



**Szent István University  
Gödöllő  
PhD School of Management and Business Administration Sciences**

**THE EXAMINATION OF SUPPLY CHAIN  
INTEGRATION OF SMALL AND MEDIUM-SIZED  
ENTERPRISES OPERATING IN THE FOOD INDUSTRY**

**Theses of Doctoral (PhD) Dissertation**

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**Gödöllő  
2014**

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**Field of science:** Management and Business Sciences

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# 1. INTRODUCTION

In recent years, the increasingly more pronounced time-based competition has increased the significance of supply chain management (SCM) as well as that of the cooperation between companies. Companies under the pressure of time-based competition must be able to change their strategies in a flexible way (for example, according to the demands of a dominant partner), and/or to integrate and optimize their processes in new business models (along the supply chain). The significance of supply chain management is well presented by the survey of DMSCA (Diverse Manufacturing Supply Chain Alliance) in 2010, according to which costs of supply chain management depending on the sectors vary between 7% and 13% (given in percentage of the income). At the same time, in case of the best-performing companies of a given sector, these costs can be minimised between 3% and 5.5% by the proper management of supply chain processes and partnership relations. This results in a 50% cost advantage for the leading companies of the given sector over their competitors. (DMSCA, 2010)

Naturally, competition between supply chains can also be seen in the food industry I selected as the field of my investigation, having crucial influence on the operation of small and medium-sized enterprises operating in the industry. The importance of small and medium-sized enterprises in the food industry is well presented by the approximately 35-40% share of the SME sector (excluding micro-enterprises) from the whole food industry, as well as by their realized profit of 30-40% from export. (Kralovánszky, 2011). SMEs operating in the food industry have to face not only the requirements of time-based competition, but also the supply chain features of the sector (dominant retail chains, special shipment and warehousing requirements, tracking and traceability). In spite of several difficulties, operation as integrated part of supply chains in the food industry can be favourable for small and medium-sized enterprises as it may have positive effect on their technological development, organisational learning and the conditions of market access.

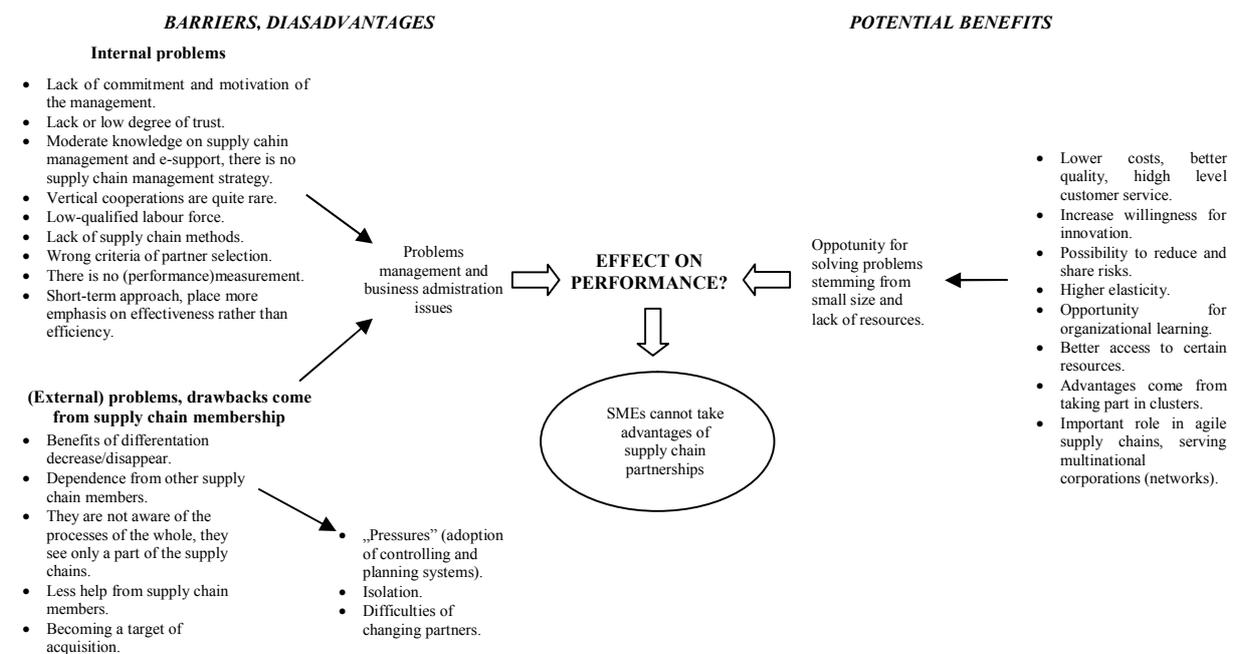
## 1.1. The purposes of the thesis

The focus of my dissertation is on the partnership relations of small and medium-sized enterprises operating in the food industry and on the factors of supply chain integration. I have set out the following objectives related thereto.

**Creating my own definition of supply chain.** Since the appearance of supply chain management as an independent discipline, several definitions have been created for the determination of supply chain. By the development and expansion of the discipline, more and more characteristics have been determined by both researchers and practical experts. For the successful preparation of my dissertation I considered the review of the most important definitions, relations, development of the discipline important. As a result of this desk research I have created my own definition of supply chain.

**Examining supply chain partnerships of small and medium-sized enterprises operating in the food industry.** The purpose of the questionnaire I prepared for the survey is to be able to characterise the supply chain relationships of small and medium-sized enterprises in food industry by using the information acquired thereby on the basis of the criteria selected by me. One of the characteristics of my survey is to review the factors of cooperation between companies on supplier and customer sides separately, thus providing an excellent opportunity to evaluate and compare supplier and customer relationships separately.

**The effect of supply chain integration on the performance of SMEs operating in the Hungarian food industry.** One of the most frequently researched areas of the discipline of supply chain management is supply chain integration, especially, the effect of the integration on company performance. The cause of giving priority to this topic, among others, was that in the competition of supply chains, the intention of optimizing internal company structures and processes is not sufficient any more, companies must form efficient partnerships with their suppliers and customers in order to achieve the highest customer satisfaction. Supply chain management causes several difficulties to the Hungarian small and medium-sized enterprises (for example, expectations of dominant partners, high costs of changing partners, etc.) at the same time, it also has more potential benefits for the participants of the SME sector (Figure 1.). In my dissertation, among others, I am seeking to ascertain whether supply chain management, strengthening supply chain partnerships, deepening supply chain integration may be some kind of tools of improving/overcoming the disadvantageous positions of small and medium-sized enterprises. In order to do this, by using part of the valuables measured in my questionnaire, I developed a so-called supply chain integration index used for measuring the rate of integration. I examined, both on supplier and on customer side, how the performance of companies operating in the food industry is influenced by the rate of integration.



Source: own construction, 2012

**Figure 1:** Relationship between SMEs and supply chain management

**The role of position in the supply chain and size class in the rate of integration.** As the classification by activities for each company, which practically identifies the position of the companies in the supply chain, was available in my research data base, I examined how their positions in the chain influence certain (soft and hard) factors of supply chain integration. For example, can it be stated regarding the examined small and medium-sized enterprises that the depth of integration increases or decreases from the upstream side of the chains towards the end customers? Although the research includes only three levels of the supply chain (producers, wholesalers, retailers), exploring possible correlations is considered a significant result and provides proper basis for defining further research purposes and for the initiation of

even more detailed examinations. In addition, I examined whether company size classes (small/medium-sized companies) have any role in the strength of partnerships established with chain members.

### **Comparison of the characteristics of partnerships of Hungarian and German SMEs.**

Further purpose of my dissertation is to compare the characteristics revealed within the range of Hungarian small and medium-sized companies operating in the food industry to the partnership features of the German (within that from Bavaria) SMEs pursuing the same business activities. On one hand it is important because it provides an opportunity to compare each supply chain integration feature, thus we can get to know where small and medium-sized companies operating in the Hungarian FMCG/Food sector are compared to the Bavarian companies. On the other hand, it may provide a benchmark for the Hungarian SMEs, in case my initial assumption that small and medium-sized companies of the German food industry are on a higher level of supply chain integration (higher level of confidence, more willingness to share information, more mature attitude towards supply chain management etc.) than the Hungarian companies.

## **1.2. The structure of the thesis**

In the first step of my review of relevant literature, I reviewed the relevance and most important Hungarian features of the examined population, small and medium-sized companies as well as that of the environment, food industry, of the review (chapter 2.1.), in order to acquire sufficient knowledge about the sector for my subsequent supply chain examinations. Then, after the review and interpretation of several definitions, I created my own supply chain management definition (chapter 2.2.2.). Stadler and Kilger (2008) collected the functional and structural criteria of supply chains for the characterization of the chains of a certain sector (chapter 2.2.3.), which I supplemented with a third group set up by the characteristics of integration (partnership relations) (chapter 2.3.2.). For the establishment of this group of characteristics, I reviewed those factors, which have a crucial role in the strength of the integration between supply chain members. I placed a special emphasis on the role of sharing information (chapter 2.3.3.) and trust (chapter 2.3.4.) in supply chain partnerships and on the effect thereof on company performance (chapter 2.3.5.), as well as on the significance of power relations between supply chain members (chapter 2.4.).

Based on previous research results I presented the potential advantages and difficulties carried by supply chain management and cooperations within chains for small and medium-sized companies and the way it influences their performance (chapter 2.5.). Subsequently, I reviewed the main features of the Hungarian food industry (chapter 2.6.1) with regards to supply chain issues. Although the range of relevant Hungarian literature is not particularly wide, I described the supply chains of the food industry by the use of these sources, based on the previously presented functional, structural and integration criteria groups set up by myself (chapter 2.6.2.).

After the review of the topics of relevant literature in relationship with my dissertation, I introduced the method of my research, which is a survey done in the range of companies from Hungary and Germany by personal interviews on questionnaires, and I also outlined the most important objectives of individual questions of my questionnaire (chapter 3.1.). I presented the steps and features of establishing company samples (Hungarian and German) and I interpreted the applied performance indicators (chapter 3.2.). In addition, I introduced my

research hypotheses (chapter 3.3.) and briefly the theoretical background of statistical methods applied later (chapter 3.4.).

Subsequently, I introduced the results received from hypothesis testing (chapter 4.), consisting on one hand of the detailed description of research results based on Hungarian samples, on the other hand of the comparisons to the conclusions drawn from the surveys in Germany. Finally, on the basis of the research results, I drew up my conclusions and suggestions.

## 2. MATERIAL AND METHOD

The research presented in my dissertation is of descriptive and analytic nature as its basic purpose is to describe the behaviour of certain companies, as well as to reveal the cause and effect relationship between the examined factors. In addition, my research is a single cross-sectional research, as I have taken sample from the population only once and information thereof provides the basis of the analysis.

### 2.1. The sample of companies

Such small and medium-sized companies may be classified into the population of the research (by which I mean companies employing minimum 10 and maximum 249 employees), which deal with the production, wholesale (463) and retail (472) of food products (10), beverages (11) and tobacco products (12) in FMCG/Food sector. In the Hungarian food industry 1.855 small- and 422 medium-sized companies operated in the year of the search of the questionnaire (2011). In the same size classes 20.000 small- and 4.800 medium-sized enterprises operated in Germany. The distribution of population (signed by grey background) based on size class and activities is presented by table 1.

**Table 1:** The number of the Hungarian and the German companies operating in the FMCG/Food sector based on size class and activities

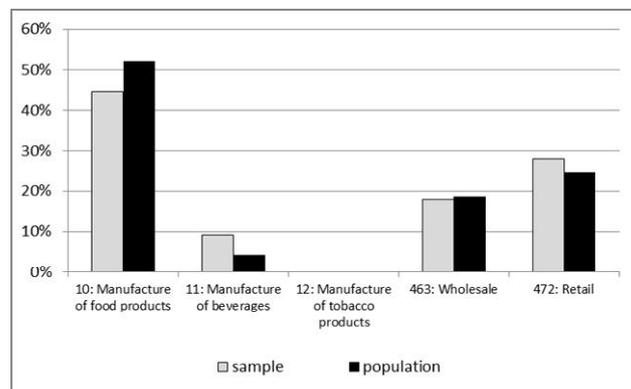
2011 Size category	Hungary					Total	Germany					Total
	10	11	12	463	472		10	11	12	463	472	
micro enterprises	3,031	2,165	0	4,317	7,206	16,719	15,884	1,157	0	9,651	33,051	59,743
small-sized enterprises	1,045	130	0	448	232	1,855	10,431	596	16	3,398	5,008	19,449
medium-sized enterprises	282	31	1	93	14	422	2,113	379	5	1006	1332	4,835
large enterprises	54	8	4	14	0	79	507	37	11	97	60	712
<b>Total</b>	<b>4,412</b>	<b>2,334</b>	<b>5</b>	<b>4,872</b>	<b>7,452</b>	<b>19,075</b>	<b>28,935</b>	<b>2,169</b>	<b>32</b>	<b>14,152</b>	<b>39,451</b>	<b>84,739</b>

Source: own collection based on Eurostat databases, 2013

The data base compiled by myself, contained slightly more than 600 Hungarian and 500 German small and medium-sized companies in food industry. The Hungarian questionnaires were filled in by personal interviews, by the help of interviewers (previously prepared students of logistics). Companies in Germany returned the questionnaires filled in via e-mail, after consultations by phone. The questionnaires were filled in by strategic leaders (mostly logistics managers and executive directors) of each company. I have found 196 Hungarian and 32 German questionnaires appropriate to be evaluated from nearly 450 questionnaires returned by Hungarian companies and 60 questionnaires returned by German companies. In accordance with this, the subsequently presented results are based on the data of 196 companies in the case of Hungarian companies (N=196) and 32 companies in the case of German SMEs (N=32).

By the comparison of the companies of the two countries I merged the two samples in order to provide comparability. I used random sampling for the development of the complete (merged) sample. I regard the composition of the sample suitable for doing my examinations as the distribution of the companies in the sample by company activities (position in the supply chain) properly represents the population, illustrated by Figure 2. The composition of the sample meets the criteria to be able to extend the conclusions I made about the integration differences of certain levels of the supply chain to the entire population.

In order to do the targeted examinations, I collected secondary data as well, calculating the performance indicators (ROE, ROA, ROS) of companies in the sample thereby. As the search (sampling) of the questionnaires was done in 2011, the sources of data used for the calculation of performance indicators were the annual reports of companies for the year 2011. Information from the balance sheets, profit and loss statements and supplementary notes of Hungarian companies was available on the electronic report portal of the Ministry of Public Administration and Justice, while in the case of the German companies it was available on the webpage of the German Ministry of Justice (Bundesministerium der Justiz, Bundesanzeiger Verlag).



Source: own construction, 2013

**Figure 2:** Distribution of the sample and the population on the basis of supply chain stages

## 2.2. Research hypotheses

During my research I formulated six hypotheses, some of which I broke down to further sub-hypotheses. The hypotheses of my dissertation mainly deal with the factors of partnerships determining supply chain integration, with the relationship between integration and profitability, and they also involve comparative research about the similarities and differences between the integration of Hungarian and German small and medium-sized enterprises. I created the first four hypotheses (H1, H2, H3 and H4) about the sample made from Hungarian companies exclusively.

My first hypothesis (H1) examines whether the operation of systems based on the pull principle, which requires close cooperation, (Vendor Managed Inventory /VMI/ and postponement) influences the performance of companies.

**H1. Those Hungarian small and medium-sized companies, which supply their customers by the application of supply chain methods based on the pull principle (VMI, postponement), operate in a more profitable way.**

*H1.1. Those Hungarian small and medium-sized companies in food industry, which manage the inventories of their customers themselves (application of VMI), operate in a more profitable way.*

*H1.2. Those Hungarian small and medium-sized companies, which supply their customers by the application of postponement, operate in a more profitable way.*

The second hypothesis (H2) of the dissertation examines the relationship between the degree of integration between the supply chain members and the performance of the examined companies operating in the food industry. A more detailed presentation of the supply chain integration indicator developed to measure the degree of integration (hereinafter SCI index) is contained by the chapter entitled 'Results'.

**H2. Those SMEs operating in the food industry, which established stronger integration with their supply chain partners, have higher profitability ratios.**

*H2.1. Those SMEs operating in the food industry, which established a higher degree of integration with their suppliers, have higher profitability ratios.*

*H2.2. Those SMEs operating in the food industry, which established higher degree of integration with their customers, have higher profitability ratios.*

The research objectives of the dissertation included the examination whether the company size (small/medium-sized company) and/or the position in the supply chain (proximity to the customer, to the source of information on demand) influences the degree of integration. In the research the position of small and medium-sized companies in the supply chain is identified by their TEÁOR numbers (food producers, producers of beverages, retailers and wholesalers).

**H3. Small and medium-sized companies establish stronger cooperation both with their suppliers and buyers.**

**H4. As we approach customers in the supply chain, the combined integration index decreases.**

The next two hypotheses (H5, H6) already focus on the comparison of the integration features of Hungarian and German small and medium-sized enterprises. The fifth hypothesis (H5) concentrates on trust, one of the most important soft factors of interorganizational cooperations, in order to reveal differences between Hungarian and German companies. For the measurement of trust the possibility of comparison between the companies of the two countries is provided by a so-called trust indicator developed by involving more variables.

**H5. German small and medium-sized companies show a higher degree of trust in their supply chain partners than Hungarian small and medium-sized companies.**

*H5.1. German small and medium-sized companies operating in the food industry have more trust in their suppliers than Hungarian small and medium-sized companies.*

*H5.1. German small and medium-sized companies operating in the food industry have more trust in their customers than Hungarian small and medium-sized companies.*

My last hypothesis (H6) compares the strength of supply chain partnerships of Hungarian and German enterprises by the application of SCI index.

***H6. German small and medium-sized enterprises are on a higher level of supply chain integration (their combined supply chain integration indicator is higher) than Hungarian SMEs operating in the food industry.***

*H6.1. German small and medium-sized companies establish stronger integration with their suppliers (their supplier-side integration indicator is higher) than Hungarian SMEs operating in the food industry.*

*H6.2. German small and medium-sized companies establish stronger integration with their customers (buyer-side integration indicator is higher) than Hungarian SMEs operating in the food industry.*

In the next subdivision of this chapter I provide a brief description of some features of the statistical methods applied in my dissertation.

### **2.3. Statistical methodology**

More types of statistical methods were required by the features and quantity of the collected information as well as by the examination of the established hypotheses. The practical analyses of my dissertation were based on the works of Pallant (2005), Sajtos and Mitev (2007), Tyrrell (2009), as well as that of Huzsvai and Vincze (2012), and the short theoretical review in my dissertation is also mainly based on this literature.

For the justification of the hypotheses formulated in my dissertation I applied the *analysis of variance (ANOVA)* and *the method of linear correlation and regression analysis* and the method of *cross tabulation analysis* from the most frequently applied statistical methods for examining and justifying structures. Furthermore, I applied an asymmetry test (*calculation of 'Eta' indicators*) (besides regression analysis) for the determination of cause and effect relationships between the variables used during the analysis of variance. From the data compressing and data structure revealing methods I used *factor analysis* in case of more examinations as well. I exclude the presentation of the theoretical background of the above-mentioned methods from my thesis booklet due to the limited length thereof.

During all my examinations I took into consideration the limiting conditions of the applied methods and examined the fulfilment of the conditions of application of methods. I completed the statistical analyses at 5% significance level of the models regarded as validity criterion. During my research I did the statistical examinations by the help of SPSS 19 programme package, I used Excel of MS Office software package for the visual presentation of the results.

## **3. RESULTS**

In my dissertation I examined more factors of the integration features of small and medium-sized enterprises operating in the food industry. Here, however, due to the limits of length, I only present the results of more complex examinations, thus I exclude the general experience of the questionnaire survey.

### 3.1. The relationship between pull systems (VMI, postponement) and company profitability

If we examine the attitude of Hungarian companies towards modern supply chain methods, we can state that the modern principles examined by me are applied at a higher rate on supplier side. The application frequency of modern supply chain solutions in the examined Hungarian SMEs is practically equal to the result of the research done by Nyhuis and Hasenfuss (2006) on German small and medium-sized enterprises, who considered the approximately 20-25% rate of application quite low.

According to my first hypothesis (H1), those Hungarian small and medium-size enterprises who supply their customers by applying supply chain methods based on the pull principle operate with higher profitability. I tested the statement regarding vendor managed inventory and the method of postponement by the analysis of variance. As shown in table 2., significant difference can be recognized between small and medium-sized enterprises applying VMI and postponement and those who do not apply such supply chain methods in the return on equity (VMI F sig.: 0.000, postponement F sig.: 0.007), return on assets (VMI F sig.: 0.000, postponement F sig.: 0.023) and return on sales (VMI F sig.: 0.000, postponement F sig.: 0.046). Table 2. shows the average value of each indicator according to categories (applies/not applies).

**Table 2:** The effect of applying VMI and postponement on the profitability of the companies

Indicators of profitability	Applying VMI on the output side		Applying postponement on the output side	
	no	yes	no	yes
Return On Equity (ROE)	,2951	,6131	,3485	,4584
Return On Assets (ROA)	,1824	,5010	,2363	,3446
Return On Sales (ROS)	,0594	,1632	,0459	,1401

Source: own calculation, 2014

Based on the above examinations significant differences can be found in the examined relations, however, it is not proven whether the application of the methods results in higher productivity indicators or companies who operate more profitably decide on introducing and applying these methods. Revealing this cause and effect relationship shall be done in subdivision 3.4., the cause thereof is that a cause and effect relationship shall also emerge in subdivision 3.3. and I consider it reasonable to reveal these relationships at the same time from the aspects of length and transparency as well.

### 3.2. Developing the supply chain integration index

My objective, regarding the development of supply chain integration index, was to present the highest possible number of partnership variables measured by the questionnaire in the indicator to make the explanatory power of the model acceptable for reflecting the degree of integration reliably. I planned to include more types of variables in the ratio, by help of the method of factor analysis (where it was necessary), subsequent to the standardisation of variables. In order to achieve better matching, I removed the distorting and/or not relevant variables from the index both on supplier and customer sides, thus the remaining variables (table 3.) already show the degree of integration homogeneously on the input (supplier-side SCI) and output (buyer-side SCI) sides as well.

**Table 3:** Variables of the supplier- and buyer-side SCI indicators applied to the Hungarian sample

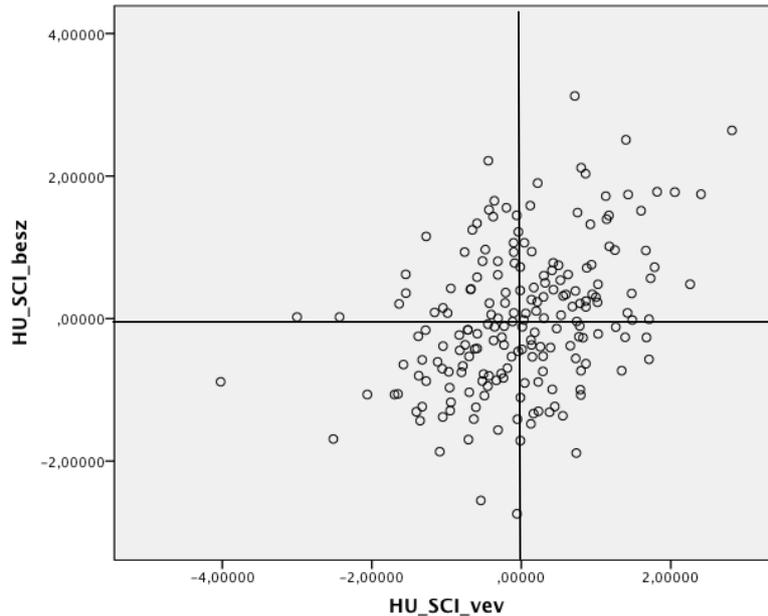
supplier-side SCI		buyer-side SCI	
Applying modern supply chain methods, principles	Vendor managed inventory (VMI)	Applying modern supply chain methods, principles	Vendor managed inventory (VMI)
	postponement		postponement
	risk sharing		risk sharing
	költségek átláthatósága (open book)		költségek átláthatósága (open book)
	electronic data interchange (EDI)		electronic data interchange (EDI)
	sharing market information		sharing market information
Type of interorganizational cooperations on the supplier-side		Type of interorganizational cooperations on the buyer-side	
Cooperation aspects beyond the general terms of agreement	length of cooperation	Cooperation aspects beyond the general terms of agreement	length of cooperation
	informal communication with the partner		informal communication with the partner
	periodically evaluation of the partnership with the partner		periodically evaluation of the partnership with the partner
	using performance indicators applying to the cooperation		using performance indicators applying to the cooperation
Factors of trust	formal control over the suppliers	Factors of trust	formal control over the buyers
	informal control over the suppliers		informal control over the buyers
	sharing knowledge and experiences with the suppliers		sharing knowledge and experiences with the buyers
	trust in suppliers		trust in buyers
	ask for advice in order to improve processes		

Source: own construction, 2014

In order to be able to characterize the degree of integration by a single indicator (combined SCI) (independently from whether it rather belongs to the customer or supplier side), I measured the distance of each individual from the origin in the dimension of supplier and customer SCIs. Figure 3. shows those four categories in which the companies examined by me can be classified depending on the degree of supplier- and buyer-side supply chain integration. I denominated them in the following way:

- *SMEs committed to integration*: small and medium-sized enterprises belonging to the first quarter of figure 3. (29% of Hungarian companies), their integration rate is high both on supplier and customer sides of the supply chain (the farther they are from the origin, the higher it is).
- *Supplier-oriented SMEs*: these companies can be found in the second quarter of the plane (20% of the companies), their integration rate is positive on the supplier side, but negative on the customer side.
- *Customer-oriented SMEs*: interviewed companies in the fourth quarter, whose integration is high on customer side, but low on the supplier side (19% of the interviewed Hungarian companies).
- *Non-cooperating SMEs*: companies in the third quarter, both integration indicators are low (32% of companies).

For the preparation of appropriate statistical examinations, I assigned a nominal scale to the metric values of the received indicators. For this, I divided the variables into three along their terciles, and I determined the low, moderate or high evaluation of the indicator. Categorization of SCI indicators is necessary to be able to make certain analyses and comparisons in a more efficient way. Moreover, this technique makes graphic presentation and interpretation thereby easier.

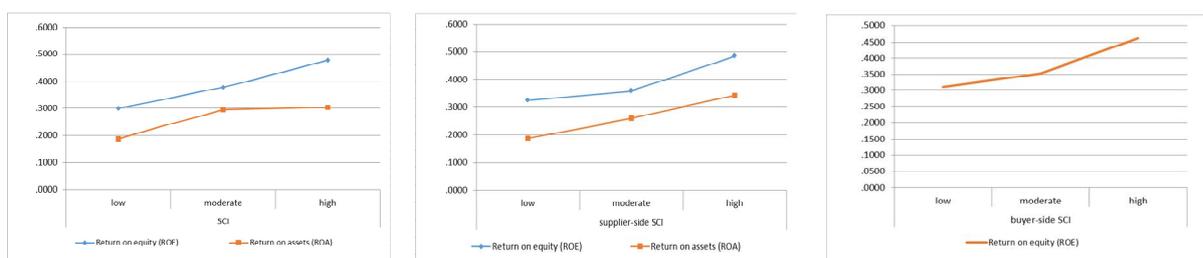


Source: own construction, 2014

**Figure 3:** Extent of the supplier- and buyer-side integration amongst the Hungarian SMEs operating in the food industry

### 3.3. Effect of supply chain integration on the performance of Hungarian SMEs

Developing supply chain integration index on supplier and customer side as well as a combined one, made the testing of my second hypothesis (H2) possible, that such SMEs operating in the food industry who established stronger integration with their supply chain partners have higher profitability ratios. I examined this statement not only with regards to the SCI index, but also regarding integration on supplier side (H2.1.) and buyer side (H2.2.) separately. My hypotheses were tested by the analysis of variance (ANOVA), the results thereof are shown by figure 4.



Source: own construction, 2014

**Figure 4:** Average values of profitability indicators in certain SCI categories

From the examined profitability ratios ROE (F sig.: 0.023) and ROA (F sig.: 0.032) show significant relationship with the combined SCI index of the examined SMEs operating in the food industry. This means, that ROE and ROA values are significantly different in each category of the combined index. If we examine the relationship between profitability and the degree of integration on the supplier side, we repeatedly experience that return on assets (F sig.: 0.007) and return on equity (F sig.: 0.034) of examined SMEs are significantly different in each supplier-side SCI category. However, in the case of supply chain integration index on

buyer side, only the values of ROE are significantly different in each category of the indicator (F sig.: 0.042). All significant relationships are linear and have positive directions. At the same time, the question arises, whether (as in subdivision 3.1. as well) higher degree of integration results in higher profitability or the otherwise also competitive, more profitable companies are more willing to establish strong supply chain cooperations? I provide a detailed examination of this question in subdivision 3.4.

### **3.4. Examination of the cause and effect relationships of correlations related to company performance**

The objective of the present subdivision is to confirm the results of my examinations done so far regarding my first (subdivision 3.1.) and second (subdivision 3.3.) hypotheses, as well as to determine the directions (cause and effect relationships) of the revealed correlations.

According to the most simple explanation, (Freedman et al., 2005) in the case of mixed relationships, qualitative variables form the cause, quantitative (interval) variables form the effect. In my dissertation, in case of testing the above-mentioned relationships I used the analysis of variance based on such mixed relationships to test my hypotheses, where the quantitative variable is to be considered dependent (cause) and the qualitative is the independent (effect) variable. (Northcott, 2008, Morgan et al., 2011) In this respect, I consider the direction of causation according to the theses proper, at the same time, I justify this more efficiently by further examinations (two methods) in the subdivision below.

As the first step of the determination of the cause and effect relationships of the relationships proven before, I prepared a linear regression model, including the variables I measured the profitability of the companies by (dependent variables) and those, which I assume, determine the profitability of the companies (independent variables). According to the result of the regression model, (which I do not show here in detail due to the limited length of my study) the combined integration index, trust on customer and supplier side as well as the application of VMI on customer side have crucial role in the changing of the ROA index, while trust on supplier and customer side and application of VMI on output side show significant relationship with ROE ratio. The above-mentioned variables determine 20.2% of the change of ROA ratio, the other 79.8% comprise factors besides the variables of the questionnaire (involved in the model). The regression equation of ROA ratio can be written out in the following way:

$$y_{ROA} = 0,196 + 0,067 \times \beta_{SCI} + 0,075 \times \beta_{trust\ in\ buyers} + 0,044 \times \beta_{trust\ in\ suppliers} + 0,332 \times \beta_{VMI\ buyer-side}$$

According to the regression model there is significant relationship between the combined SCI index and the ROA ratios, but there is no relationship between the combined SCI index and the ROE ratios. I applied the analysis of variance for the first examination of the H2 hypothesis, where I measured the SCI index on nominal scale, thus it was a categorical indicator. However, I applied regression in case of the analysis described above, where I interpreted and handled the SCI indicator as a metric (continuous) variable. By the categorization of SCI index (by converting the metric scale to a nominal one) the 'finess' (high resolution) of data disappears, becomes simple (by this it also goes with the loss of data), thus relationship not occurring in metric data becomes somewhat stronger in the simplified nominal structure so here differences appear. This explains the fact that results differ by the two methods, that is, in case of the analysis of variance there is significance

relationship between the SCI indicator and ROE ratios of the companies, while this relationship cannot be shown by the application of regression.

Based on the results of the regression model I have made two important conclusions. On the one hand, the direction of the examined relationship could be seen, that is, higher degree of integration (SCI index) causes higher profitability, and the application of VMI on customer side results in higher profitability ratios, not vice versa. At the same time, no relationship could be proven between postponement on customer side and profitability by regression. The other important conclusion is that the relationship "higher degree of integration results in higher profitability" can be shown not only by the examination of SCI as categorical variable (nominal), but also by its application as continuous (metric) variable.

For the determination of cause and effect relationships I calculated so-called 'Eta' ( $\eta$ ) indicators in the second step, to which the variables had to be converted to nominal scale. In my case the cause and effect examination is necessary for the application of VMI and postponement on customer side in relation to profitability as well as for the degree of integration (SCI indicator) in relation to profitability. As VMI, application of postponement on output side and the degree of integration variables have been measured on nominal scale so far as well, only profitability variables had to be converted.

Values of " $\eta$ " ratios are shown by table 4. The value of ratios refer to the strength of the relationship and two values can be found in the table regarding each relationship, supposing that either one or the other ratio has the role of the effect. The value of ratios is typically not too high, but in this case not the justification of the existence of the relationship, rather the orientation about its direction is important to me. Based on the results of the calculations, the role of effect is fulfilled typically by performance indicators (green background), while SCI ratios and application of VMI on customer side have the role of cause. However, the application of postponement on the output side is rather an effect (red background), against other variables, that is, companies operating in a more profitable way apply the method of postponement in the direction of their customers at a higher rate.

**Table 4:** „Eta” indicators of the profitability indicators and the examined variables

		supplier-side SCI	buyer-side SCI	combined SCI	supplier-side VMI	buyer-side postponement	
profitability indicators	ROE	cause	0,164	0,209	0,196	0,226	0,010
		effect	0,170	0,206	0,192	0,221	0,074
	ROA	cause	0,210	0,136	0,156	0,250	0,034
		effect	0,195	0,135	0,156	0,240	0,071
	ROS	cause	0,241	0,175	0,212	0,275	0,053
		effect	0,102	0,089	0,102	0,203	0,110

Source: own calculation, 2014

The associative examinations made above, had results similar to the previously presented regression, that is, the higher degree of variables, which I consider independent variables, result in higher profitability ratios. An exception thereto is the application of postponement on customer side, which rather has the role of effect.

In view of the above results and the results of subdivision 3.1. **I regard my first hypothesis (H1) only partly supported**, as the analysis of variance and results of the examinations to reveal cause and effect relationships justified that such small and medium-sized enterprises supplying their customers with the application of the principle of vendor managed inventory (VMI), operate in a more profitable way. The same cannot be stated in case of applying

postponement on customer side. Although the results of the analysis of variance justified that the difference between SMEs applying and not applying the method is significant in the case of all three examined profitability ratios, at the same time, the relationship (based on the results of the association examination) is probably reverse. That is, companies operating in a more profitable way decide to introduce the method, and it is not introduced by the companies to operate in a more profitable way. In view of the above, **I regard my H1.1. hypothesis supported, and I reject my H1.2. hypothesis.**

Summarizing the results of the relationship between the degree of supply chain integration and profitability, we can state that **my second hypothesis (H2) was supported**, that is, companies with a higher degree of integration both on supplier and customer side are able to achieve higher profitability and more effective operation. Even if I was not able to show significant differences in the case of one of the two profitability ratios (ROE) by one of the examination methods (regression). In addition, **H2.1. partial hypothesis**, according to which those SMEs in FMCG/Food sector having suppliers better integrated operate more profitably (differences between each supplier-side SCI category are significant in the case of both examined profitability ratios, ROE and ROA and cause and effect relationships are also justified), **was also proven. I regard my second partial hypothesis (H2.2) belonging to the examination only partly supported** as in case of customer-side integration only one of the performance indicators (ROE) shows significant differences, in addition, the direction of relationship is in compliance with previous assumptions.

### 3.4. The role of company size in the degree of supply chain integration

During my research I wanted to ascertain that the assumption of company size influencing the degree of integration is right. In order to do this, I formulated my third hypothesis (H3), according to which medium-sized companies establish a higher degree of integration with their suppliers and customers as well than small companies. I assumed that medium-sized companies have more mature attitude to supply chain management, thus managing cooperation in the chain has a (bigger) role in their corporate strategy.

I have done the comparisons with regards to size categories limited by staff number and annual turnover as well. I have checked the hypothesis by both metric SCI ratios (ANOVA. table 5.), and nominal ratios (association strength, Cramer Test V, table 6.)

**Table 5:** ANOVA table of the supplier- and the buyer-side SCI indicators as per staff number and as per annual turnover

		As per staff number					As per annual turnover				
		Sum of Squares	df	Mean Square	F	Sig.	Sum of Squares	df	Mean Square	F	Sig.
Supplier-side SCI	Between Groups	1.307	1	1.307	1.688	.195	2.281	1	2.281	2.143	.146
	Within Groups	150.219	194	.774			129.854	122	1.064		
	Total	151.525	195				132.136	123			
Buyer-side SCI	Between Groups	2.947	1	2.947	3.181	.046	5.835	1	5.835	6.085	.015
	Within Groups	179.719	194	.926			116.990	122	.959		
	Total	182.666	195				122.824	123			

Source: own calculation, 2014

I received similar results in the case of both examinations either by the use of staff number or annual turnover as the basis of establishing size categories. In the distribution of the individuals of the sample (small-sized enterprise/medium-sized enterprise) from the examined two supply chain indexes only the customer-side SCI is significantly different. In the case of metric ratios F sig.: 0.046, in the case of nominal ratios the Cramer V test value refers to weak (0.181), but significant (0.040) relationship. Based on the annual turnover, in the case of metric ratios F sig.: 0.015, in the case of nominal ratios the Cramer V test value refers to medium strong (0.309), significant (0.003) relationship. No significant difference can be shown on the supplier side in the integration index of small and medium-sized companies either grouping them on the basis of staff number or that of annual turnover.

**Table 6:** Cramer V test values of the supplier- and the buyer-side SCI indicators as per staff number and as per annual turnover

		As per staff number				As per annual turnover			
		Supplier-side SCI		Buyer-side SCI		Supplier-side SCI		Buyer-side SCI	
		Value	Approx. Sig.	Value	Approx. Sig.	Value	Approx. Sig.	Value	Approx. Sig.
Nominal by Nominal	Phi	.098	.331	.181	.040	.102	.258	.309	.003
	Cramer's V	.098	.331	.181	.040	.102	.258	.309	.003
N of Valid Cases		196		196		124		124	

Source: own calculation, 2014

In view of the above results it cannot be surely stated that medium-sized companies operating in the food industry are on a higher level of supply chain integration than small companies. At the same time, it is proven that medium-sized companies establish stronger relationships with their customers than small companies, that is, **my third hypothesis (H3) was partly supported.**

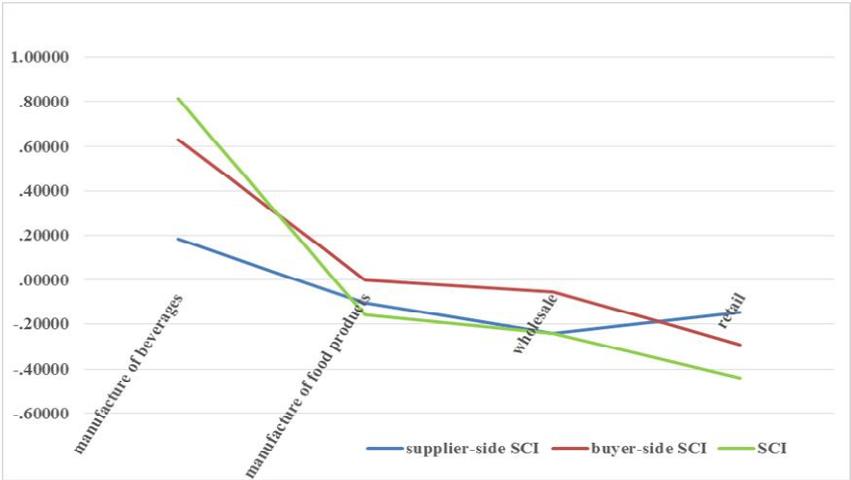
### 3.5. The role of position in the supply chain in the strength of integration

According to my fourth hypothesis (H4) the integration index of companies decreases approaching towards the customers in the supply chain. I examined this statement with regards to the integration indicator on the output and input side as well in order to be able to interpret the results received about the combined indicator better and more exactly. Although manufacturers of food products and beverages are situated on the same level (producers) of the supply chain, I have separated them. The reason for this is that if I can successfully justify my hypothesis, I can determine the integration features of the four groups (producers of food products and beverages, wholesalers, retailers) based on the variables in the SCI index.

According to the results of the analysis of variance necessary for the justification of the hypothesis, in the combined integration index there is significant difference (F sig.: 0.036) between each stages of the supply chain. In the case of SCI on customer side (F sig.: 0.008) there is significant difference, at the same time, in the case of SCI on supplier side we cannot state significant difference. Figure 5. illustrates perfectly that supply chain integration is high in the case of manufacture of beverages (with respect to all three indicators), in the case of food producers it is medium (the value near zero indicates this), in the case of wholesale it is also medium and in the case of retail it is the lowest.

In view of the above results **my hypothesis has been supported** as the SCI index (H4) decreases approaching the customer in the supply chain. (The same can be concluded about

the customer-side supply chain index.) Based on this, we can characterize SMEs operating in the food industry involved in the examination, based on the variables of partnerships in the supply chain by different 'integration patterns', characteristics shown by table 7.



Source: own construction, 2014

**Figure 5:** Strength of supply chain integration depending on stages of the supply chain

By most of the variables in the integration index I experienced that they follow the tendency outlined on the basis of combined SCI index (table 7.). Where I experienced little difference between each level of the supply chain, I indicated the tendency by broken line, where the difference is bigger, I used continuous arrow. Exceptions to the decreasing tendency are VMI and postponement, in addition, the decreasing tendency does not appear by the frequency of the distribution of knowledge and experience, which integration indicator is not characteristic in case of either sector anyway. By these variables I indicated by dotted line that the above-mentioned tendency does not appear. Regarding table 7. I need to note that I merged the variables of formal and informal control, calculating the average of the responses to the questions. This variable has to interpreted in the opposite way as the lower its value is, the higher is the level of trust in partners (it is shown by the reverse arrow). Based on the examination of the results of the relationship between the combined integration index and the position in the supply chain, I recognized the following features of the integration with regards to the individual participants.

**Manufacturers of drink products:** there is a high rate of applying VMI both on input and output sides and they can be characterised by strong willingness for risk and information sharing. They share a high rate of information with their supply chain partners by electronic data interchange (EDI). All these show well that they establish strong cooperation mainly with their customers where they focus on the length of the relationship, the periodical supervision and evaluation of the cooperation and communication with the partner. Manufacturers of beverages typically trust their partners, which is well presented by the fact that exercising control over their partners is not a characteristic feature of them. They did not formulate special expectations of strengthening supplier and customer relationships, that is, probably they are contented with the cooperations they established.

**Manufacturers of food products:** the strength of integration on supplier and customer side of food producers typically applying modern supply chain methods at a medium rate is closer to that of wholesalers than manufacturers of beverages. Their characteristics are very similar

to the integration features of wholesalers, but in their case the length of the cooperation with their customers and the evaluation and development of partnerships have a bigger role and they have higher trust in their customers. For developing their customer relationships they consider their customers' meeting their deadlines precisely, signing longer-term supplier contracts and establishing common information systems important. They regard, from their expectations from their suppliers, the more efficient way of handling problems, the flexibility of partners and establishing common information system the most important.

**Table 7:** Integration features of SMEs operating in the food industry on the basis of the combined SCI as per supply chain stages

Stages of supply chains		Manufacture of beverages (11)	Manufacture of food products (10)	Wholesale (463)	Retail (472)
Applying modern supply chain methods, principles.	Vendor Managed Inventory (VMI)	52,9%	25,0%	33,3%	31,1%
	postponement	17,6%	17,6%	27,8%	21,8%
	risk sharing	31,1%	29,4%	28,0%	26,4%
	Electronic Data Interchange (EDI)	58,8%	30,7%	27,1%	26,0%
	information sharing	55,9%	48,4%	46,4%	40,0%
Type of interorganizational cooperations on the supplier-side.		close (3,68)	moderate (3,28)	moderate(3,18)	weak (2,65)
Opinion about the partnerships, aims of the cooperations.	length of cooperations	important aim (4,43)	important aim (4,41)	important aim (4,39)	important aim (4,30)
	informal communication with the partners	important aim (3,53)	average importance (3,26)	not so important (3,20)	not so important (3,18)
	periodically evaluation of the partnership with the partners	frequently, high importance (4,32)	less frequent, but important target (3,80)	average importance (3,43)	average importance (3,30)
Control over the partners.		it happens very rarely (2,13)	sometimes it happens (2,40)	it happens more often (2,49)	it happens more often (2,52)
Sharing knowledge and experiences with supply chain partners.		it happens quite rarely (1,79)	it happens quite rarely (1,73)	it happens quite rarely (1,86)	it happens quite rarely (1,88)
Trust in partners.		high (3,37)	moderate (3,12)	moderate (3,00)	low (2,79)
Other expectations from buyers in order to strengthen the cooperation.		no particular expectations	keep the due dates of payments, flexibility, joint information system, long-term contracts	keep the due dates of payments, joint innovation, get to know the strategic goals of the buyers	get discounts from buyers, ensure a stiff price-level
Other expectations from suppliers in order to strengthen the cooperation.		no particular expectations	more efficient problem solving, joint information system, keep the deadlines and the quality, flexibility	improvement of food safety, get to know the strategic goals of the suppliers, share exchange rate and other financial risks, shipping accuracy and good quality	aspects of quality management (secure traceability), partnerships built on trust, reliable business relationship

Source: own construction, 2014

**Wholesalers:** in spite of having lower SCI index than that of food producer companies, interestingly, they apply the method of VMI and postponement at a high rate both on input and output sides. Soft integration factors (trust, evaluation of the cooperation, communication) are not considered too important by them. They also indicated meeting

payment deadlines as an important expectation from their customers, and they require the realization of common innovation. Furthermore, they would like to know the strategic objectives of their customers in order to make cooperations more effective. Besides, they require risk sharing with their suppliers and they would improve the precision of their suppliers as well as their compliance with food safety regulations.

**Retailers:** retailers can be characterized by the lowest integration on customer side. On output side they can be characterized by lower level of trust, information and risk sharing, their customer partnerships are weaker. Their lack of trust in their customers is illustrated well by their control of partners more often than companies operating on other stages of the supply chain. They formulated two important expectations from their customers: providing discounts and relatively stable purchase prices.

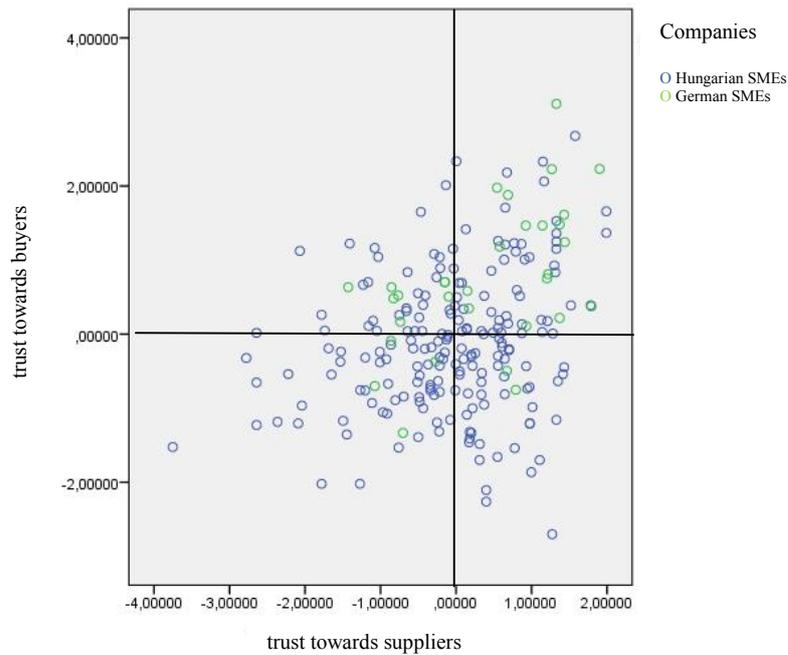
Their supplier-side integration index is higher than that of wholesalers and approximates to food producers. Higher supplier integration is due to higher trust in suppliers and higher rate of application of modern supplier chain methods on input side. Although they have stated to have trust in their suppliers, most of them emphasized the higher degree of trust, establishing confidence relationships as their most important expectations from suppliers. In addition, they regard such supplier developments, which improve their compliance with the requirements of traceability important.

### **3.4. Comparison of Hungarian and German research results**

I examined two important factors by the comparison of Hungarian and German small and medium-sized companies operating in the food industry: on one hand, by highlighting the degree of trust from the factors of integration, on the other hand, the degree of integration (Hungarian and German companies together), I had to develop the supply chain integration index once more thereto. However, I need to note that due to the relatively small size of the Bavarian sample (32 companies), results received about German companies can be regarded less well-founded than those of the Hungarian examination. The significance of the subdivision is on one hand in the foreign outlook and in the comparative analysis based on an identical questionnaire and on the other hand in signing the directions of further researches.

I used more indicators for measuring the level of trust. I regarded acquiring information about companies' scale of formal and/or informal control over their partners both on supplier and customer side important for the determination of the variables of trust. In addition, I also consider the openness of companies about asking for advice for the development of their corporate processes (including their common ones) a question of trust (competence trust). Besides, trust has a crucial role in sharing knowledge, experience as well as information (especially information on inventories) with supply chain partners. I developed two-two ratios (sharing and controlling ratio on supplier and customer side) for indicating trust.

My fifth hypothesis (H5) assumes that German small and medium-sized companies operating in the food industry show higher degree of trust towards their supply chain partners than Hungarian small and medium-sized enterprises. I intersected the above-mentioned customer and supplier trust factors by the seats of the companies (figure 6.) Having done test F of the analysis of variance I experienced that in the distribution of the group by seats, the variance of companies is significantly different both in the variables of customer ( $F \text{ sig.}: 0.013$ ), and supplier ( $F \text{ sig.}: 0.000$ ) trust.



Source: own construction, 2014

**Figure 6:** Hungarian and German companies in the dimensions of trust

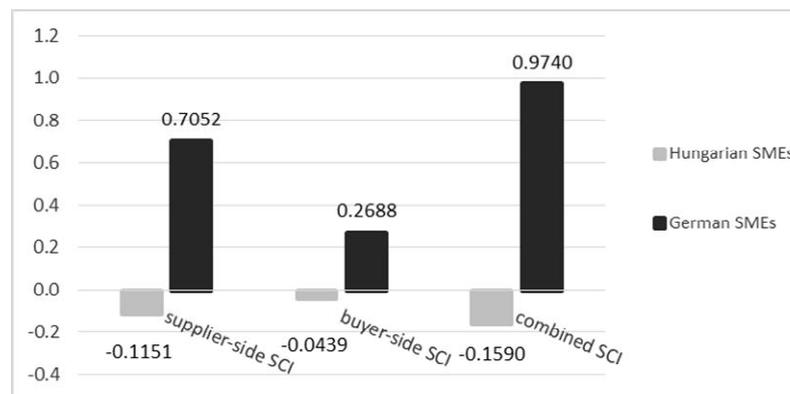
In view of the results described above we can state that **my fifth hypothesis (H5) is completely supported**, that is, German small and medium-sized companies have higher trust in their suppliers than Hungarian small and medium-sized enterprises (H5.1.), and the same can be said concerning the supply chain customer partnerships of Hungarian and German small and medium-sized companies (H5.2.) as well. In consequence of the low degree of trust, cooperations of Hungarian SMEs are less durable (it is also reflected by the answers to certain questions of the questionnaire) and I assume, cooperations can be seen in less strong forms of partnership (for example: strategic cooperations rarely occurs). Consequently, more developed supply strategies (pull strategies; VMI, postponement) requiring strong cooperation, appear at a lower rate by the Hungarian small and medium-sized enterprises. Besides, lower level of trust in supply chain partners results in lower level of company performance (see for example, the research results of Panayides and Lun /2009/).

In order to justify my assumption about the strength of the integration of Hungarian and German SMEs, I prepared the SCI indexes developed for the whole sample (supplier, customer and on their basis: combined index). Having compared the SCI indicators developed from the whole sample with SCI indexes developed from the Hungarian sample, we can experience a high degree of similarity between them. SCI index on customer side contains the same variables in case of the Hungarian and the whole samples as well, while in case of the supplier-side SCI index of the whole sample contains two variables (length of cooperation, formal control over suppliers) less. The high level of similarity is also shown by the Pearson's correlation coefficients: on supplier side  $r = 0.986$ ,  $sig: 0.000$ ; on customer side  $r = 0.957$ ,  $sig: 0.000$ .

Following the principle similar to the previous one, the degree of integration is expressed by the distance of each individual from the origin in the dimension of customer and supplier SCIs (figure 6.). The previously presented integration groups based on the integration indicators including companies of the two countries are the following:

- *SMEs committed to integration*: 26% of Hungarians, 37.5% of Germans.
- *Supplier-oriented SMEs*: 15.8% of Hungarians and 21.8% of Germans.
- *Customer-oriented SMEs*: 21.5% of Hungarian, 12.5% of German small and medium-sized enterprises.
- *Non-cooperating SMEs*: 36.7% of Hungarian, 28.1% of German companies.

Having done the sample tests of the analysis of variance necessary for the justification of the hypothesis, I experienced a significant difference between the degree of supply chain integration of German and Hungarian companies on supplier side ( $F$  sig.: 0.000) and between their combined SCI indexes ( $F$  sig.: 0.001) At the same time, difference on customer side is less significant. Thus the difference between Hungarian and German companies is significant statistically as well, which is also well illustrated by figure 7.



Source: own construction, 2014

**Figure 7:** Supply chain indicators of the Hungarian and the German small and medium-sized enterprises

I have made the following conclusions based on the SCI indicators of the small and medium-sized enterprises operating in the food industries of the two countries:

- The frequency of application of modern supply chain methods, principles shows a mixed picture. Application frequency of VMI is nearly the same regarding the companies of the two countries, either on input or on output side. The method of postponement is applied at a higher rate by German companies and risk sharing appears at a higher rate at Hungarian enterprises, although the difference is not significant. There is significant difference in the application of EDI as it is nearly 16% on supplier and a bit over 20% on customer side. The same in the case of German SMEs is 24% and 31 %. Providing the transparency of costs is not characteristics of the companies of either country.
- One of the main reasons of the difference in the integration indexes is *the characteristics of partnerships in the supply chain*. While in the case of Hungarian SMEs relationships of medium strength are dominant both on supplier and customer side, German small and medium-sized companies operate in typically strong forms of cooperations, for example in the frame of strategic alliances. The ratio of participation in strategic alliances in the case of German small and medium-sized enterprises is 34% both on supplier and customer side in contrast with the 5% and 8% we can experience by Hungarian SMEs.

- The conclusion that German companies can be characterized by longer-term partnerships than Hungarian companies is related to the above statement. The rate of supplier relationships with the duration of more than 3 years is a bit more than 60% by Hungarian companies, by German SMEs it is nearly 74%. In respect of customer relationships the difference is even more marked: cooperations with the duration of more than 3 years constitute 47% by Hungarian companies and 74% by German companies.
- Hungarian companies find communication with their partners and *common evaluation of their cooperation* less important. Evaluation can typically be made on the basis of practical experience as the companies of neither country find the development and application of *performance indicators related to cooperations* particularly important.
- Either by the use of previously presented trust indicators or that of the variables contained by the integration index, we can experience that Hungarian SMEs are considerably behind concerning *trust*. (It can also be experienced by looking at the variances of trust separately.)
- If we look at the *expectations* of the examined companies *from their partners in the chain*, we can experience interesting differences. Hungarian companies, unlike the Germans, expressed several objections, which can be categorised in two groups. On the one hand they mentioned their expectations about common activities, objectives (common developments, common information system, longer-term cooperation, establishing partnerships based on mutual trust), on the other hand those by which they are able to improve mainly their own operation (higher flexibility of partners, more information from partners). German companies typically formulated such expectations that can improve the operation of more members of the chain, for example: developing the transparency of processes and costs in the chain, unifying the systems of traceability.
- Based on the previous examinations we can state that German small and medium-sized enterprises are on a higher level of integration than Hungarian SMEs thus **my sixth hypothesis (H6) is fulfilled**. By the examination of supplier and customer side separately, I experienced that German small and medium-sized enterprises establish significantly stronger integration with their suppliers (H6.1.) than Hungarian companies (H6.2.) Hypothesis H6.2. cannot be supported, although there is difference between German and Hungarian SMEs on customer side as well, it is not significant (*F sig.*: 0.101).

#### 4. NEW SCIENTIFIC RESULTS

More scientific researches deal with the operation of supply chains in the food industry, several studies have the objective of measuring the degree of supply chain integration and we can also find such examinations targeting the relationship between SMEs and supply chain management. At the same time, the topic of my dissertation is situated in the intersection of the above areas of investigations, filling up the void constituting the examination of the partnerships and integration of small and medium-sized companies in the supply chain. During my research I have formulated the following new scientific results:

1. By the application of variables measured in my research questionnaire **I developed a supply chain integration index**, by which the strength of cooperation of each company with its supply chain partners can be measured. The developed index can be obtained by integration indexes on supplier and customer sides. As *variables contained by the indexes are not sector-specific*, their objective is to measure the degree of integration in general,

*they can also be applied in other sectors.* As variables contained by the indexes on input and output sides are nearly identical, they provide the opportunity to compare cooperations on customer side to supplier-side cooperations and to reveal the emphatic and less essential elements of supply chain partnerships of small and medium-sized enterprises operating in the food industry. I have classified the examined SMEs by the development of the SCI index into four groups depending on the degree of their integration on supplier and customer side, specifying thereby the rate of the *four supply chain integration strategies* determined by the indexes (*committed to integration, supplier-oriented, customer-oriented, non-cooperating SMEs*) characterizing small and medium-sized enterprises.

By the application of two statistical methods I proved that a **higher degree of supply chain integration is accompanied by higher profitability** for small and medium-sized companies operating in the food industry. Thus strengthening supply chain partnerships can mean a kind of 'way out', but at least help for the members of the SME sector in the difficult situation characteristic thereof. By the integration index on the supplier and customer side I proved that companies of the examined sector are able to obtain significantly higher performance by increasing the degree of integration on supplier or customer side separately. I have shown by breaking down the supply chain index to factors *the areas where companies should reconsider their corporate strategies*: mainly trust in their partners should be strengthened, investments in modern supply chain methods should be undertaken and establishing long-term partnerships based on communication and the evaluation and development of cooperation should be targeted. Emphasizing one of the factors of the supply chain integration index I separately examined the way profitability of the examined companies is influenced by the application of vendor managed inventory on customer side. I proved that ***such small and medium-sized companies of the sample operating in the food sector, which supply their customers by the application of the method VMI, are able to achieve higher profitability*** (it was proved by three profitability ratios as well). Although the effect of the above-mentioned pull method on profitability has already been examined by several researchers, the new result of my research lies in my revealing of the above-mentioned relationship with regards to the participants of the SME sector in the food industry and that being significantly influenced by the characteristics of the sector (dominant role of retail chains and its consequence, characteristics of the products etc.). Consequently, the above-mentioned method can be applied by fewer companies, which makes research more difficult.

2. **I proved that company size and position in the supply chain has influence on the strength of integration.** One of the new approaches of my dissertation is examining the degree of supply chain integration depending on the position of the companies in the supply chain. During the examination – by the application of SCI index – I found that a *tendency of decreasing integration index of small and medium-sized enterprises from producers (including manufacturers of beverages and food products) through wholesalers to retailers can be justified* in a given stage of the supply chain. By breaking down the integration indexes to their factors, I determined 'integration samples' with regards to small and medium-sized companies operating in the food industry included in the sample, which each level of the supply chain can be characterized by. Thus *I identified the strongest integration links and the deficiencies that can be detected on each level of the supply chain*. By breaking down the SCI index to variables I presented the way, among others, the degree of certain soft factors (e.g. trust, common evaluation of cooperations) as well as the frequency of applying hard factors (e.g. electronic data interchange or the

frequency of applying risk sharing methods) decreases. In addition, I proved that the decreasing tendency of the degree of integration from the upstream side towards the downstream side of the chains in the case of the buyer-side SCI indicator is even more significant than in case of the combined SCI index.

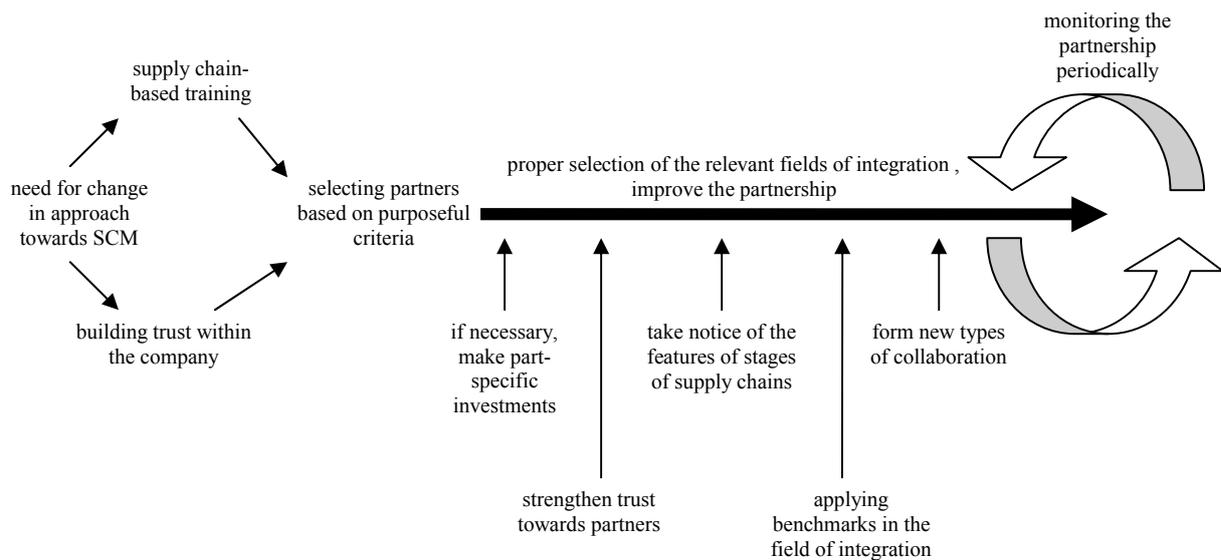
I proved that **Hungarian medium-sized companies cooperate with their suppliers at a higher degree of supply chain integration than small companies**. I proved my statement in the case of limiting size category by staff number and annual turnover as well. The same could not be proven with regards to supplier relationships. That is, size has an effect on the strength of integration on the output side of companies in the examined industry.

3. I prepared a comparative analysis of the degree of supply chain integration of Hungarian and German (Bavarian) small and medium-sized companies operating in the food industry. However, by the evaluation of the results I have to bear in mind the relative small number of individuals in the German sample compared to the Hungarian sample and to the German population. Although the received results have been treated by reservations, the revealed differences are so significant, in spite of the low number of individuals in the German sample, that they outline the factors in which Hungarian SMEs in food industry are behind quite well.

During the comparative analysis I statistically proved that **German companies have a higher degree of integration**. I stated that the above-mentioned relationship is especially true about the supplier-side partnerships of companies. On the basis of all these, I determined *such integration (related to cooperations) factors in which German companies surpass participants of the Hungarian SME sector*. By comparing the integration features of the companies of the two countries I concluded that such differences are basically due to the objectives of cooperations (shorter term, company-focused attitude/longer term, thinking in chain) and trust in partners. By empirical analysis I proved that *Hungarian small and medium-sized enterprises operating in the food industry have lower degree of trust in their supply chain partners compared to Bavarian companies in the sample*. In addition, I showed that the mentioned difference is more significant between the companies of the two countries on supplier side. It is shown by the examination that Hungarian companies more often control the activities of their partners, less often share their information on inventory, knowledge, experience and they do not really ask the opinion of their partners for the development of their own processes.

## 5. SUGGESTIONS

Based on the experience and research results I acquired during the preparation of my dissertation, my suggestions for the small and medium-sized companies of the Hungarian food industry are summarized in Figure 8.



Source: own construction, 2014

**Figure 8:** Summary of the suggestions regarding supply chain integration recommended to the Hungarian small and medium-sized enterprises operating in the food industry

One of the most important statements and suggestions at the same time of my dissertation is related to the attitude of small and medium-sized enterprises operating in the food industry to supply chain management and to their partnerships in the chain. Companies of the examined sector regard supply chain management and suiting the requirements of thereof a kind of force; due to their short-term attitude, their short-term difficulties and challenges, possible investments push long-term advantages into the background. My research results refer to the fact that the intention of moving into the direction of stronger cooperation exists within Hungarian companies, but it cannot be realized without the appropriate level trust. The low level of trust is one of the biggest barriers of increasing the efficiency of supply chains in the Hungarian food industry. In my view, *corporate culture should be changed radically from the presently non-cooperating strategy to the direction of a more cooperating strategy, in which there is enough emphasis on the conscious, goal-oriented establishment, maintenance and development of supply chain partnerships.* Companies of the Hungarian FMCG/Food sector mainly focus on the performance of their own companies. This attitude should be changed into such direction that if the efficiency of a given part of the chain improves (better coordinated logistics processes, shorter lead times, lower cost of time, better product identification, lower inventory levels), individual companies could operate in a more efficient way.

The realization of the above-mentioned may seem simple theoretically, but the practical realization thereof might be hindered. From the aspect of supply chain management small and medium-sized enterprises are often characterised by strategic (lack in the commitment and expertise of the management, deficient or lacking knowledge of the advantages of having e-support) as well as operative, management and process management (difficulties in the introduction of supply chain methods, applying improper criteria of selecting partners, workforce with low qualification) deficiencies. I find *the goal-oriented training of employees in the examined range of companies, in which the knowledge of logistics and supply chain management must have enough emphasis as well as establishing such attitude that extends further than the limits of the individual company and prepares for meeting the requirements of time-based competition necessary.*

The small and medium-sized companies of the Hungarian food industry must move from the typically distant relationship to the direction of committed partnerships as it was proved by my research that *stronger cooperation is accompanied by higher performance*. To this, *they must find such fields of integration*, processes where partnerships must be deepened in order to cooperate successfully. A successful partnership does not mean the strongest possible cooperation in the most possible fields, but the proper selection of those fields the linking thereof is beneficial for both partners. Trust has crucial role in this process as without the proper level thereof cooperation is doomed to failure. In my opinion, *SMEs in the Hungarian food industry first must create a climate of trust within the company, which the establishment of trust with supply chain partners can be built on*. Companies must be aware that trust is a long-term, two-way process thus they must set aside their short-term, profit-oriented attitude.

Meeting the expectations of the dominant member of the chain can also be accompanied by benefits for SMEs, at the same time, it often requires significant additional investments from small companies, in which they can see not long-term profitability and the possibility of extracting further profit, rather the difficulties and force. At the same time the suggestion can be formulated for such small and medium-sized companies operating as suppliers of bigger companies (and the nature of the product to be supplied as well as the partner makes it possible) that *they should make investments into such infrastructure supporting supplies, which are based on modern supply principles (for example VMI) and EDI systems supporting such principles*. In my opinion, *investments supporting supply chain management may be realized reasonably by the application of external sources* (for example, Növekedési Hitelprogram for small and medium-sized companies).

For small and medium-sized enterprises of the FMCG/Food sector the research results of my thesis may be prevailing in the realisation of integration processes also from the aspect that *integration links on the individual stages of the supply chain can be different thus establishing different integration strategy on each level is recommended*. Food producers should develop in the field of hard integration factors, consequently they should increase the rate of application of more developed supplying principles, in addition, they should put more emphasis on the development of common information systems on input and output sides as well. Wholesalers are recommended to place more emphasis on soft integration factors and common developments, innovation activities. The broader awareness of the strategic objectives of their suppliers and customers could develop their operations. Retailers are also recommended to develop soft partnership factors, mainly to increase trust in their partners, and improve traceability in the cooperation with their suppliers.

Based on the results of the comparative analysis of Hungarian and German small and medium-sized companies, by the expansion of the developed supply chain integration index, the determination of such supply chain integration benchmarks would be beneficial to the Hungarian companies, their supply chain partnerships could be strengthened by targeting thereof. Naturally, the proper selection of partners must obtain an important role in this process, Hungarian SMEs must have clear objectives and proper partner selection criteria therefor.

Supply chain integration of small and medium-sized enterprises could be largely helped by establishing such forms of cooperations, clusters, (such types are for example, clusters in the automobile industry) providing opportunity for the realisation of benefits from sharing knowledge and experience, as well as for learning from bigger companies. Such *new forms of cooperations* can increase willingness for innovation and can help the faster and more efficient adaptation and application of different supply chain management methods.

In my opinion, besides the several integration factors mentioned above, a key element of long-term supply chain cooperations is *the evaluation of the partnerships from time to time together with the partners*. This has an especially important role in the business environment typical of nowadays, which can be characterized by fast changing market demands, rapidly developing technology and increasingly complex supply chain networks. I find it important to develop such relationship-specific indicators (quantifiable or even non-quantifiable), which can describe the efficiency of common activities.

Summarising the above concepts, I would like to emphasize that surviving for small and medium-sized companies in the food industry and operating efficiently is not easy due to the specific power relations (dominance of retail chains), the increasing expectations in the field of food safety, and the increasingly intense competition in the sector. At the same time, supply chain management, strong cooperation based on trust can be the keys of success for the participants of the SME sector. However, it requires the change of attitude, goal-oriented training and reconsidering corporate strategy, in which cooperative attitude reaching beyond the borders of their own companies should have an emphatic role.

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