

PROFIT OR LESS WASTE? DIGITAINABILITY IN SMEs - A COMPARISON OF HUNGARIAN AND SLOVAKIAN SMEs

Réka Saáry, Judit Kárpáti-Daróczi and Andrea Tick*

*Óbuda University, Keleti Faculty of Business and Management, 15-17 Tavaszmező str.
Budapest, 1084, Hungary*

(Received 13 February 2022; accepted 25 March 2022)

Abstract

SMEs operating in the 21st century must face several challenges including a push towards digital transformation, reorganising business operations to maintain sustainability but on the other hand not to lose profit and keep the business running. This paper aims to reveal whether the profit and the high rate of digitalisation or the sustainability concerns are the main driving forces of SMEs in Hungary and Slovakia. The paper analyses 210 observed SMEs and uses the CHAID decision tree method parallel to factor and cluster analyses to explore the similarities and differences in Hungarian and Slovakian SME behaviours. The results show Slovakian SMEs have a more positive attitude to digitalisation; both Hungarian and Slovakian SMEs are split into two groups in terms of approach to digitalisation and sustainability while the significant differences vary provided the questions of cost and resource reduction, extension of product life cycle or higher productivity are concerned. SMEs in both countries agree that business models need to be adjusted to digitalisation and sustainability while they are concerned about the negative impact of digitalisation although significantly differently.

Keywords: digitalisation, SME, sustainability, digitainability, SDGs, Visegrad Four countries

1. INTRODUCTION

The competitiveness of a country is determined equally by its economic growth, its potential for sustainable development and also by its social conditions. In general, competition between nations is a

fundamental factor in increasing prosperity (Csath et al., 2020), and the competitiveness of individual countries can only be improved today if they have social capital for innovation. Despite their financial vulnerability, small enterprises are important

* Corresponding author: tick.andrea@uni-obuda.hu

players in national economies (Majláth et al., 2019), both in terms of employment and economic performance, but they also deserve special attention for their potential for innovation (European Commission, 2004). A significant proportion of innovation in recent decades has been technology-driven and as such can be linked to digitalisation (Bencsik, 2021). The ability to innovate on the basis of technology also partly determines the digital performance of individual countries, which can be measured (with limitations) by the DESI index (Marcysiak & Pleskacz, 2021).

In addition to the numerous other benefits of digitalisation (increased productivity, cost reduction, etc.), it can also have a positive impact on the environmental performance of companies (Szalavetz, 2017). At the same time, research studies on the relationship between the two areas are revealing an increasing number of negative effects, as a growing number of studies are drawing attention to the environmental burden and the negative social consequences of digitalisation (Berkhout & Hertin, 2004).

This paper analyses the relationship between digitalisation and sustainable business operations in the perspective of SME owners and managers. While the topic is relevant per se, the study also seeks to explore the background of the differences between the digital performance of two countries, Hungary and Slovakia, along the lines of the indicated issue.

The comparison of Hungarian and Slovak opinions is justified for several reasons. The two neighbouring countries had roughly the same starting position after the change of the communist regime, but in recent years Slovakia's economic performance has exceeded that of Hungary. While the number of SMEs in Slovakia (487k in 2021) is only slightly more than half of the number of

small enterprises in Hungary (851k in 2020), the distribution of enterprises in the two countries is almost identical in terms of size categories (eg. companies with employees between 0-9 make up 96% of SMEs in Hungary and 97% in Slovakia) (Statista, 2022). The economic performance of the two countries differs in a number of indicators, Slovakia is, however, just barely ahead of Hungary in the DESI ranking.

The Digital Economy and Society Index (DESI) monitors Europe's overall digital performance and tracks the progress of EU countries in their digital competitiveness (European Commission, 2021). The DESI 2021 index ranks Hungary 23rd in the EU 28 with a score of 41.2 (the EU average is 50.7). At the same time Slovakia is ranked 22nd, one place ahead of Hungary with a score of 43.2. To understand the reasons behind the rankings achieved by the two countries, Table 1 presents their performance along some selected key indicators.

Over the past few years, both Hungary and Slovakia have improved their scores to similar extent to a rate broadly like the EU average, but both countries' digital development is still below the EU average (European Commission, 2021). However, Slovakia performs better than Hungary in almost all sub-indicators. The proportion of enterprises with High levels of Digital Intensity in the two countries is about 10%, which is 5% below the EU average. Enterprises with very low levels of Digital Intensity are more typical.

This paper poses the following research questions (2) How similarly Hungarian and Slovakian SMEs are prepared for company sustainability through digitalisation? (3) Does SME behaviour in digitalisation depend on business size, age and economic sector in Hungary and Slovakia?

Table 1. Digitalisation among SMEs in Hungary and in EU; % (European Commission, 2021)

eBusiness	Year	EU average (%)	Hungary (%)	Slovakia (%)
<i>Enterprises with high levels of Digital Intensity</i>	2020	14.40	9.77	9.99
<i>Enterprises with very low levels of Digital Intensity</i>	2020	39.80	54.4	47.80
<i>Integration of internal processes (ERP)</i>	2019	34.7	13.0	29.4
<i>E-invoicing</i>	2017	17.1	7.89	17.2
<i>Supply chain Management</i>	2017	17.6	7.86	13.7

The paper is organised as follows: after the introduction of the terms digitalisation, sustainability and digitability, it presents the applied methodology and data collection methods, then the next section gives the demographic profile of the sample and presents participating SMEs' responses. The results section also discusses the findings and implications and the conclusions on the research questions are made in the discussion and the conclusion section.

2. LITERATURE REVIEW

Digitalisation and sustainability are by far the two most dominant megatrends nowadays. Before discussing the relationship between the two phenomena, it is important to understand the two notions separately. The term digitalisation can be understood from both a technical and a business perspective (Şerban, 2017). In technical sense, it refers to the digitisation of processes, contents and objects that were previously physical or analogue (Csedő et al., 2019) while as a business term, it describes newly created business models and processes as well (Gubán & Sándor, 2021). Digitalisation has a significant impact on the business operations, as the introduction of new technologies usually improves efficiency and

increases revenue, helps cost-reduction, contributes to business diversification (Gerasimenko & Razumova, 2020), therefore it should be understood as a transition to a new digital business model (Gartner, 2019). This paper uses the term digitalisation in the business context as described.

Sustainability also has a major impact on the evolution of business models. In today's interpretation, corporate sustainability is defined as a set of guidelines by which the organisation creates social and environmental value (Elkington, 2018), without overriding economic considerations. A large number of studies on the relationship between business and environmental performance of companies are based on the assumption that most companies have a high potential for eco-efficiency, which requires innovation to exploit (Szalavetz, 2017). The success of these innovations depends on the integration of sustainability initiatives into corporate strategy.

Digitainability has emerged as a current term in academic research. The notion itself was recently coined, and it refers to 'the cross-fertilization between the processes of digitalization and sustainable development' (Gupta et al., 2020). In terms of practical applicability, this new concept provides a framework for integrating digital and

sustainability efforts (Lichtenthaler, 2021).

Recent studies on the relationship between digitalisation and sustainability at the enterprise level have typically explored links between digitalisation and sustainability in one specific area such as production, logistics, trade etc. In the case of the supply chain Kayikci (2018) found that digital technology has a significant impact on sustainability, mainly in its economic dimension and less so in the environmental and social dimension. The most extensive relationships emerged in relation to industry and manufacturing companies (Demartini et al., 2019). Several studies revealed the positive impact of digitalisation in terms of cost reduction, carbon emissions, raw material consumption, waste reduction and, implicitly, improved customer satisfaction (Berkhout & Hertin, 2004; Demartini et al., 2019). Regarding the impact of digitalisation on the product life-cycle, it was found that, contrary to preliminary expectations, digitalisation will continue to shorten product life-cycles, as innovation is fostering product replacement, and as a result of product obsolescence product usability experience is steadily decreasing (Ordieres-Meré et al., 2020) A summarising paper on the relationship between digitalisation and sustainability distinguished three broad categories of positive and negative impacts: direct, indirect and structural/behavioural (e.g. green consumption) (Berkhout & Hertin, 2004). According to recent Hungarian qualitative research among company managers, only a few positive effects of information technology on the environment were mentioned, whereas the environmental burden of increased e-waste was noted more significantly (Szalavetz, 2017).

In the present research, the negative and

positive environmental impacts and social contexts of digitalisation were considered simultaneously, with the aim of exploring the attitudes of SME owners and managers regarding the issue, based on their individual perceptions. It is assumed that the differences of opinion revealed will help to understand a narrow slice of the background of the difference between the Hungarian and Slovakian DESI performance.

3. THE CONCEPTUAL FRAMEWORK AND RESEARCH QUESTIONS

The literature review and the responses allowed the researchers to design the conceptual framework of the topic in focus. Figure 1 outlines the main concepts of the research including the two factors identified and validated. The reliability of the items was high (Cronbach's $\alpha=0.921$). The two factors confirmed are the positive or beneficial impacts on digitalisation and the adverse or negative impacts of digitalisation on sustainability, each question has a factor loading over 0.77.

Cluster analysis using KMeans and Ward methods identified two groups of SMEs, one being the Concerned Inspired group and the other being the group of Indifferent Conservatives (Figure 2).

Based on the factors and the cluster differences the following conceptual framework was developed as given in Figure 3. The present study aims to reveal the differences between SMEs' attitude and behaviour regarding digitalisation and sustainability in Hungary and Slovakia.

Consequently, the authors formulated 3 hypotheses on digitainability among SMEs in Hungary and Slovakia.

H1. Hungarian and Slovakian SMEs have

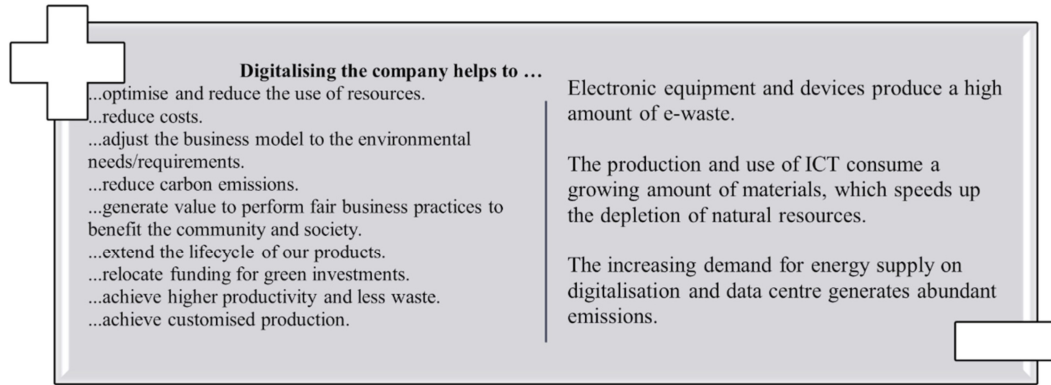


Figure 1. Two factors confirmed related to digitalisation and sustainability

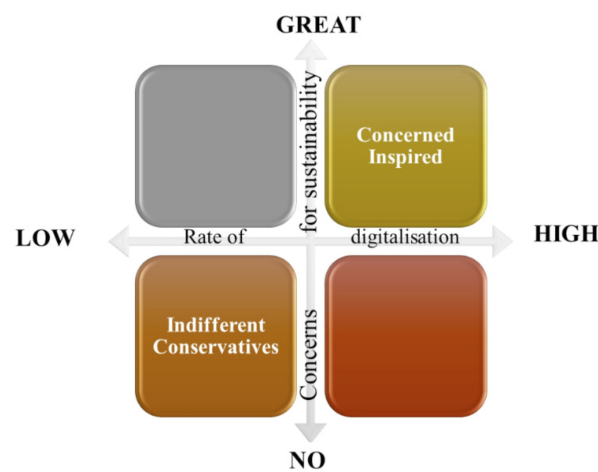


Figure 2. Two clusters identified among responding SMEs from all countries

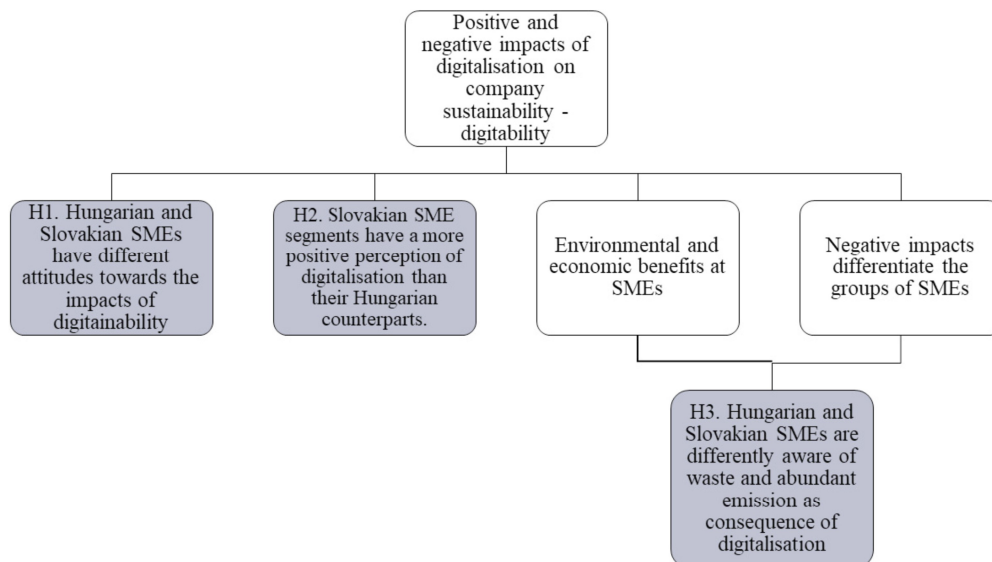


Figure 3. Conceptual research framework

different attitudes towards the impacts of digitainability.

H2. Slovakian SME segments have a more positive perception of digitalisation than their Hungarian counterparts.

H3. Hungarian and Slovakian SMEs are differently aware of waste and abundant emission as consequence of digitalisation.

4. METHODOLOGY AND DATA

The present study is part of the research conducted under the project “Possibilities and barriers for Industry 4.0 implementation in SMEs in V4 countries and Serbia”. The questionnaire used was developed by the international research team from the participating countries, namely Hungary, Poland, Serbia, Slovakia, Slovenia and Bulgaria. Data from SMEs in the participating countries were collected based on a convenient type of sampling, however, in each country over 100 SMEs were questioned. The present study focuses on the questions about the impact of digitalisation on company sustainability and two countries are analysed. The survey applied closed-ended questions in case of the topic of digitalisation related to sustainability with a five-point Likert-scales. The comprehensibility of the questions was checked in a pilot survey. Google form was used for the administration of the online questionnaire, which was accessible in the native language of the participating countries. SMEs were invited to spend 10-15 minutes responding. The questionnaire was disseminated among the respective SMEs in September/October 2021. Anonymity was ensured, no personal information was required. The quantitative research used both the online and paper version of

questionnaire. The team from Serbia merged the data into a combined dataset and shared it with each participating country. The data gathered 635 responses, 110 from Hungary and 100 from Slovakia providing a large enough sample for comparison. Some data cleansing was required due to missing or invalid data so 625 responses were used for factor and cluster analysis. Due to the non-probabilistic method of data collection the dataset does not give a representative sample but well represents the general state of SMEs attitude towards the impact of digitalisation and sustainability in Hungary and Slovakia.

This paper focuses on the questions linked to Digitalisation and Sustainability, namely 13 questions – originally 9 positive impact and 4 negative impacts of digitalisation on sustainability – and the responses from SMEs in Hungary and Slovakia are analysed. Besides the previously described Hungary and Slovakia were selected from the six countries also due to the fact that the distribution of the sample showed similarities in company size and respondent position, which means that the sample structure is similar in the dataset. Quantitative analysis was conducted using the statistical programme SPSS version 25. After some introductory descriptive analysis giving a general view of SMEs’ demographic profile and the approach on sustainability, similarities and differences in the approach of Hungarian and Slovakian SMEs were explored and characterised by country and by the identified clusters. Independent sample tests were also carried out on the clusters in Hungary and Slovakia to reveal the differences between the two countries. Company age, size and the economic sectors were also considered as independent variables for comparison. Finally, a decision tree using the exhaustive Chi2 Automatic

Interaction Detector (CHAID) splitting algorithm helped to reveal the most significant differences between the SMEs from Hungary and Slovakia. The decision tree was not used to rank the questions nor for predictive modelling, but rather to identify questions which emphasised the differences between the observed SMEs and to confirm the importance of the dimension questions. The decision tree was applied as a segmentation process (Cranfield et al., 2021; Mai & Tick, 2021; Dudás, 2018; Hámori, 2001; Kass, 1980;) to provide a visual representation of the important questions.

5. RESULTS

The results section gives the demographic characteristics of the SMEs observed in Hungary and Slovakia, then it aims to find similarities and differences in the approach of SMEs in Hungary and Slovakia toward digitainability. The analysis uses the results of the factor and the two earlier identified clusters, namely the Concerned Inspired and the Indifferent Conservatives.

5.1. Demographic profile

A total number of 635 questionnaires were completed by SMEs in the Czech Republic, Hungary, Poland, Slovakia, Serbia and Bulgaria, each of which could be used for descriptive measures. Table 2 presents the demographic profile of the responding business professionals and SMEs in Hungary and in Slovakia. First, the personal characteristics of the business professionals surveyed are presented. Most Hungarian managers are between 31-60 years old and there is a low proportion of young managers (6.3%). The age distribution of Slovak managers is more even, as more professionals from both younger and older age groups were surveyed. Nearly 70% of the Hungarian managers surveyed were male, compared to 53% of Slovak managers. In terms of position, 75% of the Hungarian respondents are company owners, 16,1% are middle managers and 4,5% managers, which means that 95.6% of the respondents work at the tactical and strategic level of the SME they represent. In contrast, only 21.2% of Slovak respondents are owners, while

Table 2. Demographic profile of respondents and SMEs in Hungary and in Slovakia (nHU=112; nSK=100)¹

Personal characteristics	Hungary (%)	Slovakia (%)	Business characteristics	Hungary (%)	Slovakia (%)
<i>Age</i>			<i>SME size</i>		
18-30	6.3	22	Micro enterprise	66.1	62.0
31-45	38.4	30	Small enterprise	26.8	21.0
46-60	47.3	32	Medium-sized enterprise	6.3	8.0
> 61	8.0	16	Large enterprise	0.9	9.0
<i>Gender</i>			<i>The dominating sector of the company</i>		
Male	68.8	53	Production	12.5	42.0
Female	28.6	46	Services	55.4	40.0
I do not wish to answer	2.7	0	Trade	32.1	18.0
<i>Position</i>			<i>Company age</i>		
The owner	75.0	21.2	21 years and older	25.0	26.0
Senior manager	16.1	25.3	From 11 to 20 years	33.9	21.0
Manager	4.5	35.4	From 3 to 5 years	8.9	8.0
Employee	4.5	18.2	From 6 to 10 years	25.0	21.0
			Up to 2 years	7.1	24.0

¹ Source: All the tables and figures are developed and edited by the authors based on the primary research of entrepreneurial questionnaires

significantly more are managers (35.4%) and employees (18.2%).

The demographic features of the SMEs represented in the survey show (Table 2) that two-thirds of the Hungarian enterprises surveyed are micro enterprises (66.1%), a quarter are small enterprises (26.8%) and 6.3% are medium-sized enterprises. Among Slovak SMEs, a smaller proportion are micro enterprises (62.0%), while a larger proportion are large enterprises (9.0%). Small enterprises represent 21% of the Slovak sample, while medium-sized enterprises represent 8%. A third of the Hungarian enterprises have been in business for 11–20 years, a quarter for more than 21 years, a quarter for 6-10 years, 8.9% for 3-5 years and only 7.1% are younger than 2 years. However, the Slovak sample includes a higher proportion of enterprises up to 2 years (24%) and a lower proportion of enterprises from 11 to 20 years (21%). Different proportions of enterprises are also present in different sectors. While more than half of Hungarian enterprises operate in the services sector, nearly a third in the trade sector and around 10% in the production sector, the corresponding proportions for Slovak enterprises are 40% in the service sector, 18% in the trade sector and 42% in the production sector. Regarding the area of Hungarian business SMEs operate in, more than 20% of the enterprises surveyed are in Wholesale and retail trade, 16.96% in Construction and developers, 13.39% in Information and communication, 6.25% in Manufacturing and less than 4% in Finance and insurance and Industry including energy. In contrast, more than a quarter of Slovak SMEs operate in Information and communication sector, 16% in the Wholesale and retail trade sector and 14% in the Construction and developers sector.

SMEs in both countries are characterised by a predominantly domestic market (81,1% in Hungary and 76% in Slovakia). However, more Slovak enterprises (6.0%) are active in foreign markets than Hungarian enterprises (2.7%). This may be due to the presence of more large enterprises in the Slovak sample, which are more likely to be present in foreign markets.

5.2. Comparison of SME attitude on digitability in Hungary and Slovakia

The two countries were selected for comparison due to the fact that the current state of digitalisation and the sample characteristics of these two countries as well as the sample construct are quite similar.

5.2.1. Country SME profile on Digitainability

Table 3 presents the attitude of Hungarian and Slovakian SMEs towards the questions of digitalisation in relation to company sustainability. The definite more positive attitude of the Slovakian SMEs can be detected since all the mean values are higher for Slovakia which implies that Slovakian SMEs rather agree with the positive impact of digitalisation and at the same time rather think that digitalisation puts less burden on the environment and helps company sustainability. However, significant difference could be traced in four questions, namely in the question of *optimisation and reduction* of resource usage ($p=0.017$), the question of the extension of *product lifecycle* ($p=0.001$), the *relocation funding for green investment* ($p=0.019$) and the question of *higher productivity and less waste*

($p=0.048$). The results show that SMEs operating in the two countries have different attitudes towards the impacts of digitainability. Despite the significant differences in certain questions in both countries SMEs agreed the most with the economic/environmental benefits of digitalisation as the ‘*optimisation and reduction of the use of resources*’, the ‘*adjustment of the business model to the environmental needs and requirements*’ while Slovakian SMEs ranked third ‘*higher productivity and less waste*’ and their Hungarian counterparts agreed with ‘*cost reduction*’ (economic benefit) as the third in the list can be considered the most beneficial impact of digitalisation on sustainable operation. The fourth economic/environmental benefit – *extension*

of product lifecycle – was not associated as a benefit of digitalisation on company sustainability.

5.2.2. Cluster differences within the countries

The clusters identified earlier to describe the different concepts and approach by SMEs could be found among Hungarian and Slovakian SMEs we well. As Figure 4 shows the two groups of SMEs can be well identified, however, the two groups are more distanced in case of Hungary, and they are closer to each other in Slovakia – SMEs behave similarly, and they are more homogenous. Testing how the groups consider the individual questions, for Hungarian SMEs no significantly different

Table 3. Comparison of Hungarian and Slovakian SMEs on digitainability

	Hungary (n=110)				Slovakia (n=100)			
	Mean	Me	Mo	STD	Mean	Me	Mo	STD
Digitalising the company helps to...								
... optimise and reduce the use of resources.	3.68	4	4	1.157	4.02	4	4	0.864
... reduce costs.	3.74	4	5	1.171	3.58	3	3	1.075
... adjust the business model to the environmental needs/requirements.	3.45	4	4	1.154	3.65	4	4	1.019
... reduce carbon emissions.	3.05	3	3	1.364	3.38	3	3	1.135
... generate value to perform fair business practices to benefit the community and society.	3.30	3	3 ^a	1.193	3.59	4	3	0.996
... to extend the lifecycle of our products.	2.79	3	1	1.415	3.37	3	3	1.002
... relocate funding for green investments.	2.98	3	3	1.211	3.36	3	3	1.087
... achieve higher productivity and less waste.	3.39	3	3	1.235	3.69	4	4	0.940
... achieve customised production.	3.26	3	4	1.379	3.55	4	4	0.999
Our company has integrated SDGs into its long-term strategy.	3.28	3	3	1.228	3.37	3	3	0.928
Electronic equipment and devices produce a high amount of e-waste	3.38	3	5	1.271	3.30	3	3	1.020
The production and use of ICT consume a growing amount of materials, which speeds up the depletion of natural resources.	3.42	3	3	1.266	3.27	3	3	0.886
The increasing demand for energy supply on digitalisation and data centre generates abundant emissions.	3.40	3	3	1.205	3.32	3	3	0.851

a. Multiple modes exist. The smallest value is shown

behaviour was found for the question of *carbon reduction emission* ($p=0.078$) while concerning all the other questions, significant difference could be detected. In case of Slovakian SMEs, the two groups think similarly about *cost reduction* ($p=0.355$). For all the other questions the difference was significant.

Indifferent Conservatives in Hungary and Slovakia are more simile than Concerned Inspired as shown by the significantly different results in Table 4. Indifferent Conservatives differ in how digitalisation changes the *lifecycle of products* while Concerned Inspired consider *cost reduction* and the negative effects of digitalisation like amount of *e-waste*, *reduction of natural*

resources and *abundant emission significantly differently*. The position of the clusters on Figure 4 displays the difference. Consequently, the behaviour of the segments is different, the Slovakian segments are more homogenous (the cluster centres are closer to each other).

The significant differences by clusters as well as by country was justified by the exhaustive CHAID method. A decision tree was developed by SPSS to check where Hungarian and Slovakian SMEs have different concepts. The decision tree analyses confirmed that SMEs do not consider *the extension of the product life cycle as beneficial* and it is considered differently in the two countries, while the

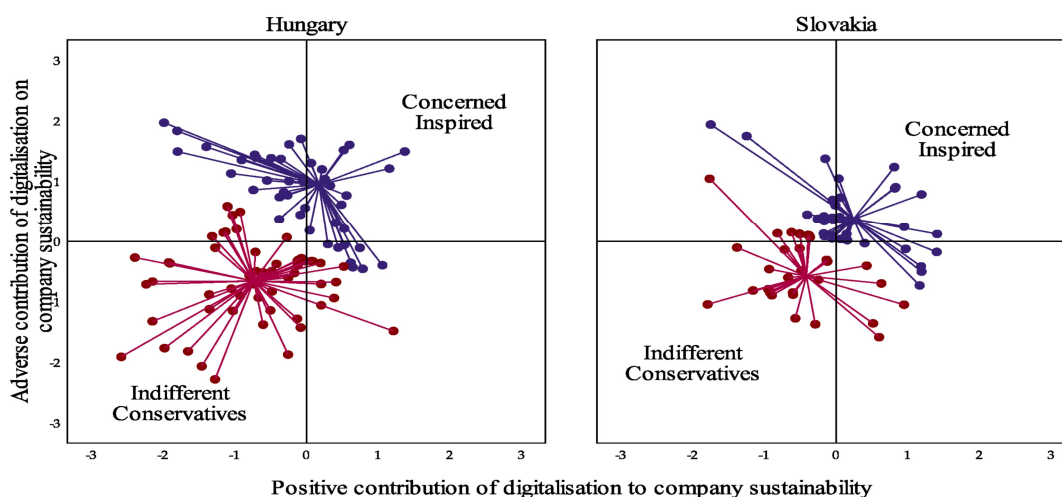


Figure 4. Clusters of SMEs in Hungary and Slovakia along digitalisation and sustainability

Table 4. Questions where clusters in Hungary and Slovakia are significantly different

Digitalising the company helps to...	Concerned Inspired	Indifferent Conservatives	P
... reduce costs.	+		0.000
... to extend the lifecycle of our products.		+	0.001
Electronic equipment and devices produce a high amount of e-waste	+		0.006
The production and use of ICT consume a growing amount of material, which speeds up the depletion of natural resources.	+		0.000
The increasing demand for energy supply on digitalisation and data centre generates abundant emissions.	+		0.000

attitude to the *negative consequences of digitalisation on sustainability* separated the participating SMEs in the two countries. The developed decision tree is shown in Figure 5. During the tree development, all the questions were added as independent variables. The criteria used were as the splitting node significance level was set to $\alpha = 0.05$, the minimum number of cases in the parent node was set to 30 while that of the child node was set to 10 as the number of SMEs dropped significantly with the depth of the decision tree and the goal was to gain a decision tree with sufficient depth. The maximum tree depth was set to 6 to gain as many significant splitting variables as possible.

The level splitting included the questions – independent variables – that proved to have caused significant differences in the course of segmentation and compare means processes. Level 1 splitting by *„extension of life cycle of products’* put 78.7% of the Hungarian SMEs on the disagreement side while 58.4% of the Slovakian SMEs agreed. Out of the 48 (78.7%) Hungarian SMEs 90.9% (40 SMEs) disagreed with *‘higher productivity and less waste’* as a benefit of digitalisation while 9 (52.9%) out of 13 Slovakian SMEs in the node agreed with the statement at level 2 splitting. On the level 1 agreement side 77.6% of the 87 Slovakian SMEs disagree or indifferent that digitalisation reduces cost, however, 53.8% of the 62 Hungarian SMEs think that cost reduction is an advantage of digitalisation.

Further significant differences could be traced only for SMEs where the extension of product life cycle was considered beneficial. At level 3 splitting despite Slovakian SMEs disagreement with cost reduction 41 of them agree with the advantageous impact of digitalisation on *optimisation and reduction*

of resource use, while 8 out of 13 Hungarian SMEs disagree with or indifferent on this statement. On the agreement side at level 3 splitting *‘the integration of SDG goals’* separated Hungarian and Slovakian SMEs. Slovakian SMEs proved to be significantly indifferent on the questions, however, Hungarian SMEs showed the two extreme behaviour patterns, either disagreed or agree, indicating that there is no consequent strategy on companies’ behaviour towards sustainability or they are not committed to sustainability issues. The groups of SMEs with the two extreme responses – rather typical among Hungarian SMEs, *‘higher productivity and less waste’* entered as a next separating question. Even in this group there were 23 Slovakian SMEs, 8 of which were indifferent or disagreed with the beneficial impact of digitalisation on high productivity and less waste, while on the other hand 70.6% of the 39 Hungarian SMEs agreed with the good impact.

The Exclusive CHAID algorithm reduces the decision uncertainty from 47.6% to 0.0857% by level 5 ($[3+15]/313=0.0857$) which is a 69.03% reduction in uncertainty (i.e. error) compared to level 0. Table 5 gives the representation of the decision tree. There was a 23.3% probability of misclassification, meaning that classification is 76.7% accurate.

It can be concluded from the results that Hungarian and Slovakian SMEs are differently aware of waste and abundant emission as consequence of digitalisation, while Slovakian SMEs finds less waste and abundant emission as consequence of digitalisation.

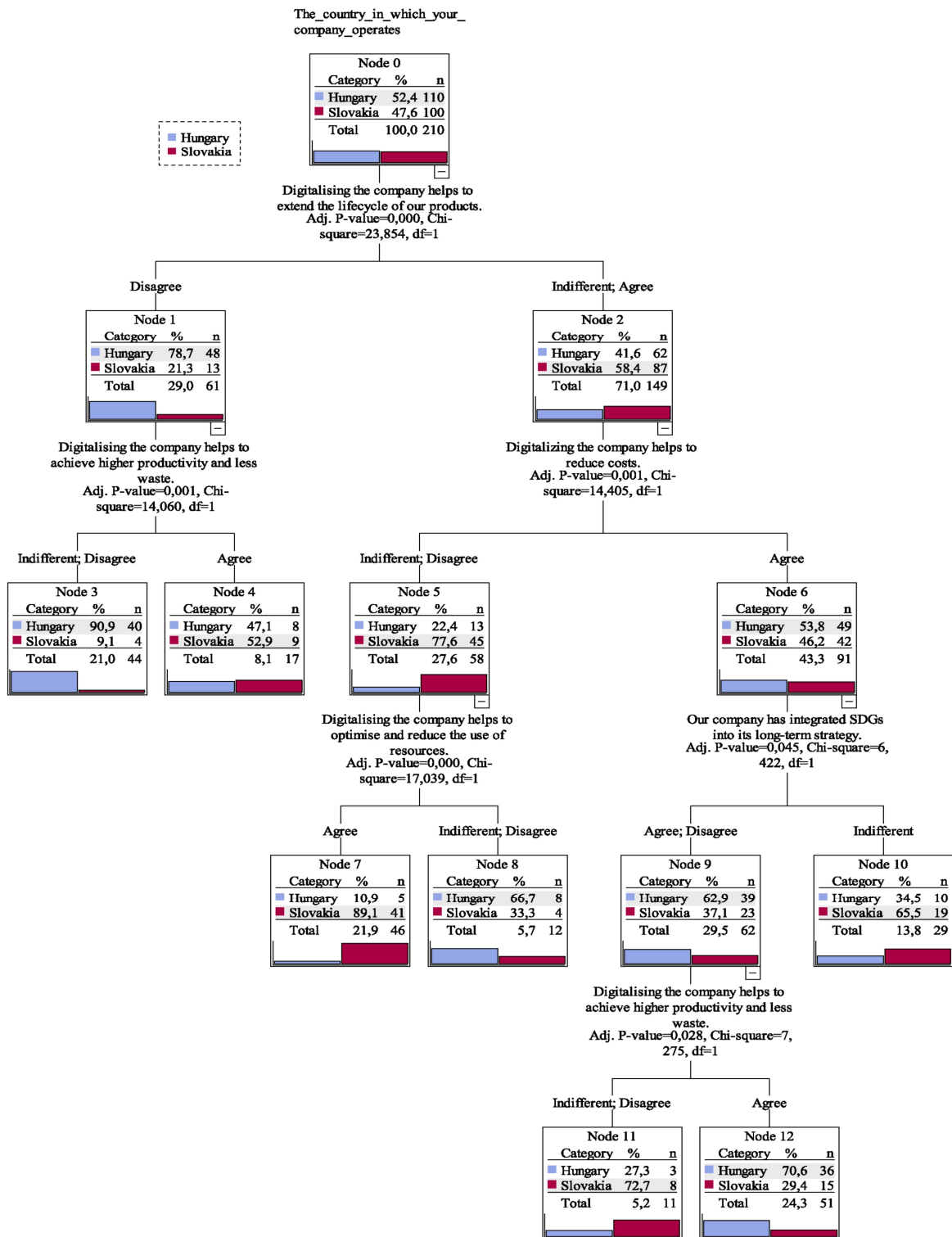


Figure 5. The decision tree developed to find different attitudes among SMEs in Hungary and Slovakia

Table 5. The representation of the decision tree

Node	Hungary		Slovakia		Predicted Category	Parent Node	Separating Questions	P	Split Values
	n	%	n	%					
0	110	52.4	100	47.6	Hungary			0.000	
1	48	78.7	13	21.3	Hungary	0	extend the lifecycle of our products.	0.000	Disagree
2	62	41.6	87	58.4	Slovakia	0		0.001	Indifferent; Agree
3	40	90.9	4	9.1	Hungary	1	achieve higher productivity and less waste.	0.001	Indifferent; Disagree
4	8	47.1	9	52.9	Slovakia	1		0.001	Agree
5	13	22.4	45	77.6	Slovakia	2	reduce costs.	0.001	Indifferent; Disagree
6	49	53.8	42	46.2	Hungary	2		0.000	Agree
7	5	10.9	41	89.1	Slovakia	5	optimise and reduce the use of resources.	0.000	Agree
8	8	66.7	4	33.3	Hungary	5		0.045	Indifferent; Disagree
9	39	62.9	23	37.1	Hungary	6	integrated SDGs into its long-term strategy.	0.045	Agree; Disagree
10	10	34.5	19	65.5	Slovakia	6		0.028	Indifferent
11	3	27.3	8	72.7	Slovakia	9	achieve higher productivity and less waste.	0.028	Indifferent; Disagree
12	36	70.6	15	29.4	Hungary	9		0.000	Agree

Growing Method: EXHAUSTIVE CHAID, Dependent Variable: Country, a. Bonferroni adjusted

6. DISCUSSION

The aim of the study was to compare the perceptions of Hungarian and Slovak SME owners and managers on the impact of digitalisation.

The results confirm the findings of the previously presented DESI 2021 index, which, according to the literature, is an indicative of the digital performance of countries (Marcysiak & Pleskacz, 2021). According to this index, Slovak companies perform slightly better in terms of digital readiness, as Slovak SME owners and managers have a clearly more positive opinion regarding the impacts of digitalisation: each of the averages along the dimensions is higher for Slovak respondents. This suggests that SMEs in Slovakia tend to agree more with the positive effects of digitalisation and prefer to believe that digitalisation has less negative impact on the environment and helps business sustainability. Among the other benefits of digitalisation identified in the literature (Demartini et al., 2019; Szalavetz, 2017),

Hungarian SMEs identified cost reduction and productivity gains, meanwhile Slovak firms are more aware of positive impacts on environmental performance.

The first hypothesis, according to which H1. Hungarian and Slovakian SMEs have different attitudes towards the impacts of digitainability,

therefore, has been confirmed.

When analysing the decision tree, it clearly shows the differences between the opinions of entrepreneurs in the two countries. The most significant difference was observed regarding the impact of digitalisation on the product lifecycle. Hungarian entrepreneurs seemed to be better informed (or realistic) on the issue, as according to the answers 78.7% disagree with the statement that digitalisation helps to extend product lifecycle, which is in the line with previously presented literature (Ordieres-Meré et al., 2020).

On the other hand, Slovak companies are over-represented (58.4%) among those who agree with the positive impact of digitalisation on the product life cycle.

Within the group of agree or neutral, majority of the Hungarian responses think that digitalisation helps companies to reduce costs, but the impact of integrating it into the long-term strategy is split between agree and disagree with 62.9% of Hungarian companies.

Moreover, a lot of Hungarian companies disagree or are indifferent while Slovak enterprises agree with doubts that digitalisation helps to increase productivity and reduce waste.

The research did not confirm that SMEs have different perceptions of the positive and negative effects of digitalisation based on the demographic data of the respondents (age, gender, position) or the age, size, and the dominating sector of the company, i.e., the research did not reveal any significant difference between the demographic data of the respondents or the surveyed companies and the responses to the questions on the attitude towards digitalisation. However, two clusters can be clearly distinguished for both countries, namely Concerned Inspired and Indifferent Conservatives (Figure 2 and Figure 4).

It is also clear from the results that Slovak companies tend to behave more homogeneously, as the two clusters are much closer to each other in the Slovak sample than in the Hungarian one. This implies that while Slovak enterprises are uniformly much more similar in their views on digitalisation and sustainability, some Hungarian entrepreneurs believe less in digitalisation and are indifferent when it comes to issues of sustainability. Consequently hypothesis number two, that

H2. Slovakian SME segments have a more positive perception of digitalisation than their Hungarian counterparts.

was thus partially confirmed. The

negative impacts of digitalisation identified in the literature, such as environmental pressures and negative social consequences (Berkhout & Hertin, 2004), are differently understood by the surveyed companies. The research highlights that companies have different levels of awareness of these impacts.

Hypothesis number three

H3. Hungarian and Slovakian SMEs are differently aware of waste and abundant emission as consequence of digitalisation.

was confirmed in the research, because significant differences could be detected regarding the high amount of e-waste, the depletion of natural resources and the generation of abundant emission in the context of digitalisation (Table 4). As presented earlier, the decision tree analysis revealed that 40 (78.7%) out of 48 Hungarian SMEs do not think that digitalisation will extend the life cycle of the product, compared to 58.4% of Slovak SMEs who agree with this statement. Among Hungarian SMEs, 40 disagree with 'higher productivity and less waste' as a benefit of digitalisation, while 52.9% of the 21.3% of Slovak SMEs who disagree in the same category agree with this statement. These findings confirm that generating high amount of e-waste as consequence of digitalisation has a more influential role in the different awareness of the entrepreneurs of the two countries and are in line with the results of the qualitative study among business leaders in Hungary (Szalavetz, 2017), in which the negative effects of digitalisation were much more emphasised than its positive environmental benefits.

According to the research Hungarian SMEs usually do not integrate sustainability goals into their strategy, but agree with the cost-reducing effects of digitalisation. This

suggests that Hungarian companies are cost-sensitive, however, they do not recognise that digitalisation helps optimisation and also fail to recognise the potential of sustainable operations.

The research has its limitations since it compared two countries out of the six participating ones due to sample differences. Future studies are to be conducted in order to make a wider scale comparison of SME behaviour and attitude in the Visegrad countries, Serbia and Bulgaria.

7. CONCLUSION

The research conducted among SMEs in Hungary and Slovakia within the framework of the project ‘Possibilities and barriers for Industry 4.0 implementation in SMEs in V4 countries and Serbia’ revealed valuable results for consideration.

According to the findings, both in Hungary and Slovakia firms can be divided into two clusters based on their attitudes towards digitalisation, and there is a significant difference between the two clusters in terms of their opinion on the impact of digitalisation on sustainable operation. The two clusters, namely Concerned Inspires and Indifferent Conservatives, have different views on the positive and negative environmental impacts of digitalisation. The research also shows that the two Hungarian clusters are more heterogeneous (cluster centres are further apart) than the Slovak clusters (cluster centres are closer together) (Figure 4), however, Indifferent Conservatives are more similar than the Concerned Inspired in the two countries. Indifferent Conservatives differ regarding their opinion on how digitalisation changes the life cycle of

products, while Concerned Inspired see differently the impact of digitalisation on cost reduction and its environmental burdens, such as e-waste, loss of natural resources and abundant emissions.

Overall, it can be concluded that entrepreneurs in the two countries have slightly different views on the environmental impact of digitalisation. The Slovak enterprises in the sample are less polarised than their Hungarian counterparts. The more uniform attitude and similar sets of values among small businesses in Slovakia also simplifies the identification of development directions and partly explains the better Slovak position in terms of digitisation performance (DESI ranking). For SMEs, the first possible direction of development may be digitalisation, and then, accepting its potential environmental burden, they should strive to set strategic goals that will guide them towards sustainable operations.

Acknowledgement

This paper was supported by the International Visegrad Fund, project number 22110036, titled “Possibilities and barriers for Industry 4.0 implementation in SMEs in V4 countries and Serbia”.

References

- Bencsik, A. (2021). Assessment of leadership preparedness for the challenges of the digital age. *International comparison*. *Budapest Management Review*, 52 (4), 93-108 (in Hungarian).
- Berkhout, F., & Hertin, J. (2004). De-materialising and re-materialising: digital technologies and the environment. *Futures*,

ДОБИТАК ИЛИ МАЊЕ ОТПАДА? ДИГИТАЛИНАБИЛНОСТ У МСП - ПОРЕЂЕЊЕ МАЂАРСКИХ И СЛОВАЧКИХ МСП

Réka Saáry, Judit Kárpáti-Daróczy, Andrea Tick

Извод

Мала и средња предузећа која послују у 21. веку морају се суочити са неколико изазова, укључујући померање ка дигиталној трансформацији, реорганизацију пословања како би се одржала одрживост, али, с друге стране, како не би изгубили профит и одржали пословање. Овај рад има за циљ да открије да ли су профит и висока стопа дигитализације или забринутост за одрживост главне покретачке снаге малих и средњих предузећа у Мађарској и Словачкој. У раду се анализира 210 посматраних МСП и користи се метод дрво одлучивања CHAID паралелно са факторском и кластерском анализом како би се истражиле сличности и разлике у понашању МСП у Мађарској и Словачкој. Резултати показују да словачка МСП имају позитивнији став према дигитализацији; и мађарска и словачка мала и средња предузећа су подељена у две групе у погледу приступа дигитализацији и одрживости, док значајне разлике варирају под условом да су у питању смањење трошкова и ресурса, продужење животног циклуса производа или већа продуктивност. МСП у обе земље се слажу да се пословни модели морају прилагодити дигитализацији и одрживости, док су забринуте због негативног утицаја дигитализације иако се значајно разликују.

Кључне речи: дигитализација, МСП, одрживост, дигиталнабилност, SDGs, земље Вишеградске четворке

36 (8), 903-920.

Cranfield, D.J., Tick, A., Venter, I.M., Bignaut, R.J., & Renaud, K. (2021). Higher Education Students Perception of Online Learning during COVID-19 – A Comparative Study. *Education Sciences*, 11(8), 1-17.

Csath, M., Fási, C., Nagy, B., Pálfi, N., & Vinogradov, S. (2020). Competitiveness dilemmas in the age of digitalization and robotization. Budapest, Hungary: Ludovika University Press (In Hungarian).

Csedő, Z., Zavarkó, M., & Sára, Z. (2019). Is digitalization an innovation? Lessons learned from digital transformation and innovation management at a financial service provider. *Budapest Management*

Review, 50 (7-8), 88-101 (in Hungarian).

Demartini, M., Evans, S., & Tonelli, F. (2019). Digitalization technologies for industrial sustainability. *Procedia manufacturing*, 33, 264-271.

Dudás, P. (2018). Segmentation using a decision tree. *Economica New*, 9 (2), 49-54.

Elkington, J. (2018). 25 years ago I coined the phrase “triple bottom line.” Here’s why it’s time to rethink it. *Harvard Business Review*, 25, 2-5.

European Commission. (2004). *European Charter for Small Enterprises*. Luxembourg: Office for Official Publications of the European Communities

European Commission. (2021). *The Digital Economy and Society Index (DESI)*.

- Shaping Europe's digital future. Available at: <https://digital-strategy.ec.europa.eu/en/policies/digital-strategy>
- Gartner. (2019). Digitalization. Information technology glossary. Available at: <https://www.gartner.com/en/information-technology/glossary/digitalization>
- Gerasimenko, V.V., & Razumova, T.O. (2020). Digital competencies in management: a way to superior competitiveness and resistance to changes. *Serbian Journal of Management*, 15 (1), 115-126.
- Gubán, Á., & Sándor, Á. (2021). Opportunities for digital maturity measurement for SMEs. *Budapest Management Review*, 52 (3), 13-28 (in Hungarian).
- Gupta, S., Motlagh, M., & Rhyner, J. (2020). The digitalization sustainability matrix: A participatory research tool for investigating digitainability. *Sustainability*, 12 (21), 9283.
- Hámori, G. (2001). Characteristics of CHAID-based decision trees. *Hungarian Statistical Review*, 79 (8), 703-710 (in Hungarian).
- Kass, G. (1980). An exploratory technique for investigating large quantities of categorical data. *Applied Statistics*, 29 (2), 119-127.
- Kayikci, Y. (2018). Sustainability impact of digitization in logistics. *Procedia manufacturing*, 21, 782-789.
- Lichtenthaler, U. (2021). Digitainability: the combined effects of the megatrends digitalization and sustainability. *Journal of Innovation Management*, 9 (2), 64-80.
- Mai, P. T., & Tick, A. (2021). Cyber Security Awareness and Behaviour of Youth in Smartphone Usage: A Comparative Study between University Students in Hungary and Vietnam. *Acta Polytechnica Hungarica*, 18 (8), 67-89.
- Majláth, M., Kelemen-Erdős, A., & Valociková, C. (2019). Understanding SME's failure: Focus on success factors and gender differences: Comparative analysis of SME's in Czech Republic, Hungary and Serbia. *Serbian Journal of Management*, 14 (1), 327-345.
- Marcysiak, A., & Pleskacz, Z. (2021). Determinants of digitization in SMEs. *Entrepreneurship and Sustainability Issues*, 9 (1), 300-318.
- Ordieres-Meré, J., Pietro Remon, T., & Rubio, J. (2020). Digitalization: An opportunity for contributing to sustainability from knowledge creation. *Sustainability*, 12 (4), 1460.
- Șerban, R. A. (2017). The Impact of Big Data, Sustainability, and Digitalization on Company Performance. *Studies in Business and Economics*. 12, 181-189.
- Statista. (2022. February 3). Number of small and medium-sized enterprises (SMEs) in Slovakia from 2010 to 2021. Available at: <https://www.statista.com/statistics/880143/number-of-smes-in-slovakia/>
- Szalavetz, A. (2017). Industry 4.0 technologies and environmental sustainability-Hungarian manufacturing experience. *International Economics*, 61(7-8), 28-45 (in Hungarian).