THESES OF DOCTORAL (PHD) DISSERTATION

ANTAL BALOGH

GÖDÖLLŐ

2023

HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

POSSIBLE OPTIMIZATION OF SUPPORTING BUSINESS PROCESSES IN THE SUPPLY CHAIN

Antal Balogh

Gödöllő

2023

Presented to

Institution: Doctoral School of Economic and Regional Sciences

Discipline: Management and Organizational Science

Head of Doctoral School:

Prof. Dr. Zoltán Lakner DSc

Professor / Doctor of the Hungarian Academy of Sciences
Hungarian University of Agriculture and Life Sciences
Institute of Agricultural and Food Economics

Supervisor: **Prof. Dr. Zoltán Zéman PhD**

Professor / PhD
Hungarian University of Agriculture and Life Sciences
Institute of Rural Development and Sustainable Economy

....

Approval of Head of Doctoral School Approval of Supervisor

TABLE OF CONTENTS

1. BACKGROUND AND OBJECTIVES

1.1. The background of the research

In order to reach its full competitive potential, the Hungarian SME sector must rely on its skills, capital strength and corporate relationships. Undoubtedly, closing up on the market leaders may only be achieved through continuous improvement, which inevitably requires innovation. Certainly, this is also true on the international scene, as the opportunities for small and medium-sized enterprises are always limited compared to multinational companies. Every corporation aims to be an equal player in its supply chain, to meet performance expectations and to achieve continuous long-term improvement. This can be rather challenging in crisis situations. At the same time, large companies also want to ensure that their suppliers and customers are operating at maximum performance and profitably, as their goal is to realize a stable and superior supply chain performance. The main motivation and objective is to increase turnover, maximize profits, increase market share and competitiveness, and above all this, to establish satisfied, returning and brand loyal consumer bases.

For this reason, companies are optimizing costs, improving their processes and expecting their suppliers to maximize performance. Few new solutions or management methods are emerging; we are mostly talking about fine-tuning. Today's inflation trends (2022) mean an explosion in consumer prices, with one of the main drivers being the extraordinary increase in energy costs. The shift in the demand-supply ratio is heavily influenced by the Russian-Ukrainian war, which is imposing a persistent shortage of raw materials on the market. This is reflected in the continuous, unpredictable rise in consumer prices and the aforementioned rise in energy prices, as well as dramatic increases in food prices around the world, such as corn up by 14.66%, soybeans up by 8.91% and wheat up by 24.53% (NASIR, et al. 2022). In the ongoing competition for consumers, companies face new challenges. Through personal experience – based on conversations with business leaders, supply chain and logistics professionals – an important observation was formulated. When companies gain market share and want to increase it to meet the expectations of their owners and customers, they

almost always see the way forward within the company's own framework. Yet, consumers or end users usually buy products or services that are end products of a whole supply chain. The development of the company may not in itself lead to significant performance improvements in the supply chain, so such objectives require performance-enhancing opportunities beyond the company's framework, or better, more extensive and closer collaboration.

Improving the performance of supply chains and the competitiveness of the involved companies is a topical concern. Today we solve a problem; tomorrow we face a new challenge. But the goal is always the same – to increase efficiency and performance, while keeping costs at the same level or reducing them where possible.

1.2. Objectives

As a first step, the aims and objectives of the research are established, enabling the formulation of the research question. This research question is addressed via detailed presentation of related research findings in the literature and using a qualitative research method, the results of which provide an opportunity to formulate hypotheses and then conduct a quantitative research.

Aims

- To explore a new approach and new corporate governance method, which involves sharing controlling data related to company logistics and the alignment of processes between collaborating companies, creating a "process chain" between companies that cooperate at a higher level – based on the interdependence and interconnection of the companies' logistics processes – thus increasing company and supply chain performance, while directly enhancing service quality and indirectly increasing customer satisfaction.

- To raise awareness among researchers and companies to the benefits of higher level collaboration both for the enterprise and the supply chain – which also impacts inventories and may mitigate the bullwhip effect – and to determine the role of shared logistics

controlling data, information and metrics between companies, which impacts company-to-company processes.

- To achieve consistent performance from all actors via the development of controlling data-driven enterprise collaboration – or process chain – ultimately maintaining predictable and reliable performance throughout the supply chain, which results from this higher level of collaboration. Also, to reduce supplier uncertainty and risk among companies using the process chain while, in the case of any arising uncertainty, to provide sufficient reaction time for dealing with such uncertainties.

- To emphasize the role of the company's controlling function and the importance of its link to logistics, which can contribute to a consistent performance not only for the company but also for the supply chain, through information provided by appropriate and uniform reporting systems. To provide a basis for a system of metrics provided by the cooperating companies, which would grant both suppliers and customers adequate information on the company's logistics performance over a given period.

2. MATERIALS AND METHODOLOGY

2.1. The research workflow

My research focuses on two important areas. One element is the research results and findings specifically describing the functioning of supply chains and the relationships between cooperating companies, as cited in secondary sources and literature. I consider it very important to illustrate where the level of cooperation between companies started from and where it is today; then I go on to supplement the literature with the results of primary research and the presentation of cooperation methods implemented and applied in practice.

The primary research consists of two parts. Both are instrumental for the outcome of the research, as I first apply a qualitative research method, whereby I learn about and present the methods and procedures used by companies via a semi-structured interview, complemented by the insights from conversations with acknowledged professionals. This will be followed by quantitative research, which is based on a questionnaire survey of professional staff, company managers and managers of Supply Chain – Logistics areas.

The main elements of the research workflow are:

- qualitative research to establish the research problem and hypotheses; then
- quantitative research using a questionnaire and processing the results related to the assumptions verified by the qualitative research.

2.2. Research data and methodology

2.2.1. Qualitative research

The qualitative research was carried out as described above, at five selected companies, formulating the findings mainly in a descriptive, case study format. Most qualitative organizational research uses this format (BRYMAN, 1992). Qualitative research is based on a small sample (VERES

et al., 2006). In qualitative research, several sampling principles may be considered, and the one that most efficiently supports the research objective is selected. In my research, one of the most common methods of focusing on the observed phenomenon or context is selected, which is also underlined by Bokor (1999) as a key principle.

Central research question, sub-questions, (basic hypothesis):

- The central question is whether it is possible to design a process chain that is beneficial both from the aspect of physical and administrative tasks by integrating administrative tasks into the process.
    - In addition to the administrative tasks related to inbound and outbound delivery, can the continuous reporting system of the controlling function be integrated to support the day-to-day work of those involved in the material processes?
    - Can the administrative tasks of the procurement function related to material flow take into account the changes in overall process optimization? (E.g. by scheduling the arrival of goods and optimizing stock levels)
    - Is process integration also an opportunity for resource optimization?

Definition of the research method:

The primary research is based on a semi-structured interview with the administrative/managerial staff responsible for material flow at the selected companies. The idea of the semi-structured interview is that, in addition to the predetermined questions, the subject's substantive contributions shape the conversation throughout the interview.

Sampling plan:

The sampling – for the qualitative research – was carried out on the premises of the selected companies, via quasi-informal conversations with the warehouse managers, and then it was extended to include interviews with administrative staff in the warehouse offices. The subjects did not

encompass the entire administrative staff in these areas, but the experience and insights of those who had been working in these positions for a longer period of time were important and relevant. As the research continued, the sampling was extended to a further group of people working in the areas covered by the sub-hypotheses and sub-questions – the manual workers – who expressed similar experiences and observations. They uniformly described problems in a different way, for example not understanding why in certain situations it is so cumbersome to execute a process, why the information from suppliers on the receipt of goods is so hectic, or why goods arriving at warehouses cannot be managed according to a set standard. These short conversations confirmed the perceptions of those taking part in the semi-structured interviews, so the picture that emerged from the additional exchanges greatly contributed to the formulation of the outline and key questions of the questionnaire. The demonstration study pointed out several problems, making it possible to extend the sampling and refine the hypotheses.

2.2.2. Quantitative research

The quantitative research was designed based on the responses received during the qualitative research by supplementing its findings to form a questionnaire. The scope of the questionnaire extends to supply chain and in-house processes, as well as their interdependence. The questionnaire is mainly concerned with material processes and related administrative "support" tasks, including electronic data exchange processes and the link with the controlling function.

The questionnaire was sent out to functional or executive managers of about 1300 companies in electronic form. It was accessed by respondents via the Limesurvey online platform. The questionnaire was distributed to the relevant persons through my own network – the NLV KLUB (Club of Logistics Directors) – and the professional network of logistics organizations. In addition, the questionnaire was sent to MSc students in Supply Chain/Logistics at several universities, who had the questionnaire completed by a logistics manager at the company where they spent their internships. Relying on the cooperation of a sufficient number of

internationally prominent companies and the large number of responses received through other channels, a significant number of questionnaires suitable for assessment were completed. The questionnaires were processed and analyzed using the data analysis software SPSS. Correlation analyses (e.g. factor analysis, etc.) were carried out based on the data analysis manual by Sajtos – Mitev (2007), as the evaluation of the results predicted the expected positive outcome. The findings are only relevant if there is a strong correlation between the original observed variables or between certain groups of variables (SAJTOS-MITEV, 2007).

Looking at the key periods of our era, the Hungarian research elite also saw an opportunity in exploring the link between data analysis and competitiveness. CSATH, et al. (2020) wrote a book on the topic titled *Versenyképesség: új elméleti és módszertani közelítések* [Competitiveness: New Theoretical and Methodological Approaches]. Competitiveness and the relationship between members of the supply chain have been studied by a number of international researchers, including XIU - ZHEN (2020), SHEETAL, et al. (2020), and AILING, et al. (2020), without applying statistical data analysis methods. The method of statistical data analysis also provides an opportunity to assess management-employee relations, highlighting the critical areas of corporate cooperation, which is explored in this context by BORISOV and VINOGRADOV (2019). Many researchers are interested in understanding the success of companies and the possibilities for improvement, but they rarely or not at all use data analysis. This is why I find it important to use this method, which I consider to be an accessible and essential analytical tool for companies to apply in practice.

In the quantitative research, I employ analysis of variance, factor analysis, cluster analysis, cross-tabulation, discriminant analysis, and path models and I perform the calculations with the software IBM SPSS v27 based on the recommendations of the relevant literature (JÁNOSA, 2015; MORGAN, et al. 2011, SAJTOS - MITEV, 2007; SZÉKELYI - BARNA, 2004; WAGNER, 2013).

3. RESULTS AND DISCUSSION

3.1. Hypothesis H1

A higher degree of interdependency between the processes of cooperating companies increases service quality and supply chain performance.

3.1.1. Objective

O1

To explore a new approach and new corporate governance method, which involves sharing controlling data related to company logistics and the alignment of processes between collaborating companies, creating a "process chain" between companies that cooperate at a higher level, thus increasing company and supply chain performance, while directly enhancing service quality and indirectly increasing customer satisfaction.

3.1.2. Hypothesis verification method

Primary research, processing of questionnaire survey responses. Analysis of variance→ hypothesis is acceptable if $p<0.05$.

3.1.3. Hypothesis verification

The testing of the hypothesis requires generating a variable based on the following question:

- Does your company have access to the outputs of your partners' logistics controlling reports related to material flow?

Based on the responses to the questionnaire, it can be stated that companies have access to supplier material flow controlling reports at the highest proportion, but it is also important to highlight that 43% of the responding companies have access to customer or supplier logistics controlling outputs. When the answers to the questions are segmented by the industry sectors of the supply chain companies, the wholesale sector has a higher proportion of insight into the customer logistics controlling reports, while the

manufacturing/production sector has a higher proportion of insight into the supplier logistics controlling reports. An important finding related to the research is that 54% of manufacturing/producing companies are given access to supplier and/or customer logistics controlling results. But it is not surprising either that a certain number of logistics service providers (24%) also have access to the controlling reports of companies they work with.

According to the results of the analysis of variance (F-test), there are considerable differences for all observed variables based on the access to the partners' controlling reports. The results are shown in Table 1.

Table 1: F-test, result of access to partners' controlling reports

	Does your company have access to the outputs of your partners' logistics controlling reports related to material flow?				F	Sig.
	no	only for suppliers	only for customers	yes, both for customers and suppliers		
our aim is to maximize the satisfaction of the end consumer (even if the company is located far away from the consumer in the supply chain)	4.573	4.777	4.758	4.441	4.155	.006
the company receives information on the results of supplier and customer logistics controlling reports related to the material flow	1.975	2.543	2.161	3.492	52.497	.000
the company informs its suppliers and customers about changes in the company's performance	2.801	3.319	2.774	3.542	18.122	.000
the company's logistics system and the supplier logistics systems are coordinated	3.659	4.287	3.855	3.890	9.689	.000
we take into account customer expectations and considerations	4.105	4.447	4.161	4.322	4.686	.003
the company enhances the performance of its supply chain with maximum output performance	3.753	4.223	3.677	4.008	10.078	.000
the company is informed about changes in the performance of other actors in the supply chain	2.859	3.426	3.097	3.763	26.414	.000

Source: SPSS data analysis

The companies involved in the research demonstrate an ambition to meet end consumer needs at a high level and see the potential for higher corporate performance, but the responses suggest that improvement is necessary in the

field of information exchange and communication. For most metrics, companies with full access to their partners' logistics controlling reports (both on the customer and supplier side) scored higher on average. Companies that do not have access to such analyses and results consistently achieved lower averages (except for maximizing customer satisfaction).

Based on the above results, the following **thesis** can be formulated for hypothesis H1:

In the supply chain, a higher degree of process interdependence between companies that exchange information, in particular the results of logistics controlling reports, increases service quality and supply chain performance, giving them a competitive advantage over companies that do not have access to such information.
This is particularly true if the company:
- **receives information on the relevant results of supplier and customer logistics controlling reports related to the material flow**
- **informs its suppliers and customers about changes in the company's performance**
- **coordinates its logistics system with the supplier's logistics system**
- **takes into account customer expectations and considerations**
- **enhances the performance of its supply chain with maximum output performance**
- **is informed about changes in the performance of other actors in the supply chain**

3.2. Hypothesis H2

By exchanging logistics controlling data, the linking of customer and supplier processes has an impact on optimal production, reducing inventory in the supply chain, as well as the bullwhip effect, the supplier risk and uncertainty, while increasing customer predictability.

3.2.1. Objective

C2

To raise awareness among researchers and companies to the benefits of higher level collaboration both for the enterprise and the supply chain – which also impacts inventories and may mitigate the bullwhip effect – and to determine the role of shared logistics controlling data, information and metrics between companies, which impacts company-to-company processes.

3.2.2. Hypothesis verification method

Primary research, processing of questionnaire survey responses, with practical application of process management. Analysis of variance→ hypothesis is acceptable if $p<0.05$.

3.2.3. Hypothesis verification

For the analysis of variance (F-test), considerable differences can be detected here as well regarding the observed variable. The results are shown in Table 2. Three groups of the observed variables can be identified, according to their average values in each information sharing category.

1. Where there is no information sharing within the supply chain, or where only customers have access to information, the average values of the variables are significantly lower.
2. Where there is any kind of information sharing, the average values of the variables are significantly higher, regardless of its direction.
3. Minimal (albeit significant at $p=0.006$) variation in the averages of the metrics across the observed categories.
    a. VEVŐK_22: our aim is to maximize the satisfaction of the end consumer (even if the company is located far away from the consumer in the supply chain)

Table 2: F-test, level of partnership

	Does your company have access to the outputs of your partners' logistics controlling reports related to material flow?					
	no	only for suppliers	only for customers	yes, both for customers and suppliers	F	Sig.
we have alternative solutions to deal with supplier uncertainty	3.108	3.096	3.032	3.788	13.609	0.000
our aim is to maximize the satisfaction of the end consumer (even if the company is located far away from the consumer in the supply chain)	4.573	4.777	4.758	4.441	4.155	0.006
our company has access to suppliers' inventory information	2.690	3.500	2.823	3.610	25.348	0.000
the supplier has access to our company's inventory information relevant to them	2.978	3.904	2.516	3.720	22.861	0.000
the supplier manages the inventory related to them (VMI)	2.684	2.947	2.113	3.229	9.300	0.000
we provide inventory data to our customers on a continuous basis	3.324	4.202	4.210	3.678	17.972	0.000
the ERP system is linked to supplier and customer systems via electronic data interchange (EDI)	2.654	3.383	2.645	3.712	24.139	0.000
suppliers are regularly informed of inventory changes	2.898	3.872	2.710	3.788	26.991	0.000
we provide inventory data to our customers on a continuous basis	3.066	3.713	4.065	3.814	21.609	0.000
suppliers are involved in turnover planning	2.884	3.809	2.984	3.661	22.791	0.000
customers are involved in turnover planning	2.676	3.351	3.387	3.585	23.616	0.000
the information provided by EDI data interchange has an impact on our companies' inventory levels	2.382	3.511	2.500	3.432	29.594	0.000
our company is able to influence the supplier's production through inventory-related reports	2.640	3.766	3.032	3.669	32.867	0.000

Source: SPSS data analysis

Based on the above results, a **thesis** can be formulated for hypothesis H2:

Information sharing, in particular the sharing of logistics controlling data between collaborating companies within the supply chain, enables companies to manage supplier uncertainty and supplier risk in a timely and adequate manner, and by providing the appropriate data, they can significantly influence supplier production, thus impacting the performance and results of their supplier and their own company relative to those companies that:

- **have access only to customer information;**
- **employ a weaker ERP system;**
- **do not inform suppliers of their inventory and do not involve them in the turnover planning.**

Closer cooperation is facilitated by the transfer of information from the company to its customers and suppliers, which means passing on inventory information, informing them of any changes and involving partners in turnover planning, in addition to handing over logistics controlling data.

3.3. Hypothesis H3

Evaluating the performance information received through the customer-supplier relationships via controlling reports reveals bottlenecks, which helps to increase the efficiency of cooperation between companies. That is, if supplier and customer information is also integrated into the company's controlling reporting system, the company's output performance becomes sustainable.

3.3.1. Objective

C3

To achieve consistent performance from all actors via the development of controlling data-driven enterprise collaboration – or process chain – ultimately maintaining predictable and reliable performance throughout the supply chain. Also, to reduce supplier uncertainty and risk among companies

using the process chain while, in the case of any arising uncertainty, to provide sufficient reaction time for dealing with such uncertainties.

3.3.2. Hypothesis verification method

Primary research, processing of questionnaire survey responses, with practical application of process management. Linear regression → The hypothesis is acceptable if the explanatory power (coefficient of determination) of the regression model(s) is greater than 25%, the model is significant (F-test significance level: $p<0.05$), while only significantly aligned ($p<0.05$) variables can be accepted as explanatory variables for dependent variables, and the higher their standardized betas are, the more important role they play in explaining the dependent variable.

3.3.3. Hypothesis verification

In order to test the hypothesis, let us examine to what extent the performance factor (F_TELJ_2) (previously obtained by factor analysis) can be explained by the variables measuring the INF category included in the hypothesis. For this reason, a linear regression model was created where the dependent variable is F_TELJ_2 and the independent ones are the INF variables. This way I seek to answer the question of how information acquisition (INF variables) explains optimal performance and efficiency.
The model is significant (p=0.000) with an explanatory power of R^2=31.8%, which is relatively high for business administration models.
The standardized beta coefficients of the model are presented in Table 3, with those significantly explaining the dependent variable (F_TELJ_2) highlighted in green. It can be observed that each of the explanatory variables related to information sharing has a positive effect on the performance and efficiency of the company.

Table 3: Standardized beta coefficients of the model

	F_TELJ_2		
	Standard. Coeff. Beta	t	Sig.
(Constant)		-11.294	0.000
the company is informed about changes in the performance of other actors in the supply chain	0.231	6.704	0.007
the company informs its suppliers and customers about changes in the company's performance	0.254	7.098	0.002
the company's logistics controlling reports contain performance-related information provided by suppliers	0.142	3.203	0.001
we have alternative solutions to deal with supplier uncertainty	0.159	4.165	0.000
F			35.153
sig.			0.000
R-sq			0.318

Source: SPSS data analysis

From this, I can conclude that the performance and efficiency of companies operating within a supply chain is considerably improved if:

- the company is informed about changes in the performance of other actors in the supply chain;
- the company informs its suppliers and customers about changes in the company's performance;
- the company's logistics controlling reports contain performance-related information provided by suppliers; and/or
- the companies have alternative solutions to deal with supplier uncertainty.

Based on the above results, a **thesis** can be formulated for hypothesis H3:

Various forms of collaboration between companies within the supply chain (sharing information on performance changes, sharing logistics controlling reports, linking processes, higher level of supplier uncertainty management) definitely improves company performance and efficiency. The information supplemented by the transfer of logistics controlling data can greatly improve a company's security of supply and its ability to manage supplier uncertainty, as well as its overall performance, especially if the organization is a holding company or a concern.

3.4. Hypothesis H4

The harmonization of logistics processes provides an opportunity to establish a new approach and a new corporate governance method, resulting in a complex corporate sustainability.

3.4.1. Objective

C4

To emphasize the role of the company's controlling function and the importance of its link to logistics, which can contribute to a consistent performance not only for the company but also for the supply chain, through information provided by appropriate and uniform reporting systems. To provide a basis for a system of metrics provided by the cooperating companies, which would grant both suppliers and customers adequate information on the company's logistics performance over a given period.

3.4.2. Hypothesis verification method

Secondary research, processing and modeling of the controlling methodology for the given topic.
Linear regression → The hypothesis is acceptable if the explanatory power (coefficient of determination) of the regression model(s) is greater than 25%, the model is significant (F-test significance level: $p<0.05$), while only

significantly aligned ($p<0.05$) variables can be accepted as explanatory variables for dependent variables, and the higher their standardized betas are, the more important role they play in explaining the dependent variable.

3.4.3. Hypothesis verification

In order to test the hypothesis, let us examine to what extent the performance factors (F_TELJ_1 and F_TELJ_2) (previously obtained by factor analysis) can be explained by the variables measuring the INF category included in the hypothesis. For this reason, two linear regression models were created: for the first one, the dependent variable is F_TELJ_1 and the independent ones are the INF variables; for the second one the dependent variable is F_TELJ_2 and the independent ones are also the INF variables. Thus, via these models I seek to answer the question of how information acquisition (INF variables) explains (1) the alignment and sophistication of the given systems and (2) optimal performance and efficiency.

Both models are significant (p=0.000) with an explanatory power of (1) R^2=42.1% and (2) R^2=32.9%, which is relatively high for business administration models.

The standardized beta coefficients of the models are presented in Table 4, with those significantly explaining either of the dependent variables (F_TELJ_1 and F_TELJ_2) highlighted in green.

Table 4: Standardized beta coefficients of the models

	alignment and sophistication of the systems			optimal performance and efficiency		
	Standard. Coeff. Beta	t	Sig.	Standard. Coeff. Beta	t	Sig.
(Constant)		-14.354	0.000		-12.970	0.000
suppliers are regularly informed of inventory changes	0.049	1.112	0.266	0.164	3.446	0.001
customers are regularly informed of inventory changes	0.073	1.880	0.061	-0.051	-1.226	0.221
suppliers are involved in turnover planning	0.220	5.100	0.000	-0.069	-1.487	0.138
customers are involved in turnover planning	-0.160	-4.124	0.000	0.100	2.403	0.017
order backlog and inventory change information is shared with logistics service providers	0.098	2.232	0.026	0.001	0.025	0.980
we have alternative solutions to deal with supplier uncertainty	0.005	0.140	0.889	0.097	2.592	0.010
connecting the processes of collaborating companies also improves your company's performance	0.255	6.426	0.000	0.021	0.487	0.626
the logistics service provider is a strategic partner of the company	-0.051	-1.223	0.222	0.206	4.571	0.000
the company informs its suppliers and customers about changes in the company's performance	-0.031	-0.663	0.508	0.077	1.526	0.127
the company's logistics controlling reports contain performance-related information provided by suppliers	-0.045	-0.961	0.337	0.034	0.669	0.504
the company's short-term strategy takes into account supplier performance information	0.112	2.793	0.005	0.020	0.458	0.647
all departments are informed of the controlling reports of the company's functional areas	0.196	4.797	0.000	0.117	2.661	0.008
the company's suppliers and customers are aware of the results of the material flow controlling reports	-0.077	-1.603	0.109	-0.087	-1.681	0.093
the company receives information on the results of supplier and customer logistics controlling reports related to the material flow	-0.056	-1.166	0.244	0.081	1.575	0.116
the company shares its key metrics with its customers and suppliers	0.108	2.689	0.007	-0.024	-0.560	0.576
the company aims to use less packaging material in order to contribute to a sustainable environment	-0.003	-0.074	0.941	0.202	4.695	0.000
the use of reverse logistics as part of supplier and customer cooperation in order to recycle packaging materials	0.112	2.779	0.006	-0.120	-2.758	0.006
F			23.516			15.868
sig.			0.000			0.000
R-sq			0.421			0.329

Source: SPSS data analysis

Based on the above results, a **thesis** can be formulated for hypothesis H4:

By aligning logistics processes, complemented by the sharing of logistics controlling data, a new approach and corporate governance method can be developed to improve the company's performance and results, ensuring complex corporate sustainability.

Key factors of cooperation between companies are:

- **sharing information on performance changes;**
- **linking logistics processes; and**
- **a higher level of supplier uncertainty management skills.**

When supplier and customer information is integrated into the company's decision making, it can be stated that the output performance of the company becomes sustainable.

4. CONCLUSIONS AND RECOMMENDATIONS

Leading companies in supply chains identify technology as a key driver of competitive advantage, but most companies – especially smaller ones – want to address known issues by reducing costs and increasing efficiency. Most of these solutions provide for the companies' operations with minor setbacks, some with no change in turnover, so supply chain performance – the concept that each company has an impact on the operations of others – is currently less perceivable. The question is, how sustainable this is in the long term, and whether it is enough to keep smaller companies viable and a reliable part of their supply chains. My research presents a new alternative, a new approach and a new practical way of solving problems, regardless of the size of the company.

The leading companies of our global world are developing their own solutions and systems to achieve and maintain market leadership. When we think of a company behind a global brand, we rarely think about the suppliers, supply chains and supply networks that make it successful. Yet, without these companies they would not succeed either, and vice versa. Most companies consider their own skills to be the key to their success and high performance. As dominant companies in the supply chain, they set expectations for their suppliers, establish standards for their customers and set quality requirements. Very simply put, this is the basis of cooperation between companies; this is what makes a "LARGE" company successful. But what about smaller businesses? What about the very capable companies in the Hungarian SME sector that rarely have the chance to measure up to the world-renowned companies? How can they even play a dominant role in their supply chain? I think the results of my research also show that they do have the potential to do so. The 635 logistics and supply chain professionals who completed the questionnaire confirmed that it is possible to increase the level of cooperation between companies. 256 Manufacturers/Producers, 147 Wholesalers, 151 Logistics Service Providers and 81 Retailers participated in my research. The distribution of respondents reflects a sufficient representation and adequate proportion of supply chain actors to present relevant findings and draw conclusions. Based on the answers and their evaluation, I can definitely state that the research objectives are feasible in

practice and that the positive expectations of the responding professionals regarding the new approach could lead to its rapid dissemination. From the responses to my questionnaire, it is clear that many companies are using various methods to extend supplier and customer communication. The most advanced in this respect are Manufacturing/Producing companies, whose processes require much more sophisticated and precise coordination than those of other companies, such as logistics service providers. The additional costs caused by the energy crisis, both for the business and consumer side, are an additional burden. It is important for companies to optimize and reduce their costs, which can make it possible to maintain or lower prices for consumers, resulting in a supply chain that remains competitive and sustainable. The benefits of sharing logistics controlling data, for example increased service quality, improved company and supply chain performance, including the sustainability of competitiveness, are demonstrated by the theses formulated for each hypothesis. Hypotheses H1 and H2 were confirmed by analysis of variance (ANOVA), and hypotheses H3 and H4 were confirmed by data generated through explanations of beta coefficients in linear regression models. Based on these results, it is clear that linking the processes of cooperating companies in the supply chain and exchanging logistics controlling data between cooperating companies increases the degree of cooperation and has a positive impact on the whole supply chain, including the satisfaction of the final consumer. Research shows that the exchange of data-based information is of paramount importance. This means the regular transfer of those logistics controlling data between companies that affect their daily operations.

In addition to a high standard of satisfying consumer needs, companies consider it important to remarkably improve customer-supplier relations, because even though these partnerships, which in many cases have been maintained for decades, do evolve naturally, mostly between employees in personal contact, this is not necessary realized in the form of any benefits for the companies themselves in terms of results and performance.

4.1. Recommendations for implementation

Obviously, the first reaction to anything new is resistance, which is why we need dedicated company managers and regional logistics managers who are open and aware of the benefits of this approach for their company. This requires modeling the methodology at company level, understanding the material processes and creating controlling reports to identify weaknesses in the company's processes. On this basis, a logistics controlling reporting system should be compiled that can be used as valuable information by supplier companies. In their study, TANG and VEELENTURF (2019) note that companies involved in supply chains add value by processing information to provide timely support for strategic, tactical and operational decision making, which they can further enhance by transferring logistics controlling information, which is in the focus of my research.

The next step is for companies to align supplier output and customer input processes. These dialogues should also involve logistics service providers working as strategic partners, who explicitly requested this in the "Additional information" section of my research questionnaire. Such dialogues, like real-time decisions in logistics processes, are also supported by available technology solutions, for example by transforming data collected across the supply chain into efficient supply chain decisions (VILLALOBOS, et al. 2019).

It is advisable for the dominant company, usually a manufacturer or producer, to take the initiative in linking processes and setting up a controlling system. If applying the method is initiated by another company, the involvement of the dominant company will accelerate the improvement of supply chain performance. GELEI and KENESEI (2021) give special attention to the skills of the core enterprise, including the relationship between companies within the supply chain, in particular the establishment of supplier relationships based on an assessment of the corporate relationships, which may even mean restructuring the supplier portfolio.

As in lean management, the system should be designed with the involvement of employees, who, based on their knowledge of the daily routines, can point out realistic possibilities and raise real issues. This also provides continuous

feedback that the company can use to adjust the processes controlled by the logistics controlling data. GORECKI and PAUTSCH (2021) describe the benefits of involving employees in the processes as a factor in establishing appropriate processes. Before establishing inter-company processes, the company's internal logistics processes should also be reviewed and adapted to the common processes as necessary.

4.2. Proposal for further research on new research findings

A review of the retailers' operations based on aspects related to supply chain performance must be conducted, as the discriminant analysis and discriminant functions (F1: Optimal Inventory Management and Customer Relationships, F2: Process Improvement and Supplier Relationships) resulted in a new research finding, the SCPM matrix, according to which "*retailers neither strive to achieve optimal inventory management or high level customer relationship management, nor to achieve process improvement or high level supplier relationship management.*" The closing in of the retail sector is necessary for a consistent level of performance across the whole supply chain, so the results of the discriminant analysis lead to the conclusion that there is a huge potential in designing a system for the actors and reforming their operational activities. This area needs to be further researched and assessed in order to identify the aspects that will enable this sector, as the end point in the supply chain, to achieve the highest performance and to support the operation of the upstream actors.

The results of my research and the feedback from the companies surveyed reflect the willingness of companies to adopt and use the method, but further research is needed to develop standards for their collaborations. Central companies should be involved as contributors, who are able to formulate criteria and expectations through supplier assessments and knowing the logistics challenges, in such a way that by providing them to their customers they can create a basis for supplier-customer relations.

5. NEW SCIENTIFIC FINDINGS

In the context of my research, I have formulated the following new research findings:

1) ***"Sharing logistics controlling data increases service quality, thereby improving company and supply chain performance for Hungarian SMEs."***

2) ***"Sharing logistics controlling data has a positive impact on the performance of Hungarian SMEs if it is implemented on both the customer and supplier side. This enables companies to significantly improve their ability to manage supplier uncertainty and risk, and to influence supplier performance."*** By using this method, the cooperation between companies becomes much stronger, whereas if the company **has no influence on the supplier's production**, the supplier-customer relationship becomes unpredictable.

3) Compilation of the "***Supply Chain Position Matrix***" (for Hungarian SME companies) and definition of the criteria related to the position. The matrix places companies into four groups based on their absolute position in the plane of the discriminant functions, which my research has shown to coincide with their position in the supply chain, and hence **the absence or presence of designated characteristics defines the position of the company**. This new research finding can also visually categorize companies.

   Figure 1 provides an overview of the matrix created on the basis of the criteria and named **SCPM** – an acronym of the English designation.

Figure 1: Supply Chain Position Matrix – SCPM

6. SCIENTIFIC PUBLICATIONS RELATED TO THE TOPIC OF THE

Journal articles published

1. **BALOGH, A.** – PÓNUSZ, M. – KOZMA, T. (2019): Inverz logisztika a kibocsájtás visszaszorítása és újrahasznosítás érdekében. In: *Logisztikai Trendek és Legjobb Gyakorlatok* 5 : 1 pp. 56-60
2. KOZMA, T. – **BALOGH, A.** – LAJOS, A. (2019): A Lean koncepció szerepe egy középvállalat mindennapjaiban. In: *Studia Mundi – Economica* 6 : 2 pp. 59-71.
3. **BALOGH, A.** – GYENGE, B. – KOZMA, T. (2020): Lean koncepciójú vállalati fejlesztések tesztelése szimulációval. In: *Duleba, Szabolcs dr (szerk.) Logisztikai évkönyv 2020 Budapest, Magyarország: Magyar Logisztikai Egyesület* 208 p. pp. 106-116.
4. **BALOGH, A.** - GYENGE, B. - SZEGHEGYI, Á. – KOZMA, T. (2020): Advantages of Simulating Logistics Processes. In: *Acta Polytechnica Hungarica* 17 : 1 pp. 215-229.
5. **BALOGH, A.** – HORVÁTH, T. (2020): Középvállalati szereplő a söripar ellátási láncában. In: *Duleba, Szabolcs dr (szerk.) Logisztikai évkönyv 2020 Budapest, Magyarország: Magyar Logisztikai Egyesület* 208 p. pp. 81-91.
6. **BALOGH, A.** (2021): Logisztika a kontrolling megközelítéséből. In: Controller Info 9 : 3 pp. 7-11.
7. **BALOGH, A.** - KOZMA, T. – TÓTH, R. (2021): Logistics processes, supply chains and controlling. In: *Economics and Working Capital* 2021 : 1-2. pp. 23-27.

8. **BALOGH, A.** – SUHAJDA, Á. – SZABÓ, E. – PÉTERFI, CS. (2021): Versenyképesség az ellátási láncban, az Ipar 4.0 és a vizuális-szimuláció adta lehetőségekkel. *Controller Info* (2063-9309): 9 : 4 pp 25-28.
9. **BALOGH, A.** – ZÉMAN, Z. (2021): Kiterjesztett logisztikai kontrolling. *Logisztikai Trendek és Legjobb Gyakorlatok* (2416-0555): 7 : 2 pp 10-15.
10. SZABÓ, E. – **BALOGH, A.** – MAGDA, R. (2021): A beszerzés szerepe a versenyképességben, egy autóipari szereplő példáján keresztül. In: *Logisztikai Trendek és Legjobb Gyakorlatok* 7 : 1 pp. 31-36.

Conference publication or conference announcement

1. **BALOGH, A.** (2019): Disztribúció a kkv szektor versenyében. *Közgazdász Doktoranduszok és Kutatók V. Nemzetközi Téli Konferenciája. Gödöllő (DOSZ)*, pp 75-82.

2. **BALOGH, A.** (2020): From grain to the consumer – The supply chain of the beer industry. In: *International Conference of Economics PhD Students and Researchers in Komarno : Conference Proceedings*, Slovakia, Komarno: Janos Selye University, pp 46-52.
3. **BALOGH, A.** – LAJOS, A. – KOZMA, T. (2019): Készletek szerepe az ellátási láncban. In: *Debreceni Egyetem Műszaki Kar (szerk.) „Kihívások és tanulságok a menedzsment területén. Fókuszban a folyamatmenedzsment – az Ipar 4.0 kihívásai" = „New Trends and Challanges in Management. Special Focus on Process Management and Industry 4.0"* : Absztrakt kötet, Konferencia helye, ideje: Debrecen,

Magyarország 2019.11.07. - 2019.11.08. (Debreceni Egyetem Műszaki Kar), pp 17-17 (2019)

4. **BALOGH, A.** – LAJOS, A. – KOZMA, T. (2020): Készletek szerepe az ellátási láncban. In: *International Journal of Engineering and Management Sciences / Műszaki és Menedzsment Tudományi Közlemények* 5 : 1 pp. 515-526
5. NAGY, V. Á. – KOZMA, T. – **BALOGH, A.** (2019): Lean és a mezőgazdasági vállalatok kapcsolata. In: *Debreceni Egyetem Műszaki Kar (szerk.) „Kihívások és tanulságok a menedzsment területén. Fókuszban a folyamatmenedzsment – az Ipar 4.0 kihívásai" = „New Trends and Challanges in Management. Special Focus on Process Management and Industry 4.0"* : Absztrakt kötet Konferencia helye, ideje: Debrecen, Magyarország 2019.11.07. - 2019.11.08. (Debreceni Egyetem Műszaki Kar), pp 68-68 (2019)
6. NAGY, V. Á. – KOZMA, T. – **BALOGH, A.** (2020): Lean és a mezőgazdasági vállalatok kapcsolata. *International Journal of Engineering and Management Sciences / Műszaki és Menedzsment Tudományi Közlemények* (2498-700X): 5 : 1 pp 370-381.
7. SUHAJDA, Á. – **BALOGH, A.** (2020): The role of big data and analytics to support decision making in business. In: *Conference Proceedings of the 1st Online International Scientific Conference: Economics and Management in times of change, Gödöllő, Magyarország: Doktoranduszok Országos Szövetsége (DOSZ) (2019)* 714 p. pp. 75-82.
8. **BALOGH, A.** – SUHAJDA, Á. (2021): Regional Small and Mid-size Enterprises and the Influence of Crisis. In: *International Conference of*

Economics PhD Students and Researchers in Komarno, Slovakia, Association of Hungarian PhD and DLA Students, pp 25-32.

9. **BALOGH, A.** (2023): Kiskereskedők az ellátási láncok végpontjain. International cultural and religious tourism conference, Kodolányi János University, Budapest, 17 November, 2022.

7. BIBLIOGRAPHY

1. AILING, P. - LEI, X. - BIN, L. (2020): The impact of supply chain finance on firm cash holdings: Evidence from China. *Pacific-Basin Finance Journal*, Amsterdam, Netherlands
2. BOKOR, A. (1999): Szervezeti kultúra és tudásintegráció: a termékfejlesztés problémája. *PhD értekezés, Vezetési és Szervezési Tanszék*, BKÁE, Budapest
3. BORISOV, I. - VINOGRADOV, S. (2019): The Effect of Collaboration-Oriented Managerial Environment on Employee Job Satisfaction. *Journal of Management* 35: 2 pp. 39-48.
4. BRYMAN, A. (1992): Research methods and organization studies. *Routledge & CRC Press*, London, UK
5. CSATH, M. - FÁSI, CS. - NAGY, B. – TAKSÁS, B. - VINOGRADOV SZ. (2020): Versenyképesség: új elméleti és módszertani közelítések. Budapest, *Ludovika Egyetemi Kiadó Nonprofit Kft*. ISBN: ISBN 978-963-531-250-4
6. GELEI, A. – KENESEI, ZS. (2021): A beszállítók technológiai heterogenitásának hatása a megrendelő vállalat rövid és hosszú távú teljesítményére. *Statisztikai Szemle*, 99. évfolyam 12. szám, 1156–1184. o. DOI: 10.20311/stat2021.12.hu1156
7. GORECKI, P. – PAUTSCH, P.R. (2021): Lean management, *Carl Hanser Verlag*, München, ISBN: 978-3-446-44622-9
8. JÁNOSA, A. (2015): Adatelemzés IBM SPSS Statistics megoldások alkalmazásával. Budapest: *Magyar Könyvvizsgáló Kamara Oktatási Központ*.
9. MORGAN, G.A. - LEECH, N.L. - GLOECKNER, G.W. - BARRETT, K.C. (2011): IBM SPSS for Introductory Statistics: Use and

Interpretation (Fourth Edit). New York, USA: Routledge, *Taylor & Francis*.

10. NASIR, M.A. – NUGROHO, A.D. – LAKNER, Z. (2022): Impact of the Russian–Ukrainian Conflict on Global Food Crops. *FOODS* 11 : 19 Paper: 2979, https://doi.org/10.3390/foods11192979 Letöltés ideje: 2022. december 18.
11. SAJTOS, L. – MITEV, A. (2007): SPSS kutatási és adatelemzési kézikönyv. ISBN 978-963-9659-08-7, *Alinea Kiadó*, Budapest
12. SHEETAL, S. - RANDEEP, S. - RAJIV, K. (2020): An exploratory and quantitative assessment of the sustainable competitiveness of supply chain: Evidence from Indian sugar industry. *Journal of Public Affairs*, Chester, UK
13. SZÉKELYI, M. - BARNA, I. (2004): Túlélőkészlet az SPSS-hez. Budapest: *Typotex*.
14. TANG, C.S. - VEELENTURF, L.P. (2019): The Strategic Role of Logistics in the industry 4.0 Era. Transportation Research Part E: *Logistics and Transportation Review*, Volume 129, pp 1-11.
15. VERES, Z. – HOFFMANN, M. – KOZÁK, Á. (2006): Bevezetés a piackutatásba, *Akadémiai Kiadó*, Budapest
16. VILLALOBOS, J.R. - SOTO-SILVA, W.E. - GONZÁLEZ-ARAYA, M.C. - GONZÁLEZ– RAMIREZ, R.G. (2019): Research Directions in Technology Development to Support Real-Time Decisions of Fresh Produce Logistics: A Review and Research Agenda. *Computers and Electronics in Agriculture*, Volume 167, 105092, https://doi.org/10.1016/j.compag.2019.105092

17. WAGNER, W.E. (2013): Using IBM® SPSS® Statistics for Research Methods and Social Science Statistics (Fourth Edit). *Sage Publications*.
18. XIU, J.W. - ZHEN, M.Z. (2020): Economic impacts of ISO 14001 certification in China and the moderating role of firm size and age. *Journal of Cleaner Production*, Oxon, England