Hungarian University of Agriculture and Life Sciences
Doctoral School of Economic and Regional Sciences

STRATEGY AWARENESS AND DIGITALIZATION IN THE SUPPLY CHAINS OF CENTRAL AND EASTERN EUROPEAN COMPANIES

THESES OF PHD DISSERTATION

GERGELY ULECHLA
electrical engineer, economist

Gödöllő
2022

Doctoral School

Name: Hungarian University of Agriculture and Life Sciences
Doctoral School of Economic and Regional Sciences

Discipline: Management and Business Administration

Head: Prof. Dr. habil. Zoltán Károly Lakner
full professor, DSc
Hungarian University of Agriculture and Life Sciences
Institute of Agriculture and Food Economics

Supervisor: Prof. em. Dr. habil. Zoltán Szegedi
full professor, CSc
Széchenyi István University
Department of Marketing and Management

....

Approval of the Head of the Doctoral School

Approval of the Supervisor

TABLE OF CONTENTS

1. BACKGROUND AND OBJECTIVES

1.1. Introduction and background

With the prevalence of Industry 4.0 and with digitalization being on the rise, domestic companies have expanded more and more successfully. Thus, in addition to global supply chains, their own supply chains have also started to develop considerably. Expectations have grown steadily, and as a result companies have faced serious challenges from both the supplier and consumer sides. By 2020, the lack of financial capital has become a problem in meeting company expectations, and the emergence of the epidemic further aggravated the situation (Epic Innolabs, 2022).

The emergence of the coronavirus in 2020 has caused significant damage to global supply chains, which posed serious challenges not only in local and regional but also in global markets. Supply chains have become fragile as a result of this process. The ongoing analysis of the situation due to the spread of the virus and the rapid responses to changes have created entirely new supply chains. This change is still noticeable today as it affects the day-to-day operation of companies, the global supply chains, and the decisions that large companies make in response to external and internal environmental impacts (McKinsey Global Institute 2020).

It is useful to address problematic situations that help us to understand a completely re-engineered supply chain. The spread of the coronavirus has put great pressure on top companies and other economic operators and has fundamentally changed operating processes. Market changes are still happening. However, this is not the first time that economy has faced such turmoil. The past and present wars, the accession to the European Union, the financial crisis, and the pandemic have all brought significant challenges to economic actors.

The emergence of Covid-19 has led to a number of disruptions. Due to downtime and tight quarantine measures, companies have prioritized

changing their strategy and manufacturing processes as soon as possible. Production under the JIT system has severely reduced the turnover of companies, as the system is not flexible enough to deal with such sudden situations. Rigid supply chains have also become a serious threat because they are inflexible in the face of any change. They can only slowly respond to sudden events and find new suppliers or even new partners. The longer the response time to a given event, the greater the loss of revenue for the company.

In order to properly deal with the changing situation caused by Covid-19, the majority of large multinational companies have shifted their focus from their allegedly inflexible status to become more flexible. Addressing the situation of global supply chains proves to be a very complicated task because its starting point was not an economic event but the consequence of a critical health situation. Supply chains were immediately affected by the pandemic. This emerged as a problem on both the demand and supply sides. The main causes of bottlenecks generated in the economy were loss of production, suppliers' disruptions, and piled-up shipments. The epidemic affects global markets, but there are certain areas that are heavily affected while others are less affected (Haussmann 2020).

According to a study by the European Commission (2021), the future of global supply chains is currently influenced by a number of factors. The goal now is to provide support for companies and preserve most jobs while achieving economic growth. The study shows that comprehensive changes can be expected in the characteristic causes and problem areas of supply chain weaknesses. Transformations are needed, including the replacement of manual solutions in manufacturing processes with automated or digitalized solutions. The introduction of digitalization and automation has a transformative effect on companies and the supply chain since growing demand requires up-to-date technologies and networks. Flexibility and efficiency can be further improved by new networking solutions, cloud computing and enhanced cybersecurity. Companies connected to global supply chains need more and more transparency and flexibility. Optimizing inventory is of paramount importance. The proper

selection of suppliers plays an important role in this and in reengineering procurement. The goal is to reinvent inventory strategy as well as procurement strategy, to redesign dependencies, and to expand and refine procurement sources.

Companies invest their capital and resources of strategic collaborations in order to achieve long-term partner satisfaction, which results in pushing their cost-cutting efforts into the background. They provide a common online platform and database to access real-time data, which allows them to make real-time decisions on both sides. Companies strengthen mutual trust by supporting continuous communication through exchanging forecasts and financial information, sharing various technological and technical resources and information, and joint strategic planning (Szegedi 2017).

1.2. Objectives

The phenomena of technology and digitalization have developed rapidly in recent decades, leaving traces in all branches of industry. According to Lentner (2021), the spread of the epidemic accelerates trends that have already been present in the economy and industry, including the rationalization of commercial and production networks, the growing role of digitalization, and the increasing use of automation.

As there are still many uncertainties surrounding digitalization projects and measures, the thesis focuses on exploring the elements and main driving forces that influence the digitalization of supply chains and its added value.

The research is limited to the strategic management of companies within the supply chain and the possibility of incorporating digital technologies. The primary aim of the research is to explore the implications of the Covid-19 epidemic in supply chain management and to analyze the impacts and problems that companies need to address in their day-to-day operations.

Having reviewed the relevant literature, the following research questions emerged in the course of the empirical research:

- RQ1: What differentiates between strategically more conscious and less conscious businesses?
- RQ2: What benefits can companies accrue through their digital strategy? How can they do this? What are the prerequisites for this?

By operationalizing the research questions, the following hypotheses were set up in the course of the empirical research.

For RQ1:

- H1: Companies in which the time of strategic and structural changes coincides, and which adapt their strategy and/or structure to changes in the environment faster and more frequently, and which have a multinational background can be considered more strategically aware.

For RQ2:

- H2: The importance and extent of the benefits of digitalization is influenced by the goals that drive the company towards digitalization and by the extent to which certain conditions limit the company's ability to reap the benefits inside and outside the company.
- H3: The strategy awareness of companies influences the extent to which a company can take advantage of the preconditions for the digital transformation, which have different effects on the target system of the digital strategy (so-called driving forces) and through this on the benefits of digitalization.
- H4: The strategy-making process affects the extent to which a company can reap the benefits of digitalization.

2. MATERIAL AND METHOD

2.1. Research sample

In order to answer the research questions, it was practical to use a sample that was most likely to include companies for which the transition to digital strategy in the 21st century was presumably important and relevant. Thus, the population was defined as business corporations with Hungarian locations that operate along agrifood supply chains, typically in agriculture, the processing industry, transportation, warehousing, trade, and the information and communication industry. For the sake of properly differentiating the conclusions, it was important to have a relatively heterogeneous sample with companies of diverse sizes.

2.2. The questionnaire

A self-developed questionnaire was used for sampling, which contained a total of 22 questions in 3 chapters, of which a database of 114 variables was compiled. The probability of entering the sample was random. The research questionnaire consisted of three parts. The first part asked the statistical questions needed for the analysis, while the second part dealt with the strategic characteristics of the companies, and the third part was open only to companies with some kind of digitalization or possibly electronic sales or marketing goals in their strategies. The questionnaire was completed between February and June 2021 with the help of the managers of the participating companies, using a phone interview method. The sample produced during the empirical data collection has n = 101 elements.

For the indisputable reliability of the data obtained from the questionnaire, the questionnaire was considered to be fully completed only if it was answered by the head/owner of the company (53.5% of the

respondents) or by a manager with an overview of strategy and IT (i.e., a specialist) (46.5%).

2.3. Methods

The database obtained during the research was processed with the IBM SPSS Statistics 24 statistical software package, and Microsoft Excel was used for data cleaning.

Cross-tabulation and strength of association: To check the strength of association, cross-tabulation was chosen from the methods used for nominal scales, which includes the distributions obtained for each combination of the values of the two variables examined; hence, the contingency table suggests a relationship between the two variables (Freedman et al. 2005). For the actual existence of correlations and the measurement of the strength of association, Cramér's *V* was used in line with common research practice.

Analysis of variance: Analysis of variance (ANOVA) is generally used to compare the means of groups with the same standard deviation and normal distribution. The method examines whether the fluctuation in the total variance of each group created by the categorical variable in the sample is due to the effect of coincidence or some other explanatory factor, such as differences between group means (Northcott 2008). Homogeneity of variances was performed using Levene's test, which is based on the assumption that the variance of the studied populations is equal and homogeneous.

Factor analysis: Factor analysis can be used to reduce the number of dimensions of a set of variables in order to make them easier to interpret by grouping the variables that correlate with each other and by grouping the non-correlating variables separately. It is assumed that some of the

observed variables correlate with each other and can be generated as a linear combination of unobservable hypothetical background variables (factors). The weights of the original variables involved in explaining the variance of the common factor provide an opportunity to discover the hidden relationships between the components. Thus, the statistical analysis is performed in a transformed, lower-dimensional space without losing relevant information. Prerequisites were checked using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's spherical test. A priori criteria, the Kaiser criterion, and the variance ratio test were used to determine the optimal number of factors.

Path analysis, multiple linear regression: The path model is a series of regression models based on one other. The variables in the causal model are connected by arrows that indicate the causal direction of the relationships. The model breaks Pearson's zero-order linear correlation between independent and dependent variables into two additive parts. One part is the effect that the independent variable exerts directly on the final dependent variable, and the other part is the effect that the independent variable exerts on that variable through other intermediate, mediated variables. For this, regression relationships must be constructed and the relevant regression coefficients and their significance must be calculated (Füstös et al. 2004, Székelyi & Barna 2004). The fit of each model was tested with an *F*-test. The analysis was performed using the Enter method, which includes all independent variables in the model, regardless of whether the partial explanatory power of the variable is significant, and then eliminates the non-significant variables one by one (E. Szabó et al. 2010).

3. RESULTS

3.1. For RQ1

RQ1: What differentiates between strategically more conscious and less conscious businesses?

During the examination of the strategic characteristics of the companies, the profile of the companies undergoing structural changes was determined first *(Table 1).*

Table 1. Structural change profiles of companies

Date of structural change

New structural change	**Old structural change**
Processing industry, information and communication industry	Agriculture, trade
Foreign or mixed ownership	Domestic ownership
Legal entity ownership	Private ownership
Large to mid-size companies	Micro-enterprises and SMEs

Source: Author

In the next step, the companies were profiled according to the time of the strategy changes. The following three groups emerged here *(Table 2).*

Table 2. Strategy change profiles of companies

Date of strategy change

New strategy change	**Old strategy change**	**Rolling planning**
Processing industry, transportation and warehousing	Agriculture, trade	Information and communication industry

New strategy change	Old strategy change	Rolling planning
Foreign or mixed ownership	Domestic ownership	Mixed ownership
Legal entity ownership (company)	Private ownership	Private ownership or company/companies, but not mixed ownership
Large to mid-size companies	Micro-enterprises and SMEs	Large companies

Source: Author

With regard to the harmonization of changes in strategy and structure, the dates of the two changes coincide in almost three quarters of the surveyed companies (72.3%). 22% changed their strategy and structure within two years, while 14% did so 2–3 years ago, and 37% did so more than three years ago. For the remaining 20.8%, these dates do not coincide. 7% have rolling strategic planning. Overall, the changes in strategy and structure go hand in hand in most cases. Thus, there is a significant relationship between the two variables, which is slightly stronger than average (Cramér's $V = 0.643$; $p = 0.000$).

Figure 1 shows that strategy awareness increases linearly with company size. Thus, the strategy awareness of companies with fewer than 50 employees is already well below average. On the one hand, the strategy awareness of businesses that are owned by companies or have a mixed ownership background is above average. On the other hand, the strategy awareness of companies that are privately owned is below average. The situation is similar with regard to the nationality of the owners: the strategy awareness of companies with foreign or mixed domestic and foreign ownership background is above average, whereas that of companies with only domestic ownership is below average. In terms of scope of activities, companies operating in the fields of the processing industry and the information and communication industry have above-average strategy awareness. Trading companies have average-level strategy awareness,

while companies engaged in agriculture, transportation, and warehousing are below average. Deviations from the main mean shown (see the red vertical line) are significant ($p = 0.000$) *(Figure 1)*.

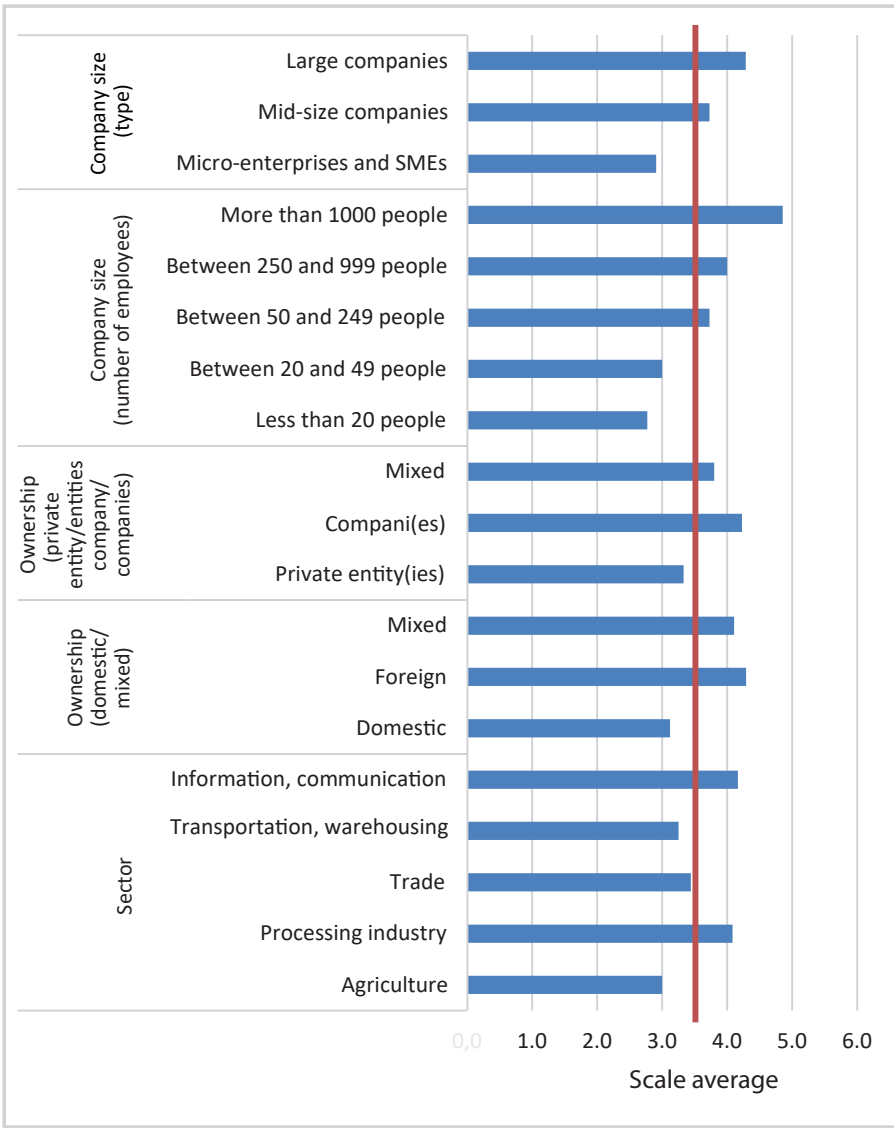

Figure 1. Strategy awareness in each research category
Source: Author

On the basis of these significant differences, we can formulate the profiles of strategically conscious companies *(Table 3)*.

Table 3. Company profiles by strategy awareness

Strategy awareness	
High	**Low**
Processing industry, information and communication industry	Agriculture, transportation, warehousing
Foreign or mixed ownership	Domestic ownership
Legal entity ownership	Private entity ownership
Large companies	Micro-enterprises and SMEs
The time of strategic and structural changes coincides	Strategic and/or structural changes took place more than two years ago

Source: Author

3.2. For RQ2

RQ2: What benefits can companies accrue through their digital strategy? How can they do this? What are the prerequisites for this?

A path model was created in order to answer the second research question and to test the hypotheses derived from RQ2. This model consists of a series of overlapping partial regression models. The starting point was the following: The specifics of the company's strategy formulation influence the exploitation of the preconditions for the digital transformation. This has a direct impact on the perceived importance of the driving forces of the digital transition. This, in turn, directly affects the exploitation of process benefits. However, the acquisition of these benefits is also influenced by the effects of limiting factors. In addition, it seems that the specifics of strategy formulation can directly influence the efficiency of exploiting the process benefits. The concept of the model is illustrated in the diagram shown in *Figure 2.*

Figure 2. Schematic causal diagram
Source: Author

The path model illustrates the existence of the following relationships:

- The extent of the benefits of digitalization is influenced by the goals that drive the company towards digitalization and the extent to which this process is limited by internal and external factors.
- The strategy awareness of companies influences the extent to which a company can take advantage of the preconditions for the digital transformation, which have different effects on the target system of the digital strategy (driving forces) and thus on the benefits of digitalization.
- The strategy formulation process affects the extent to which a company can reap the benefits of digitalization.

The path model, therefore, includes both direct and indirect effects. On the one hand, it contains the schematic causal relationships (direct effects) shown in *Figure 2,* and on the other hand, it contains indirect effects that some explanatory variables have on the outcome variable through other explanatory variables. Indeed, a great advantage of this model is the demonstration of the latter mediative effects, in addition to showing the direct effects. As the method allows the incorporation of causality, the variables aggregated by factor analysis, which are connected by arrows in the model, express causal relationships: the explanatory variables behave as causes, and the independent variable behaves as an effect.

The purpose of this model is to break down the zero-order linear correlation between the (exogenous) independent variables and the dependent variable into two additive parts. One part is the direct effect that can be used to explain the results in the process. The other part is the effect that the independent variable has on this variable through other intermediate variables (preconditions, incentives). The conceptual structure of the model based on the hypotheses is illustrated in *Figure 3.*

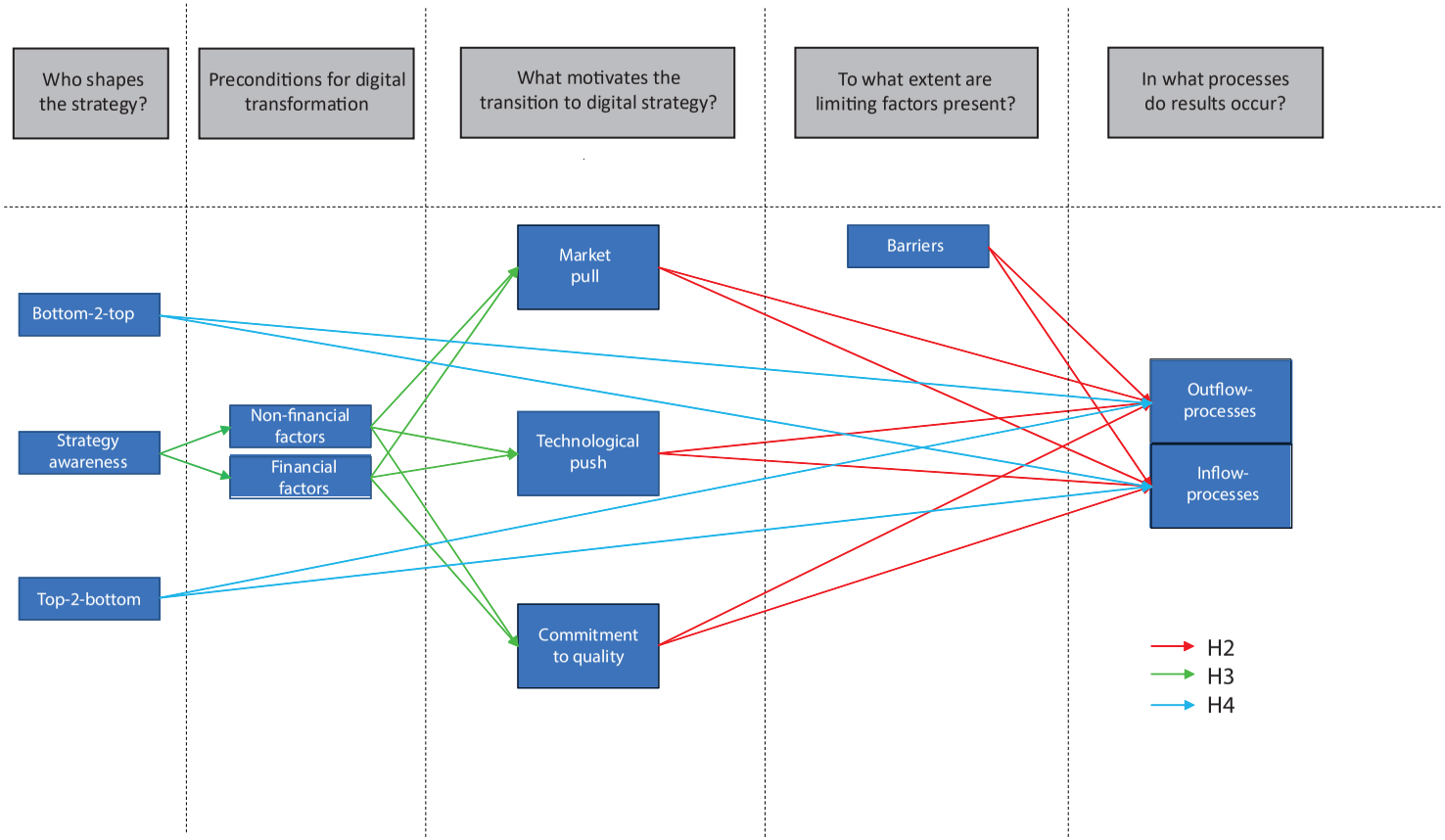

Figure 3. Conceptual path model

Source: Author

To test the model, six chained partial regression models were built and ran. Their performance was measured on the basis of the criteria described in the hypotheses. The following causal relationships were found:

- A company's strategy awareness clearly and decisively influences how well the company can capitalize on the preconditions for digital transformation. However, it is very important that this strategy awareness only affects non-financial factors. This connection, therefore, means that the more consciously a company formulates its strategy, the more important the non-financial factors are to the company in the digital transformation. This suggests that the role of financial factors – their importance as one of the preconditions for the digital transformation – is not related to strategy awareness. The importance of non-financial factors in the digital transformation is explained by strategy awareness in 18.7%. This explanatory power can also be generalized to the population ($p = 0.000$).
- The model also shows that the market pull is not explained by any endogenous variables within the company. Thus, the market pull is an external feature that the company needs to recognize.
- Nevertheless, the technological push and the commitment to quality are clearly influenced by the existence of the preconditions for digital transformation in companies. The technological push is evidently influenced by non-financial and financial factors. These two factors explain the technological push in 24.3%. This explanatory power can be generalized to the population ($p = 0.001$). Interestingly, the role of non-financial factors ($\beta = 0.250$) in this causal relationship is almost half as important as the role of financial factors ($\beta = 0.411$). Therefore, financial factors play a much more important role in the technological push than non-financial factors. In addition, the preconditions for the digital transformation are also related to the commitment to quality: the deeper a company's commitment is to quality, the more important the financial factors are ($\beta = 0.274$) as preconditions for the digital transformation. The commitment to quality is explained by the importance of financial factors in 16.7%. This explanatory power can be generalized to the population ($p = 0.031$).

- The results of the transition to digital strategy were categorized as two process groups. One group contains the outflow processes, i.e., the outward-looking, externally oriented processes of the company. The other group encompasses the inflow processes, i.e., the elements that flow into the value chain and the internal or internally oriented processes of the company. These are affected by different factors in the digital transformation process. The outflow processes are significantly affected by the market pull, the technological push, and potential barriers in the implementation of the digital strategy. Thus, the outflow processes are explained in 31.2% by these three factors. This explanatory power can be generalized to the population ($p = 0.001$). Of the explanatory variables, the market pull is the most important ($\beta = 0.393$), the technological push is less important ($\beta = 0.213$), and barriers, the effect of which is also not negligible, have a minus sign ($\beta = -0.238$). The presence of the latter, therefore, has a negative effect on the benefits that can be exploited in connection with the outflow processes, but it does not affect the inflow processes. At the same time, the commitment to quality has no effect on the results in the processes. In contrast, the inflow processes are not explained at all by the driving forces of the digital transformation. The process and method of strategy formulation have the most direct effect on the inward-looking processes because the bottom-up digital strategy formulation process serves the exploitation of the benefits of the transition much more ($\beta = 0.332$) than the top-down strategy ($\beta = 0.117$). Overall, 26.9% of these strategic construction methods explain the results of the digital transformation related to the company's externally oriented processes. This explanatory power can be generalized to the population ($p = 0.047$).

These causal relationships are illustrated in the block diagram of the path model in *Figure 4,* showing the direction of the relationship (sign of the coefficient), the strength of the relationship (the value of the standardized beta coefficient), and the level of significance of the relationship *(p).*

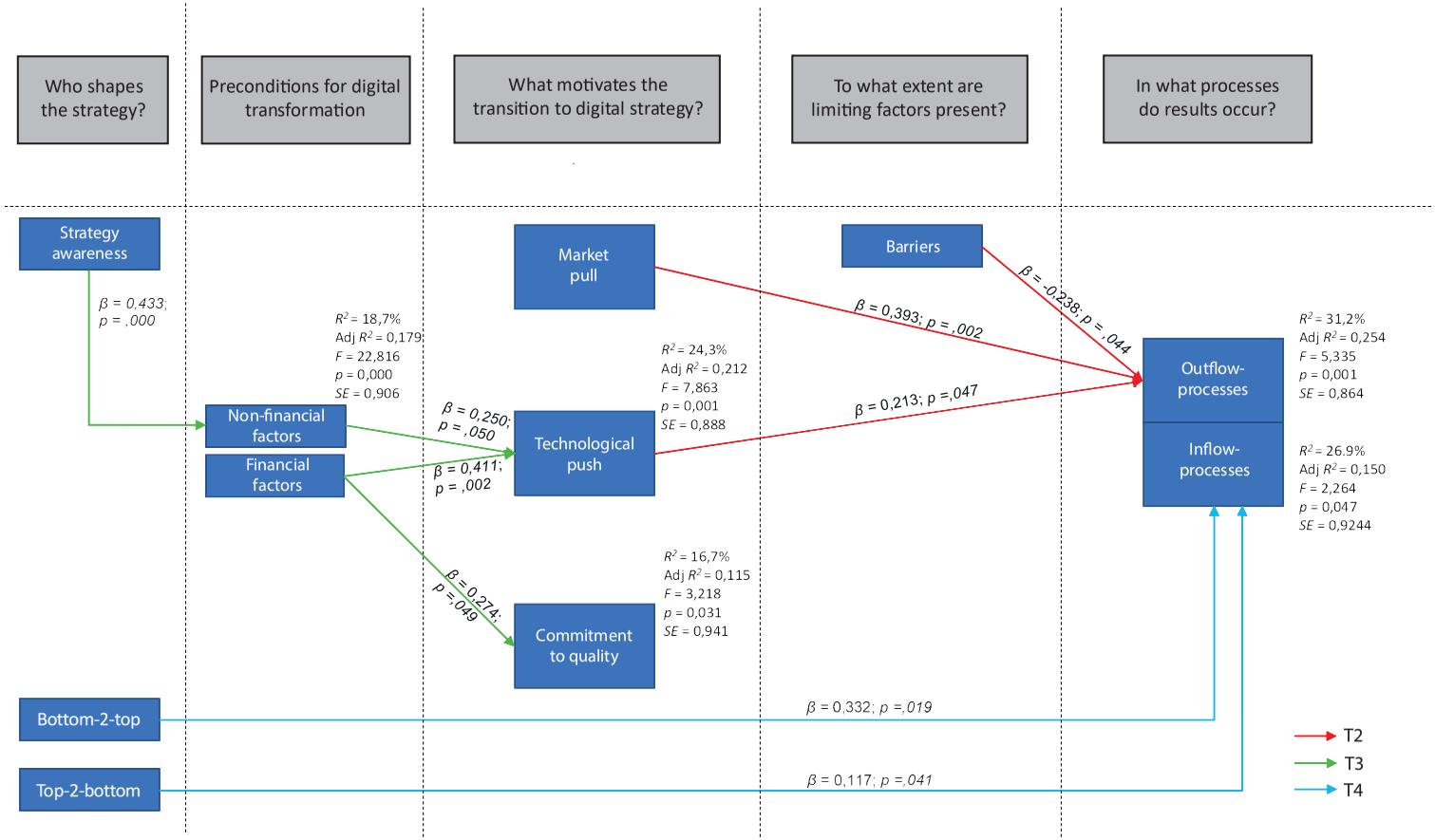

Figure 4. Significant effect lines of the path model ($p < 0.05$) with standardized coefficients
Source: Author

3.3. New scientific results

The novelty of the dissertation is that after reviewing the significant correlations published in the relevant literature, a complex causal model (path model) was compiled based on these correlations. This model outlines the path starting from the strategic features, through the preconditions of digitalization and the push and pull effects of the transformation to digital strategy, up to the expression of the effects on the process results, also taking into account the possible limitations.

The dissertation is also novel because the sampling population was defined as companies operating along agricultural and food supply chains in a complex environment, typically in agriculture, the processing industry, transportation, warehousing, trade, and the information and communication industry. It was important to have a relatively heterogeneous sample containing companies of different sizes so that the conclusions can be properly differentiated. An important aspect during the sampling was that the companies had a domestic location and, if possible, they were involved in strategy formulation not only in Hungary but also in Central and Eastern Europe. Obviously, this aspect was most characteristic of large companies. Similar research works concerning these companies have not set up such a model in the past.

Based on the model, the following conclusions were drawn in the dissertation:

1.
Strategy awareness here means that (1) the company has conscious strategy formulation processes, (2) the company's strategy is regularly reviewed, and (3) this is adjusted to environmental and market changes. Due to frequent changes in the environment, the time horizon of the strategy formulation processes and of their review frequency has been

shortened. Updating corporate strategy is an important tool for adapting to the environment and for maintaining competitiveness. Irrespective of the industry composition of the sample of companies examined, it was found that companies have high levels of strategy awareness if the date of strategic and structural changes coincides or at least one of these changes is relatively recent (not older than 2 years per the survey), or if they have rolling planning. This was typically true for companies operating in the processing industry and in the information and communication industry. In terms of ownership, companies owned by legal entities with foreign or mixed ownership are more strategy conscious. Considering company size, large companies are more strategy conscious. In contrast, domestic, mainly privately owned, typically micro and small enterprises operating in agriculture, transportation, and warehousing are less likely to engage in formal strategy planning.

2.

When examining the importance and extent of the benefits of digitalization, the results of the transformation to digital strategy were categorized as two process groups. One group includes the company's outward-looking, externally oriented processes, such as marketing, sales, and customer relationships. The other group contains the elements that flow into the value chain and the company's internal or internally oriented processes, i.e., procurement, production, and logistics. These are affected by different factors in the digital transformation process. It was found that in the case of outward processes the most important factors in exploiting the benefits are those that have an impact on the market, i.e., the market pulls, which are basically the fear of lagging behind competitors, cost reductions, regulatory changes in the industry, and changes in customer attitudes and preferences. However, the technological push, which includes new commercial or business models, rapid technological development, and the opportunity for accessing advanced technology, also plays an important role. The biggest impediments to the implementation of the digital strategy are the priority given to other urgent tasks related to day-

to-day operations, the significant difficulties in transforming existing systems, and the lack of a designated person in charge of digitalization in the company's human resources. At the same time, the company's internal orientation processes are not affected by these factors. These are influenced by the strategy formulation process. The most effective use of the benefits is provided by bottom-up strategic planning.

3.

When examining the preconditions of corporate strategy awareness and digital transformation, it was found that the strategy awareness of a company clearly influences the extent to which the company can take advantage of the preconditions for digital transformation. In terms of the technological *push,* financial factors play a much more important role than non-financial factors. In addition, the preconditions for digital transformation are related to the commitment to quality. The higher a company's commitment is to quality, the more important financial factors are as prerequisites for the digital transformation. However, it has to be noted that strategy awareness, as a precondition for the digital transformation, only affects non-financial factors. Therefore, this connection means that the more conscious a company is in its strategy formulation, the more important non-financial factors are for the company's digital transformation. Thus, the role and importance of financial factors as a prerequisite for the digital transformation are not related to strategy awareness.

4.

The strategy formulation process clearly influences the extent to which a company can reap the benefits of digitalization. However, the inflow processes are not explained at all by the driving forces of the transformation to a digital strategy. These processes are directly affected by the process and method of strategy formulation as the bottom-up digital strategy formulation process makes the exploitation of the transition benefits much more possible than forcing a top-down strategy on the organization.

5.

The path model itself, which is illustrated in *Figure 36,* can also be considered a new scientific result. In addition, the sampling of the surveyed companies by industry can be considered as a novelty, which came from industries operating along the agro-food supply chains, typically agriculture, processing industry, transportation, warehousing, trade and information and communication industries.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions, research theses

The results of the research are similar to the processed literature in many respects, but there are also differences. Among the factors stimulating the digital transformation, the improvement of the internal (production, logistics) processes became more important in both the literature and the present research, which can be imagined in the research by reducing costs and increasing quality. However, the need for cost reduction did not appear as an internal motivation, but as a market *pull,* say as an external motivating force arising from the competitive situation. Most of the incentives identified in the literature as external factors were also confirmed among the surveyed companies:

- increase in customer expectations,
- fear of falling behind competitors or
- compliance with regulations

an important motivating factor for companies involved in research.

It is interesting to note that following new business models is a kind of technological pressure for domestic companies, as opposed to the change dictated by their own corporate strategy, which is e.g. Yang, Fu & Zhang (2021) suggest. In the examined model, I classified the emergence of new technologies and the expanding possibilities of access to them into the group of technological push. This factor was not included in the literature models in this form, but it also appears indirectly in these through customer expectations and incentives from supply chain partners.

There is a relatively large consensus in the literature on the range of factors hindering digitization, but these are grouped differently in each source. The present research did not provide a solution to this problem either, as a single factor was combined during the factor analysis, say we did not find a statistically substantiated basis for group formation. The

assessment of each of the impediments overlapped with the findings in the literature in several respects:

- the complexity and interconnectedness of existing systems is a major obstacle, making it difficult to implement comprehensive systems,
- serious data security concerns,
- lack of necessary human skills and
- financial resources as well
- there is no person responsible for digitalization, which suggests the shortcomings of the digital strategy.

However, it is often mentioned in the literature:

- the restrictive effect of corporate culture,
- lack of senior management commitment or
- lack of knowledge of the benefits

(see, e.g., Cichosz, Wallenburg, & Knemeyer, 2020; Diener and Špaček, 2021; Malenkov et al., 2021) was not typical among the companies we surveyed.

At the same time, I identified the focus on day-to-day operational tasks as a new constraint that distracts attention and resources from digitalization.

In terms of the expected benefits of digitalization, the research confirmed expectations for benefits at the company level. Both the internal processes and the customer markets aspect have emerged markedly, the groups of factors obtained during the factor analysis can be well matched by Parviainen et al. (2017) and Strønen (2020), although these are not fully covered. Of the two factors, the outflow (customer) aspect was the most prominent, with companies expecting benefits primarily here, but expectations are also high in logistics.

The first area of research was related to the strategy awareness of companies. The analysis concerned the differences between strategically conscious and less conscious companies. Regarding strategy awareness, a hypothesis was formulated. To test the hypothesis, Part 1 (general information) and Part 2 (the strategic characteristics of the company) of the questionnaire were used.

H1: Companies have more strategy awareness if the time of their strategic and structural changes coincides, if they adapt their strategy and/or structure to changes in the environment faster and more often, and if they have a multinational background.

To test the hypothesis, the date of the companies' last structural and strategic changes was determined from the processed data per industry branches, and in terms of ownership and company size. Afterwards, the companies' strategy awareness was examined in these respects, and then the degree of strategy awareness was studied based on the time of the strategic and structural changes. From the obtained results, the following thesis was formulated, with which **hypothesis H1 was accepted.**

T1: Companies have more strategy awareness if the time of the changes in strategy and organizational structure coincides, and if they have a large corporate background.

The research showed that companies are more strategically conscious if the time of the changes in strategy and organizational structure corresponds, or if at least one of these changes happened less than two years ago. These companies are typically large companies owned by foreign or mixed ownership legal entities in the processing industry or the information and communication industry.

The second area of research concerned the benefits of digitalization and digital strategy. The focus was on the kinds of benefits companies make use of, and the ways in which they can exploit these, through their digital strategy. The preconditions for this were also in the spotlight. Regarding digitalization, three hypotheses were formulated. To examine the hypotheses, Part 3 of the questionnaire (the company's digitalization strategy) was used.

H2: The importance and extent of the benefits of digitalization are influenced by the goals that drive the company toward digitalization and

the extent to which certain conditions limit the company from reaping the benefits inside and outside of the company.

H3: The strategy awareness of companies influences the extent to which a company can take advantage of the preconditions of the digital transformation, which have different effects on the target system of the digital strategy (so-called driving forces) and thus on the benefits of digitalization.

H4: The strategy formulation process affects the extent to which a company can reap the benefits of digitalization.

In order to test the hypotheses, the following were analyzed according to industry branch, ownership composition, and size: the actors in strategy formulation, and the substrategies that make up the strategy (marketing, sales, customer relationships, procurement, production, and logistics). Then, the significance of the strategic changes caused by the epidemic in the companies and the importance of the factors of digital transformation were analyzed.

The examination of the companies' digitalization strategies assessed the distribution of the completion dates of the current digital strategies, the scope and goals of the digital strategic transformation, the factors encouraging and limiting the transformation and its realization, the benefits of digitalization, the important technologies, and the priority of critical steps.

To answer the second research question and to test the hypotheses derived from it, a path model was created to illustrate the direct and indirect effects and causal relationships, indicating the direction of the relationship (the sign of the coefficient), the strength of the relationship (the value of the standardized beta coefficient), and the significance level of the relationship (p). The following theses can be formulated from the path model, with which **hypotheses H2, H3 and H4 were accepted.**

T2: The market pull plays the most important role when reaping the benefits of digitalization that affect a company's outflow processes. In addition, the technological push plays a vital role. Nonetheless, limiting factors block the effectiveness of exploiting the benefits.

On the basis of the path model, it can be stated that the market pull has the most important role in exploiting the benefits of digitalization that affect the company's outflow processes (marketing, sales, and customer relations). In addition, the technological push also plays an important role. However, limiting factors can block the effectiveness of exploiting the benefits. Nonetheless, these factors do not affect the company's internally oriented processes (procurement, production, and logistics), which are only affected by the strategy formulation process. The most effective use of the benefits is provided by bottom-up strategic planning.

T3: During the transformation to digital strategy, strategy awareness influences the exploitation of the preconditions for digital transformation, which affect the profit from digitalization through the target system of the digital strategy.

On the basis of the path model, it can also be stated that the impact of the technological push in the transition to digital strategy is much more induced by financial factors than by non-financial factors, while the commitment to quality as one of the drivers of the transformation to digital strategy is influenced by financial factors. However, strategy awareness, as a precondition for the digital transformation, only affects non-financial factors. The importance and existence of financial factors are beyond the company's strategy awareness.

T4: The strategy formulation process clearly influences the extent to which a company can reap the benefits of digitalization.

On the basis of the path model, it can also be stated that the strategy formulation process clearly influences the extent to which a company can reap the benefits of digitalization. However, this influence only affects the company's inflow processes (procurement, production, and logistics), and the bottom-up approach in strategic planning is twice as efficient during the digital transition.

4.2. Limitations of the study and further research

The questionnaire was filled out by means of phone interviews at specific times to which the managers of the participating companies agreed in advance, so their willingness to answer was high. 101 questionnaires were completed by these managers. 52 of the companies had some kind of digitalization strategy. This sample size contained enough information to test the hypotheses of the doctoral dissertation. A further possibility would be to expand the research by examining a higher number of samples for the given supply chains and for the digitalization strategy in order to increase the representativeness of the research.

During the completion of the questionnaire, companies with domestic locations were included in the sample. The composition of the sample was heterogeneous in terms of company size, with the majority of large corporate participants having responsibilities in Central and Eastern Europe. International comparisons with one or more countries could be made in further research. Supply and value chains have changed due to the pandemic, with more local and regional companies being involved due to easier supply and shorter transport routes. There are typically more Tier 1-2-3-4 suppliers in Eastern Europe due to lower labor costs, so a comparison with other regions within Europe would also be interesting.

A further area of research could be comparisons with supply chains in other industries, such as the electronics industry. This branch is currently

struggling with long delivery times, mainly due to a shortage of raw materials and chips. In addition, here other aspects are typically more important than in the agrifood supply chains.

A further research opportunity could be to explore whether the emergence of new technologies in the market, directly or through other stakeholders (customers, competitors, suppliers), motivates companies to adapt to digital technologies through their motivation.

To date, the present research has not addressed the benefits that can be realized at the supply chain and industry level (see, e.g., Yang, Fu & Zhang, 2021 and Parviainen et al., 2017), as well as specific areas such as sustainability and innovation. I identified these as further research opportunities.

5. BIBLIOGRAPHY

1. EPIC INNOLABS (2022): Ipar 4.0 a Covid idején. https://epicinnolabs.hu/ipar-4-0-a-covid-idejen/. Downloaded on January 5, 2022.
2. E. SZABÓ L., GYENIS B., GYENIS Z., RÉDEI M., SZABÓ G. (2010): Korrelációk kauzális magyarázata. Magyar Filozófiai Szemle, 54 (3) pp. 78–97. http://real.mtak.hu/33975/1/E._Szabo_Laszlo_Gyenis_Balazs_Gyenis_Zalan_Redei_Miklos_Szabo_Gabor_Korrelaciok_kauzalis_magyarazata_u.pdf. Downloaded on February 10, 2022.
3. EUROPEAN COMMISSION (2021): A munkahelyek és a gazdaság védelme a koronavírus-világjárvány idején. https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/jobs-and-economy-during-coronavirus-pandemic_hu. Downloaded on January 18, 2022.
4. FREEDMAN, D. A., PISANI, R., PURVES, R. (2005): Statisztika: Statisztikai módszerek a társadalomkutatásban. Budapest, Typotex.
5. FÜSTÖS L., KOVÁCS E., MESZÉNA GY., SIMONNÉ MOSOLYGÓ N. (2004): Alakfelismerés: Sokváltozós statisztikai módszerek. Budapest, Új Mandátum Könyvkiadó.
6. HAUSSMANN R. (2020): A globális ellátási láncok átalakulása a feldolgozóiparban a koronavírus-járvány következtében. Hitelintézeti Szemle, 19 (3) pp. 130–153. https://hitelintezetiszemle.mnb.hu/letoltes/hsz-19-3-e1-hausmann.pdf. Downloaded on February 17, 2022.
7. LENTNER CS. (2021): A Covid 19-járvány hatásai a magyar gazdaságra és a fiskális válságkezelés főbb területei. Új Magyar Közigazgatás, 14 (3) pp. 1–8.
8. MCKINSEY GLOBAL INSTITUTE (2020): Risk, resilience and rebalancing in global value chains. https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Operations/Our%20Insights/Risk%20resilience%20

and%20rebalancing%20in%20global%20value%20chains/Risk-resilience-and-rebalancing-in-global-value-chains-full-report-vH.pdf.
Downloaded on December 6, 2021.
9. NORTHCOTT, R. (2008): Can ANOVA measure causal strength? The Quarterly Review of Biology, 83 (1) pp. 47–55.
10. SZEGEDI Z. (2017): Ellátásilánc-menedzsment: Elmélet és gyakorlat. 2nd, e-book edition. Budapest, Kossuth Kiadó.
11. SZÉKELYI M., BARNA I. (2004): Túlélőkészlet az SPSS-hez: Többváltozós elemzési technikáról társadalomkutatók számára. Budapest, Typotex, 453 p.

6. LIST OF THE AUTHOR'S PUBLICATIONS

Scientific journal articles

Published in Hungarian

ULECHLA G. (2011): A szállítási határidő csökkentésének módja és korlátai multinacionális termelő vállalatok esetén. In: BOKOR Z. (Ed.): Logisztikai *Évkönyv* 2012. Budapest: Magyar Logisztikai Egyesület, pp. 234–238.

KARMAZIN GY.–ULECHLA G. (2013): A termékek és szolgáltatások kombinációjának hatása a logisztikai szolgáltatókra. In: BOKOR Z. (Ed.): Logisztikai *Évkönyv* 2014. Budapest: Magyar Logisztikai Egyesület, pp. 86–90.

KARMAZIN GY.–ULECHLA G. (2015): A logisztika kihívásai a 21. században. In: KARMAZIN GY. (Ed.): Logisztikai trendek *és* legjobb gyakorlatok, I (2), pp. 49–54.

MARKOVITS-SOMOGYI R.–ULECHLA G. (2016): Időalapú verseny az ellátási láncban. In: KARMAZIN GY. (Ed.): Logisztikai trendek *és* legjobb gyakorlatok, II (1) pp. 5–7.

KARMAZIN GY.–TÓTH R.–ULECHLA G. (2017): Az ellátásilánc-menedzsment szervezeti struktúrája 2. In: BGE Logisztikai-Informatika-Menedzsment (LIM), II (1) pp. 6–21.

SZEGEDI Z.–ULECHLA G.–GÁBRIEL M. (in press): A digitális átalakulás a közép- és kelet-európai régióban az ellátási láncok mentén. In: OLÁH J. (Ed.): Logisztikai trendek *és* legjobb gyakorlatok.

Published in English

ULECHLA, G. (2012): Logistics as part of operating efficiency in multinational manufacturing companies. In: Z. BOKOR (ed.): Logisztikai *Évkönyv* 2013. Budapest: Magyar Logisztikai Egyesület, pp. 111–117.

ULECHLA, G. (in press): Strategy awareness and digitalization in the supply chains of Central and Eastern European companies. In: Sz. Duleba (ed.): Logisztikai *Évkönyv* 2023. Budapest: Magyar Logisztikai Egyesület.

SZEGEDI, Z.–ULECHLA, G.–GÁBRIEL, M. (in press): Digital Transformation Entlong Supply Chains in Central and Eastern Europe.

ULECHLA, G.–SZEGEDI, Z.–ILLÉS, B. CS. (in press): Strategy Awareness and Digitalization of Supply Chains of the Food Sector.

Presentations at scientific conferences published in conference proceedings

Conferences in Hungarian

ULECHLA G. (2011): A szállítási határidő csökkentésének módjai multinacionális termelő vállalatoknál. NYME KTK. Változó környezet – Innovatív stratégiák, Nemzetközi tudományos konferencia a magyar tudomány ünnepe alkalmából. Versenyképesség, Innováció, Hatékonyság szekció. November 2, 2011, Sopron, pp. 1175–1181.

ULECHLA G. (2012): A működésből származtatott versenyelőnyök ipari termelő nagyvállalatoknál. Sapientia EMTE Csíkszeredai Campusa. Vállalkozói és gazdasági trendek a Kárpát-medencében konferencia. Menedzsment szekció. April 20–22, 2012, Csíkszereda, Volume 2, pp. 103–110.

KARMAZIN GY.–ULECHLA G. (2015): A hálózatkutatási eredmények figyelembevétele a logisztikai szolgáltatók üzleti tevékenysége során. BGF KVIK KÖT Tudományos Szimpózium. Multidiszciplináris kihívások, Sokszínű válaszok. April 28, 2015, Budapest, pp. 94–104.

Conferences in English

KARMAZIN, GY.–ULECHLA, G. (2015): Development of companies operating logistics service centres by employing the results of network research. 8th International Conference for Young Researchers. June 15–17, 2015, Gödöllő. Studia Mundi – Economica (2015) 2 (1), pp. 77–84.

KARMAZIN, GY.–ULECHLA, G. (2015): Challenges of the 21st century and their impacts on future logistics solutions. 2nd edition of the International Conference on Economics and Business Management ICEBM 2015. November 20–21, 2015, Cluj-Napoca, Romania.

Book chapters

In Hungarian

KARMAZIN GY.–DUMA L.–GÁL I.–ULECHLA G. (2015): Logisztikai szolgáltató központok fejlesztése hálózati kutatások eredményeinek felhasználásával. In: Folyamatmenedzsment kihívásai, Döntési pontok, kapcsolatok és együttműködési stratégiák a gyakorlatban. Gödöllő: Szent István Egyetem, Gazdaság- és Társadalomtudományi Kar, Üzleti Tudományok Intézete, Tevékenység-menedzsment és Logisztika Tanszék, pp. 57–70.

Other journal articles

In Hungarian

ULECHLA G. (2011): A flottamenedzsment pozitív hatásai. In: Tranzit: az *üzleti élet*, a logisztika *és* a gazdaság szakmai lapja, 12 (4), pp. 48–50.