, their inherent volatility, and the transformative shifts occurring in logistics services. The study, [30], further underscores the significance of selecting an appropriate research approach - particularly in contexts involving inter-organizational collaboration, cost structures, cost modeling, and the comprehensive analysis of numerical comparative data. The utilization of mathematical models contributes to the continuous evolution of material flows between enterprises, the management of inventory levels across the supply chain, and the optimization of tied-up capital and corporate performance. Moreover, the implementation of advanced mathematical techniques and statistical data analysis methods facilitates operational efficiency and supports the ongoing development of supply chains, [31], [32]. Consequently, the selected methodology provides a robust foundation for generating realistic outcomes and well-substantiated decision-making scenarios.

3 Methodology

It is important to understand the relationships between the information gathered in the research, which can then be used as a basis for future decisions that affect the operation of the company. The answers to the questionnaire should therefore not be interpreted in isolation, although they may individually shed light on differences in the market situation of companies. The results of the analyses carried out on the basis of the questionnaire survey data shed light on the reasons why the situation and market position of individual companies differ, and on the characteristics that give them the advantages. The data were statistically processed using the IBM SPSS Statistics software package. The significance level used is 5%.

In the course of the study, we aim to draw conclusions by exploring associative relationships and to explain to the companies participating in the research how the differences identified affect their market position. At the same time, we aim to highlight characteristics that help companies to achieve market leadership, with a focus on logistics as a key factor for success.

In designing this study, our primary objective was to adopt a methodological framework that supports the generation of objective, generalizable results and provides practically applicable, decision-supportive insights. After evaluating several alternatives, we opted for a quantitative research methodology, implemented through the use of the SPSS statistical analysis software.

Quantitative research enables the formulation of findings that are highly likely to apply not only to the sample but to the entire target population, thereby ensuring a high degree of generalizability. Emphasizing standardized measurements minimizes subjectivity and reduces the risk of bias, while also facilitating the identification of cause-and-effect relationships. Furthermore, the numerical nature of the data supports precise comparisons and enhances interpretability.

The diversity of the industry participants involved in this research - ranging in size, capital strength, workforce, and supply chain role - justified the selection of this method and the associated analytical tool (SPSS). These differences among the companies also reflect the diversity of the variables used in the analysis, both in type and in behavior.

The analytical process included the identification of principal components and the application of factor analysis. Based on these outputs, a cluster analysis was performed to reveal distinct characteristics of the participating companies' logistics systems. To further explore behavioral patterns and

relationships, a cross-tabulation method was applied to interpret the results of the correlation analysis, which made it possible to highlight variations in corporate behavior across the sample.

The quantified results gave a chance to formulate clear, evidence-based statements, relationships, and conclusions. These findings not only identify common challenges but also support practical recommendations aimed at improving competitiveness indicators derived from operational differences. This directly aligns with the central aim of our research.

Ultimately, this combination of methodology served as a strategic tool for achieving our primary objective: uncovering the competitiveness factors that differentiate industries and individual companies within them.

Statistical data analysis and competitiveness have long been a research focus. In the priority areas of our time, the Hungarian research elite also sees the link between data analysis and competitiveness as a potential opportunity. [29] have drawn attention to this in their book titled "Competitiveness: new theoretical and methodological approaches",. The examination of the interrelationships between corporate operations and the practical application of new processes based on the opportunities that emerge also has an impact on employee satisfaction. Employee satisfaction, indirectly through a collaborative management environment, is also a competitiveness factor. Statistical data analysis, as a method, also provides an opportunity to assess manager-employee relationships, highlighting critical points of corporate cooperation, which has been elaborated on in this topic in [30]. The impact of production conditions on efficiency has been studied by several researchers, [31], as efficiency supports the success of the company.

4 Results

The research concept, the impact of company logistics systems and their correlations on company performance, results, competitiveness, and whether there is a significant difference between manufacturing and service sectors in terms of their logistics activities, is based on the premise that manufacturing and service sectors should be analyzed separately, and therefore, the results and their conclusions should be evaluated independently.

Analysis of companies in the manufacturing sector:

Of the companies that completed the questionnaire, 122 belong to the manufacturing sector. Therefore, it can be said that the data collected and evaluated show relevant information, and the results obtained allow us to draw a general conclusion.

The first step in data analysis is to carry out a factor analysis. Step 2 of running the SPSS statistical data analysis software was to produce an A-matrix table of Principal Component Weights, which yielded the results shown in Table 1.

Table 1. A matrix of weights for the productive sector Principal component

Rotated Component Matrix				
	Components			
	Competitiveness dimension	Importance of logistics	Service quality	Market power
Turnover as a percentage of capital	0,746			
Supply chain participation as a factor for business growth	0,737			
Quality of logistics services	0,665			
Consolidation of logistics activities at organisational level		0,875		
Do logistics activities appear at a higher level in the company hierarchy?		0,841		
The on-time delivery of promised deliveries			0,868	
The accuracy of promised deliveries in terms of quantity			0,844	
Product and/or service quality compared to competitors				0,827
Market share (based on turnover)				0,800
KMO=0,620, Bartlett's test: Chi2=197,708, p<0,001, explained variance=70,61%				

Source: own research

As an explanation of the principal components, it can be seen that each variable was constructed in this way based on the questions in the questionnaire:
Competitiveness factors:
- Turnover as a percentage of capital
- Supply chain participation as a factor for business growth
- Quality of logistics services

The principal component coordinates show a strong unidirectional relationship between the criteria.
The importance of logistics:
- Consolidation of logistics activities at the organizational level
- Do logistics activities appear at a higher level in the company hierarchy?

The principal component coordinate values also show a strong unidirectional relationship.
Service quality:
- The on-time delivery of promised deliveries
- The accuracy of promised deliveries in terms of quantity

Market power:
- Product and/or service quality compared to competitors
- Market share (based on turnover)

KMO indicator, Bartlett test:
To carry out the test, a set of criteria should be established, based on the questionnaire. The answers

given by the managers of the companies, evaluated on a Likert scale, and their variance, determined which and how much principal component is formed based on the values of the variables. Running the test resulted in the values in the last row of the A matrix of the table of Principal Component Weights, with an explained variance level of 70.61%.

Analysis of companies in the services sector:
83 companies are classified in the services sector. It is the same as the manufacturing sector, but the differences in their activities require the analysis of other criteria.

As shown in Table 2, the following 3 principal components are included in the matrix:
- Quality of logistics services
- Competitiveness
- The importance of logistics

Table 2. A matrix of principal component weights for the services sector

Rotated Component Matrix			
	Components		
	Quality of logistics services	Competitiveness	The importance of logistics
The on-time delivery of promised deliveries	0,876		
The accuracy of promised deliveries in terms of quantity	0,865		
Account accuracy	0,808		
Quality of logistics services	0,791		
Turnover as a percentage of capital		0,832	
Profit on turnover		0,767	
Product and/or service quality compared to competitors		0,749	
Market share (based on turnover)		0,560	
Do logistics activities appear at a higher level in the company hierarchy?			0,896
Consolidation of logistics activities at organisational level			0,832
KMO=0.712, Bartlett's test: Chi2=334.092, p<0.001, explained variance=69.62%			

Source: own research

KMO indicator, Bartlett test: running the test resulted in the values in the last row of the A matrix of the Principal Component Weights table, which was 69.62% explained variance.

Compared to the manufacturing sector, three main components have been created for service companies. A unidirectional relationship between the variables of the principal components is observed, and a strong correlation is observed in all three cases.

4.1 Comparison of the Manufacturing and Services Sectors

The sectors were compared on the basis of cluster analysis. It is important to note that after running several variants, I concluded that three cluster analyses should be distinguished for both sectors.
As a first step, I carried out a cluster analysis of the Production Sector. Based on the parameters provided, the 122 companies mentioned above were included in the analysis, and the run gave the results shown in Table 3.

Table 3. Analysis of the productive sector cluster

Initial Cluster Centres			
	Cluster 1	Cluster 2	Cluster 3
Quality of logistics services	0,87600	-3,88726	0,64844
Competitiveness	-3,93364	-2,00920	1,51533
The importance of logistics	0,75662	-0,82899	0,17506

Source: own research

The interpretation of clusters in the form of diagrams is more visual and comparable for better clarity, so the interpretation of Table 5 and Figure 1 together shows the typical differences between service providers within the sector.

The cluster analysis can be evaluated on the basis of the dimensions examined if a value around 0 is taken as average, close to the main average, but, e.g., -0.4 means a low, i.e., non-competitive value.

The clusters can be separated along the professional dimensions examined, but it is not possible to clearly identify which enterprises belong to which cluster. Conclusions must be drawn by taking into account the characteristics of the companies in the clusters, e.g., cluster 1 is average in terms of competitiveness, very strong in terms of logistics, average in terms of service quality, and poor in terms of market role strength. The companies in the second cluster scored around average on the competitiveness dimension, strong on the logistics importance dimension, markedly weak on the service quality dimension, and very strong on the market role strength dimension. The companies in the third sector are strong in terms of service quality, but poor in the other 3 factors.

Based on the characterization, each cluster should be given a short name, but the results do not provide a clear way to do this.

It can be concluded that, based on the analysis of the clusters, there is no significant difference between the companies in clusters 1 and 2 in terms of logistics and competitiveness dimensions, but compared to the companies in cluster 3, the companies in these clusters are more efficient and more developed in terms of their logistics development.
The graphical representation in Figure 1 explains this visually.

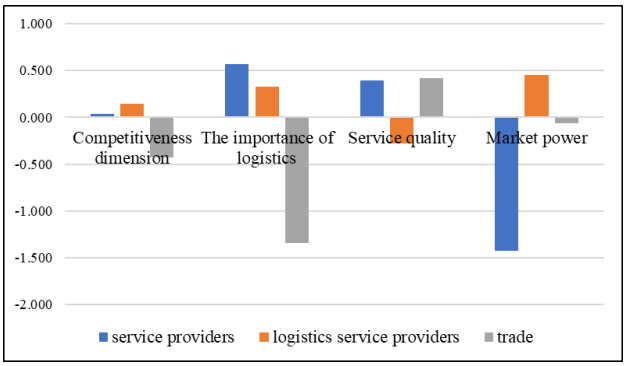

Fig. 1: Cluster analysis of the productive sector plotted on a graph
Source: own research

The next step is to carry out a cluster analysis of the service sector. 83 companies were included in the analysis, and the results are shown in Table 4.

Table 4. Cluster analysis of the services sector

Final Cluster Centres			
	Cluster 1	Cluster 2	Cluster 3
Competitiveness dimension	0,038	0,145	-0,425
The importance of logistics	0,566	0,326	-1,342
Service quality	0,397	-0,276	0,422
Strength of market role	-1,423	0,452	-0,061

Source: own research

The cluster analysis was based on 3 dimensions. The companies in cluster 1 are particularly strong in terms of quality of logistics services, very weak in terms of competitiveness, and strong in terms of the importance of logistics. Cluster 2 companies perform poorly in all dimensions, while cluster 3 companies have strong characteristics in all dimensions.

As with the producer sector, I have prepared a graphical representation for the service sector, as shown in Figure 2.

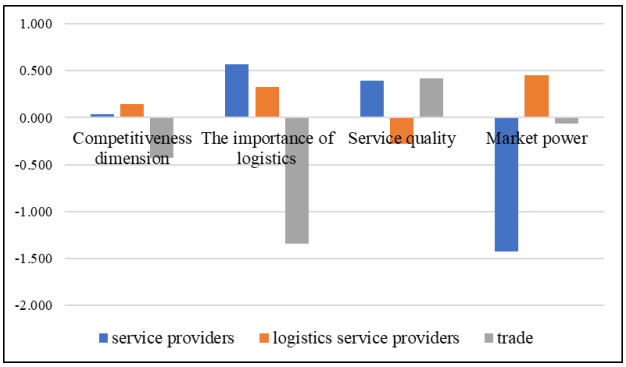

Fig. 2: Cluster analysis of the services sector, plotted on a graph
Source: own research

For the services sector, there is no significant difference in the proportions between clusters. It is not clear which enterprises are in the majority in each cluster.

4.2 Examination by Size Category

Since the clusters cannot be clearly identified, cannot be clearly named by their characteristics, and we do not know exactly which companies are in each cluster in terms of their composition, I wanted to test the hypothesis that the companies in the clusters, in terms of size (number of employees), could be categorized.

The size categories are set up as follows:
- 0-49 persons employed
- 50-249 persons employed
- more than 249 people employed

I also identify these categories as micro and small enterprises (0-49 persons), medium-sized enterprises SME (50-249 persons), and large enterprises (more than 249 persons). If the categories match the clusters, the following statements are also confirmed:
- The size of companies is proportional to their logistical development
- The size of companies is proportional to their market position

I chose the tool of cross-tabulation analysis to establish the size categories and to verify the relationships. Since respondents provided employment data for 2013 and 2016, both years are analyzed.

For the first time, this analysis was also based on the results of the questionnaire for the producer sector. The analysis for 2013 is shown in Table 5.

Table 5. Cross-tabular analysis of the productive sector, for 2013

Crosstab						
			Cluster Numbers			Total
			1	2	3	
Size category	0-49 participants	Count	7	10	19	36
		% within size category	19,4%	27,8%	52,8%	100,0%
		Adjusted Residual	0,3	-4,7	5,3	
	50-249 participants	Count	8	25	5	38
		% within size category	21,1%	65,8%	13,2%	100,0%
		Adjusted Residual	0,6	0,9	-1,6	
	More than 249 participants	Count	7	38	3	48
		% within size category	14,6%	79,2%	6,3%	100,0%
		Adjusted Residual	-0,8	3,5	-3,4	
Total		Count	22	73	27	122
		% within size category	18,0%	59,8%	22,1%	100,0%

Source: own research

The table shows that cluster 1 includes 19.4% (7 persons) of companies with 0-49 employees, 21.1% (8 persons) of companies with 50-249 employees, and 14.6% (7 persons) of companies with more than 249 employees 22 companies in total.

Among the companies in cluster 2, 27.8% of the companies are 0-49 (10 persons), 65.8% 50-249 (25 persons), and 79.2% employ more than 249 persons (38 persons). 73 companies in total.

Cluster 3 is made up of 52.8% of enterprises with 0-49 (19 persons), 13.2% of enterprises with 5 persons, and 6.3% of enterprises with more than 249 persons. A total of 27 companies.

Based on the analysis, it can be said that cluster 3 indeed includes the largest number of micro and small enterprises, but also includes the two categories with the largest number of employees. Of the micro and small enterprises, 19, 52.8% of the total number, belong to cluster 3.

The largest number of large companies in cluster 2 is 38, with more than 249 employees, accounting for 79.2% of large companies.

In cluster 1, the largest number of SMEs employing between 5 and 49 persons is represented by 8 companies, accounting for 21.1% of the total number of companies.

The study was also carried out in 2016, and the results are shown in Table 6.

Table 6. Cross-tabular analysis of the productive sector, for 2016

Crosstab						
			Cluster Numbers			Total
			1	2	3	
Size category	0-49 participants	Count	4	9	16	29
		% within size category	13,8%	31,0%	55,2%	100,0%
		Adjusted Residual	-0,7	-3,6	4,9	
	50-249 participants	Count	9	23	8	40
		% within size category	22,5%	57,5%	20,0%	100,0%
		Adjusted Residual	0,9	-0,4	-0,4	
	More than 249 participants	Count	9	41	3	53
		% within size category	17,0%	77,4%	5,7%	100,0%
		Adjusted Residual	-0,3	3,5	-3,8	
Total		Count	22	73	27	122
		% within size category	18,0%	59,8%	22,1%	100,0%

Source: own research

Comparing the data from the two years of analysis, there are no relevant differences, and the extent of the differences does not alter the conclusions drawn for 2013.

Based on these results, it can be concluded that the following companies typically form the clusters in the cluster analysis of the manufacturing sector:

- Cluster 1: medium-sized enterprises with 50-249 employees
- Cluster 2: large companies with more than 249 employees
- Cluster 3: micro and small enterprises with 0-49 employees

If we plot this on a graph, the distributions based on the 2016 results can be clearly distinguished in Figure 3.

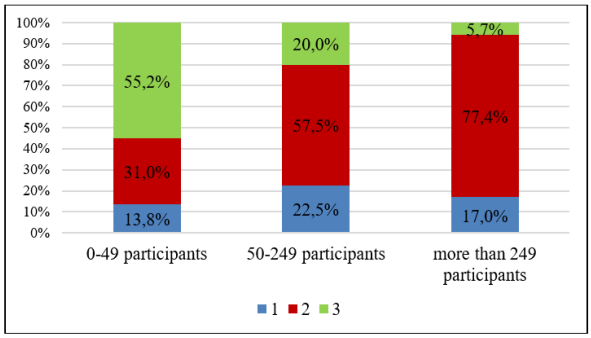

Fig. 3: Percentage distribution of the number of companies in each size category by cluster. Based on 2016 employment data for the manufacturing sector

Source: own research

The figure shows the clusters in which the majority of company sizes are located, separated by color, but it is not clear that all clusters are defined by a size group, as the largest share of clusters 2 and 3 is made up of companies with more than 249 employees.

The analysis by size category was also carried out for the services sector. The analysis of the data for 2013 is presented in Table 7.

Table 7. Cross-tabular analysis of the services sector for 2013

Crosstab						
			Cluster Numbers			Total
			1	2	3	
Size category	0-49 participants	Count	4	5	20	29
		% within size category	13,8%	17,2%	69,0%	100,0%
		Adjusted Residual	-0,1	0,1	0,0	
	50-249 participants	Count	1	3	10	14
		% within size category	7,1%	21,4%	71,4%	100,0%
		Adjusted Residual	-0,9	0,5	0,2	
	More than 249 participants	Count	7	6	27	40
		% within size category	17,5%	15,0%	67,5%	100,0%
		Adjusted Residual	0,8	-0,4	-0,2	
Total		Count	12	14	57	83
		% within size category	14,5%	16,9%	68,7%	100,0%

Source: own research

Cluster group 1 includes 4 companies from micro and small enterprises with 0-49 employees, which represents 13.8% of the total number of companies in terms of company size. Only 1 company was included in this cluster out of companies with 50-249 employees, which represents 7.1% of the total number of companies. Finally, 7 companies were included in this cluster out of the companies with more than 249 employees. This cluster was made up of 12 companies in total.

Cluster 2 includes 5 companies with 0-49 employees, which is still only 17.2% of the total number of companies. 3 companies were included in this cluster out of companies with 50-249

employees, which represents 21.4% of this company size. 6 companies with more than 249 employees were included in cluster 2, which also represents only 15% of this company size.

Cluster 3 has the highest proportion of all company sizes. Of the companies with between 0 and 49 employees, 20, representing 69% of the total number of companies. 10 companies with between 50 and 249 employees were included in this cluster, representing 71.4% of this size of company. Of the enterprises with more than 249 employees, 27 were included in this cluster, which represents 67.25% of the total number of enterprises.

It is also important to note that only 14.5% of the companies in cluster 1, 16.6% of the companies in cluster 2, and 68.7% of the companies in cluster 3 were included in cluster 1. In other words, there is no clear distinction between clusters by company size.

Companies responded to the employment data for 2016 as shown in Table 8.

Table 8. Cross-tabular analysis of the services sector, 2016

Crosstab						
			Cluster Numbers			Total
			1	2	3	
Size category	0-49 participants	Count	4	5	17	26
		% within size category	15,4%	19,2%	65,4%	100,0%
		Adjusted Residual	0,2	0,4	-0,4	
	50-249 participants	Count	1	2	10	13
		% within size category	7,7%	15,4%	76,9%	100,0%
		Adjusted Residual	-0,8	-0,2	0,7	
	More than 249 participants	Count	7	7	30	44
		% within size category	15,9%	15,9%	68,2%	100,0%
		Adjusted Residual	0,4	-0,2	-0,1	
Total		Count	12	14	57	83
		% within size category	14,5%	16,9%	68,7%	100,0%

Source: own research

Summarizing the analysis of the data for the two years, no relevant differences can be observed. To illustrate this, the graphical representation of the 2016 data for the services sector is shown in Figure 4.

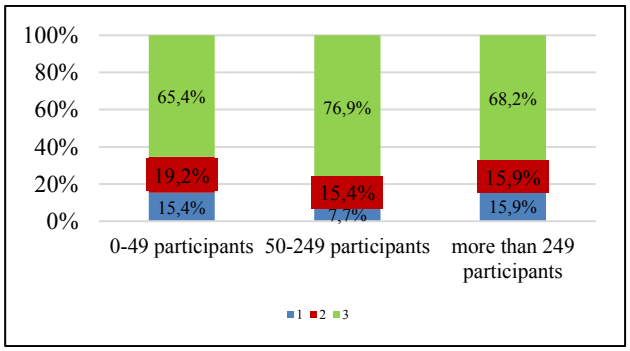

Fig. 4: Percentage distribution of the number of companies in each size category by cluster. Based on 2016 employment data for the services sector
Source: own research

5 Discussion

Our analysis highlights a well-known fact: a company's performance, market role, and position are closely linked to its level of logistical development. The results of correlations show that advanced logistics capabilities are not strictly dependent on company size, although a general trend can be observed. This is not merely a financial issue, but also a matter of belief and knowledge, rooted in the dedication of both top management and functional leaders. From the perspective of the research, this is a fundamental and particularly significant finding. The results clearly indicate that a company is more likely to achieve success if it demonstrates a high level of logistical maturity and places a strong strategic emphasis on logistics development. This insight is not only relevant from a cost-efficiency standpoint, but also because logistics performance is a critical determinant of overall competitiveness.

A firm's ability to deliver high-performing, adaptive, and cost-effective logistics solutions increasingly represents a key performance factor that directly influences its market position and long-term sustainability. It is essential to emphasize that a high level of logistical development within a company has a direct impact on both its growth and overall size. This finding reinforces our earlier conclusion and further highlights that market position and competitiveness are strongly influenced by the quality and efficiency of well-structured logistics processes.

Moreover, an important outcome of this study is the identification of a sector-specific deviation: this relationship does not hold in the same way for the service sector. This exception can be primarily attributed to the distinct strategic objectives of service-oriented companies, which differ from those of manufacturing or logistics-intensive enterprises. It can thus be stated that advanced corporate logistics is a fundamental capability for capitalizing on market opportunities. This is a critical and high-impact finding, as it underpins a company's agility in responding to its environment and its long-term viability.

Well-developed logistics not only influences a firm's position within the market and its stage in the corporate lifecycle but also has a direct effect on overall business performance. In this context, logistics becomes more than an operational function—it emerges as a strategic asset essential to sustainable growth and competitiveness. While this finding may be of lesser emphasis, it supports a well-established fact: manufacturing companies—such as automotive producers—typically operate

with a high level of logistical sophistication, whereas service-oriented firms are generally less reliant on advanced logistics capabilities. An exception, of course, is found in logistics service providers themselves, particularly in the case of third-, fourth-, or fifth-party logistics providers (3PL, 4PL, 5PL).

In developed economies, even local competition among service providers has intensified, making it increasingly evident that corporate growth, market positioning, and sustained competitiveness can only be achieved through the continuous development of logistics capabilities, including infrastructure upgrades and the expansion of logistics-related knowledge and expertise.

These insights collectively underscore the strategic importance of logistics as a driver of corporate success, while also demonstrating the nuanced differences across industry sectors that must be accounted for in competitiveness analyses.

Two other important findings are that company size is related to logistical maturity, and company size is also associated with market position—both of which influence competitiveness, costs, and profitability. A strong correlation can be observed between the size of manufacturing companies and the organizational autonomy of their logistics functions. In contrast, the same cannot be established for the service sector, and no significant differences were found between the clusters identified in that sector.

The differences between the clusters of manufacturing companies clearly indicate that logistical development and the ambition to achieve high standards play a crucial role in a company's growth potential and its ability to seize market opportunities. Therefore, even smaller companies should invest in developing their logistics capabilities, as this supports both their competitiveness and growth.

Among service companies, there are no notable differences in terms of logistics. However, based on the results from the manufacturing clusters, it is evident that advanced logistics brings competitive advantages. As such, service companies should also set logistics development as a strategic goal to improve their competitiveness, thus supporting both company growth and market positioning.

6 Conclusion

Leadership satisfaction reflects the goals set at the company level. A satisfied leader is a successful company manager who manages his or her company or functional area of the company in a successful supply chain. Success must not only be achieved, but must be appreciated and repeatedly achieved, [32].

The objective of the statistical data analysis was formulated to answer two hypotheses, namely:

- The size of companies is related to their logistical development.
- The size of companies is related to their market position.

Factor analysis provided the basis for the correlation studies, with the result (Khi-squared) predicting the expected outcome. In other words, factor analysis is relevant when there is a strong correlation between the original observation variables or between certain groups of variables. Since strong correlations were found in the studies of both sectors, we can conclude by examining the sectors separately and comparing the results.

A comparison of the two sectors is difficult to make on the basis of the analyses carried out, but some observations and conclusions can be drawn. In the case of the manufacturing sector, there is a correlation between company size and logistical development, although it cannot be stated in exact terms that companies with a high level of logistical service provision can only be large companies (more than 249 employees and an annual turnover of more than €50 million). Based on the cluster analysis, it can be concluded that a micro-sized company can be as advanced in logistics as a medium or large company that is the market leader in its segment, and it is equally true that a large company can be as "low" in logistics as a micro or medium company.

This study does not focus on the financial situation, turnover, and profit after tax of the companies, as the aim of the research is not to concentrate on the financial results, but on the assessment of the situation of logistics within the company and the resulting development. Logistics performance, however, has an impact on competitiveness, costs, profit, and the role and power in the supply chain. The manufacturing sector, therefore, shows some parallels between firm size and the functional organizational autonomy of logistics. The autonomy of the organizational units of manufacturing companies also represents the development of the know-how and the service relationship within the company, which is provided by the logistics area.

The same cannot be said of the services sector. Cross-tabulation analyses have shown the level of service or logistical development regardless of the size of the company. In any case, it should be noted

that the majority of the service companies in the study are engaged in logistics activities and, as part of the supply chain, only the maximum performance and service level can be accepted, regardless of the size of the company. This is confirmed by the cluster analysis, i.e., it can be seen that there is no significant difference in the proportions between the clusters in the service sector.

Our conclusions are confirmed by international research, including, [33], [34], [35], [36], which emphasizes the importance of the quality supply chain, stating that the content variables of quality management are customer focus, quality practices, supplier relationships, leadership, HR practices, business outcomes, and safety.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

The authors wrote, reviewed and edited the content as needed and verifies that none utilised artificial intelligence (AI) tools were used. The authors take full responsibility for the content of the publication.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Tímea Kozma conceptualised the research and integrated the results to provide the discussion.
- Marah Almelhem made the literature background research and did the edition work.
- Antal Balogh was responsible the statistical calculations and the analyses.
- Attila Kurucz supervised and summarized the paper.

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The authors have no conflicts of interest to declare that are relevant to the content of this article.