DETUROPE – *THE CENTRAL EUROPEAN JOURNAL OF REGIONAL DEVELOPMENT AND TOURISM*
Vol. 14 Issue 2 2022 *ISSN 1821-2506*

Original scientific paper

THE IMPLEMENTATION OF THE CIRCULAR ECONOMY REQUIREMENTS AMONG HUNGARIAN ENTERPRISES – CAPITAL VERSUS COUNTRYSIDE

Hajnalka FEKETE-BERZSENYI[a], Melinda KOCZOR-KEUL[b], Tamás MOLNÁR[c]

[a]University of Pannonia, Department of Accountancy and Controlling, Veszprém, Hungary, fekete-berzsenyi.hajnalka@gtk.uni-pannon.hu
[b]University of Pannonia, Department of Business Economics, Veszprém, Hungary, koczor-keul.melinda@gtk.uni-pannon.hu
[c]University of Pannonia, Department of Business Economics, Veszprém, Hungary, molnar.tamas.pannon@gmail.com

Cite this article: Fekete-Berzsenyi, H., Koczor-Keul M., Molnár T. (2022). The implementation of the circular economy requirements among Hungarian enterprises – capital versus countryside. *Deturope.* 14(2), 108-126.

Abstract

In the spirit of sustainability business organisations have also put the circular approach to the forefront, and are trying to conduct their activities accordingly. They are developing technological improvements, innovative products and services to reduce their environmental footprint. The importance of protecting the environment and the principles of the circular economy have become key competitiveness factors. This study presents the commitment to the circular economy approach at the level of economic organizations. The survey included the 5,000 largest enterprises based on the number of employees established in Hungary in the form of an electronic questionnaire, from which the results from 202 responding enterprises were evaluated. Our research questions focus on what clusters companies can be classified into according to the environmental orientation in accordance with the framework of a circular economy, and whether there is a correlation between the companies' belonging to each cluster and their territorial location. The main methods used to analyze the results were Spearman's rank correlation coefficient, Cronbach's alpha, cluster analysis and cross-tabulation analysis. The results show that enterprises can be divided into three clusters based on the environmental focus, and the difference between the capital and the countryside is also strongly felt. Based on the results, we can state that the nationwide analyzes show that the paradigm shift has really started in the business practice, measurably in favor of rural enterprises. Businesses have recognized that their territorial competitiveness position will be strengthened if they adopt an environmentally sound management approach.

Keywords: sustainability, circular economy, competitiveness, cluster analysis, crosstab analysis

INTRODUCTION

The circular economy approach is not only the subject of scientific works, but also interweaves our everyday lives. In addition to the growing number of domestic and international scientific research, we also recognize the importance of protecting the environment at the community level. In addition to individual responsibility, economic organizations have also put the circular approach at the forefront, and they seek to continue and transform their activities in accordance with this. Numerous research articles have been published examining the positive correlations between the culture of sustainability

(Schönborn et al., 2019), sustainability practices (Alshehhi et al., 2018) and the adaptation of the principles of the circular economy to corporate practice in relation with different elements of corporate performance (Rehman Khan et al., 2021; Moric et al., 2020), including financial performance (Uhrenholt et al., 2022; Fernando et al., 2022; Johl & Toha, 2021). Environmental principles have also been integrated into corporate decision-making (Bedenik et al., 2019). The concepts and solutions of sustainability, resource efficiency and zero-waste production are increasingly becoming part of our thinking, policy guidelines and corporate strategies (Kiss et al, 2019).

In the Energy 2020 document the European Union has set three targets for energy efficiency, the share of renewable energy and greenhouse gas emissions. Szép Sebestyén (2016) found that the share of renewable energy sources shows the fastest convergence. This positive trend is negatively affected by the economic crisis. Convergence is stronger in countries with poor initial energy efficiency (later entrants). The production and use of renewable energy is also essential for mitigating the well-known negative impacts of climate change which is expected to become even more important in the future (Hollósy et al, 2021a). The EU has set a target of achieving a 10% share of energy consumption produced from renewable energy sources in transport, one of the most carbon-intensive sectors, by 2020. While this ratio stood at only 1.5% in 2004, in the following years it became much closer to the target value: 7.5% in 2017, 8.3% in 2018, and 8.9% in 2019 (Kiss et al, 2021). In 2016, the share of renewable energy in electricity generation in the EU28 was nearly 30 percent, while in Hungary it was only 7 percent, the second lowest share among EU Member States. (Csizmásné Tóth, J. et al, 2018). Installing solar systems in electricity generation can reduce the use of conventional fossil fuels and reduce carbon dioxide emissions (Hollósy et al, 2021b). The conversion of animal by-products used in agricultural biogas plants into energy is also an opportunity for agriculture and rural development, which corresponds to the efforts of the European Union to diversify its energy sources in favor of renewable energy sources (Chodkowska-Miszczuk et al, 2019).

The implementation of the principles of the circular economy supports the achievement of the goals of sustainable development, therefore their application by economic actors is important, and from the researcher's perspective it is important to measure the prevalence of applications, for which purpose a wide range of circularity indicators have been developed by the researchers of this topic.

We can find a lot of good practices, but no survey has yet been conducted that shows a complete picture of the Hungarian situation. The present study examines this issue and analyzes the implementation of the environmental goals of the circular economy among enterprises, also following a territorial approach.

In section 2 of our article, in the context of the literature review, we briefly summarize the definitions of the circular economy, we discuss the framework of the circular economy, with special regard to its measurable requirements, which also forms the basis of the empirical part.

Section 3 presents the test sample and the test methods used. In Section 4 we present the results of our research, and in Section 5 we summarize them.

THEORETICAL BACKGROUND

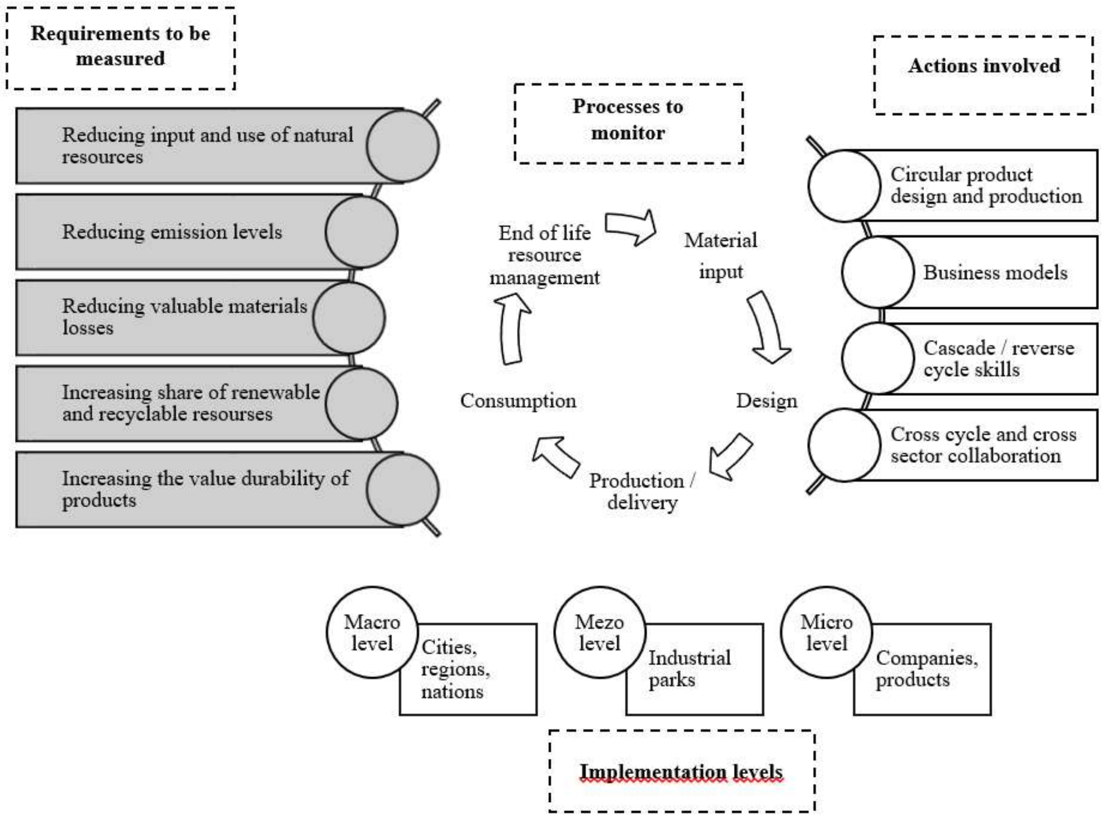
The current economic system is characterized by a linear approach. The extraction of raw materials from nature ensures the production of goods, some of which generate a large amount of waste after use (Neumanné & Varga-Dani, 2020; 2021). The goal of the circular economy is to change this linear system. The implementation of the principles of the circular economy supports the achievement of the goals of sustainable development (Briem et al., 2019), therefore their application by economic actors is important.

The topic of the circular economy has also become increasingly integrated into scientific thinking and corporate strategies (Lengyel et al., 2021; Fianko et al., 2021). It is a very common topic in the scientific literature, and as a result, we can find a variety of definitions, from which a lack of uniformity derives. Kirchherr et al. (2017) revised 114 definitions of the circular economy, dividing them into 17 dimensions. By definition, the circular economy is an economic system that replaces the concept of end of life (the linear economy) with the reduction, alternative reuse, recycling and recovery of materials in production / distribution and consumption processes. The circular economy operates at the micro level (products, companies, consumers), at the meso level (eco-industrial parks) and at the macro level (city, region, nation and beyond), with the aim of supporting the goals of sustainable development while respecting the quality of the environment, economic prosperity and social equality for the benefit of present and future generations.

Lindgreen el al. (2020) identify companies as key players in the transition to circular economy, where the essence of implementing circular economy strategies is to reduce resource use and associated impacts while increasing economic competitiveness and having a positive social impact. Circular business models can lead to reduced dependence on natural resources (Barbaritano et al., 2019). More efficient resource allocation and use are expected to increase a company's overall competitiveness as well as improve social welfare, reduce environmental damage and economic inequalities (Lu et al., 2008; McGregor & Pouw, 2017). Companies can turn waste streams into profitable ones (Engel et al., 2016), and the cost-reducing effect of an overall increase in material reuse can have a competitiveness-enhancing effect due to reduced raw material use and less exposure to the effects of price fluctuations (Rizos et al., 2015). In addition to new job opportunities, circular business models can also lead to technological and organizational innovation, thereby improving the overall well-being of society (Sariatli, 2017).

The paradigm of the circular economy introduces a new perspective to economic life where economic growth is decoupled from resource use and pollutant emissions, as end-of-life materials and products are seen as resources rather than waste. The essence of the concept is to close material loops, to reduce the need for raw materials and the need for waste management (Elia et al., 2016). The recycling system can lead to significant improvements in material use efficiency and can be profitable for manufacturers (MacArthur, 2013). The narrower the circle, i.e. the less a product needs to be changed during reuse, refurbishment and remanufacturing, the faster it returns to use, the greater the potential savings. This also applies to materials incorporated into the products, labor, energy and capital, as well as related externalities (greenhouse gas emissions, water, toxicity) (MacArthur, 2013). The framework of a circular economy is described by Elia et al. (2016) (Fig. 1.).

Figure 1 The circular economy framework



Source: adopted from Elia et al., 2016

In the middle of Fig. 1, there are five main phases of the circular economy paradigm: material input, design, production delivery, consumption, and finally end-of-life resource management, which provides the input to the first phase. These phases represent the processes whose performance measurement is essential to judge the circularity of a system.

Four categories of actions have been identified in the framework on the right-hand side of the figure (MacArthur, 2013; Philp & Winickoff, 2018; Elia et al., 2016; Janik & Ryszko, 2019; Franco-García, 2019):

(1) Circular product design and production: this category covers a wide range of activities, from eco-friendly design to promote the re-use, refurbishment and recycling of products to the design of products and processes containing less dangerous substances.

(2) Business models: the diffusion of new business models, such as product service systems that replace product ownership, or collaborative consumption tools, which are based on a wider spread of channels between consumers.

(3) Cascade / reverse skills: refers to the ability to build reverse or cascading circles. Measures to support closed-loop cycles may include e.g. the use of innovative technologies in recycling or the cascading use of materials and the support of secondary markets.

- The "power of cascading use" refers to the diversification of reuse through the value chain. For example, the cotton clothing used as a second-hand article in clothing, which would then be transferred to the furniture industry as a fiber insert for upholstery, and the fiber insert would later be reused in construction industry as rock wool insulation.
- Reverse circles: in general, closed loops consist of two supply chains (Wells & Seitz, 2005): a forward chain and an inverted chain, where the recovered product re-enters the traditional forward chain (Antikainen & Valkokari, 2016). This requires cost-effective, high-quality collection, transport and handling systems, as without them, materials will continue to leak out of the system, so building capacity and infrastructure to close the loops is critical. Reverse cycles are not limited to one industry, they are also "cascading" in different industries (MacArthur, 2013).

(4) Cross-cycle and cross-sector collaboration: measures focusing on building collaborations through the new value chain, even involving new actors, preventing by-

products from becoming waste through effective industrial symbiosis. A circular economy would shift the economic balance away from energy-intensive materials and primary extraction. Reverse-cycle activities are emerging as a new sector for the reuse, recovery, remanufacturing and recycling of materials (MacArthur, 2013).

The requirements to be measured on the left side of Figure 1 will provide the basis for our empirical research. There are several frameworks and indicator systems for measuring the circular economy in the literature. Kozma et al. (2021) notes that the most comprehensive analyzes for mapping circular economy indicators were performed and described by Elia et al. (2016), Parchomenko et al. (2019) and Saidani et al. (2019). Saidani et al. (2019) identified 55 sets of indicators, based on which a taxonomy of circular economy indicators has been developed in 10 categories. Parchomenko et al. (2019) provides a structured picture of metrics for measuring the circular economy. The authors conducted a structured analysis of 63 metrics and 24 relevant characteristics such as recycling efficiency, longevity, and stock availability. The analysis identified three main clusters of metrics:

(1) the resource efficiency cluster,

(2) a cluster of material stocks and flows,

(3) and the product-centric cluster.

It is noted that the most common aspects focus on waste disposal, primary and secondary use of resources, resource efficiency/productivity, and recycling efficiency.

Among the requirements to be measured (left side of Figure 1), the 5 factors we will use later will be described in detail. These are mentioned and suggested for use by many authors in their works (Elia et al., 2016; Philp & Winickoff, 2018; Janik & Ryszko, 2019; Kristensen, & Mosgaard, 2020; Kwarteng et al., 2021; Kravchenko et al., 2020; Mancini & Raggi, 2021; Moraga et al., 2019).

(1) Reducing input and use of natural resources: The main goal is to reduce the erosion of the natural ecosystem caused by current linear models by creating higher value from less used resources. The direct consequence of this is a more efficient conservation of natural resources through the efficient use of raw materials, water and energy.
(2) Reducing emission levels: Applies to direct and indirect emissions.
(3) Reducing valuable materials losses: Implementing closed-loop models for the recovery and recycling of products and materials. Through reverse flow, it

prevents waste generation, minimizes incineration and landfill, and reduces energy and material losses.

(4) Increasing the share of renewable and recyclable resources: thereby reducing emissions.

(5) Increasing the value of durability of products: This objective can be achieved by extending the life of products and by introducing new business models based on use-oriented services that replace the product ownership already mentioned above. In addition, it is possible to achieve this with a significant recycling of materials and the reuse of finished products as components.

Finally, at the bottom of the figure, three main areas of intervention of the paradigm are outlined: the micro level (the level of individual companies, products, customers), the meso level (i.e., eco-industrial parks), and the macro level (cities, nations) (Ghisellini et al., 2016).

In our present research, we examine the 5 measurable requirements mentioned above at the company level.

DATA AND METHODS

The research aims to examine the appearance of the theory of the circular economy in practice and its extent. The authors hypothesize that larger enterprises are those where the environmental approach appears in a measurable way. This is due to the fact that these companies also form a significant proportion of environmental strategies, the implementation of which they seek to implement through a variety of environmental management tools.

The authors defined as the basic population of the research the 5,000 largest companies with headquarter or site in Hungary, based on the number of employees. The answers to the research questions are based on the analysis of the results of a primary questionnaire sent out electronically. A total of 4,606 questionnaires were received by companies, of which 202 were returned. In terms of size, almost 70% of enterprises have between 50 and 250 employees and 30% have more than 250 employees. The largest responding company has more than 37,000 employees. 22% of the questionnaires came back from companies located in the capital (Budapest). Nearly 40% of the responding enterprises operate in the manufacturing industry, with a very diverse range of main activities. Several companies operate in the field of metalworking and the production of metal structures, as well as in the production of vehicles and vehicle engine parts. In terms of annual net sales, the variance between companies is very large. All this shows that the sample on which the analyses are based covers a wide range of businesses of different types and sizes.

The research was based on several groups of questions. Companies were asked to rate their environmental performance on a 6-level Likert scale. The authors used the Spearman rank correlation coefficient to measure the closeness of the relationships between the responses and to check their significance level.

Questionnaire testing was performed by the authors with the Cronbach's alpha index, which is the average of the correlation coefficients between items. Based on the values obtained for the indicator, it can be concluded that the statements in the questionnaire really measure what the authors were interested in during the research.

Subsequently, the examined companies were grouped by performing a cluster analysis. The advantage of cluster analysis is that similar observation units are grouped together (Molnár, 2015). This not only allows us to conduct further research using cluster variables, but also provides interesting and illustrative (with a graphical representation of each cluster) information about the proportion of surveyed companies in each cluster. In the course of the analysis, the validity of the cluster analysis was also checked in each case. Based on the significance level of the F-statistics, it can be determined whether the centers of the created clusters differ significantly from each other. It is also necessary to examine the correlation coefficients before performing the cluster analysis, as in case of correlation coefficients higher than 0.9 the strongly correlated variables may play a larger role in the analysis.

To prove the existence of a relationship between the individual cluster variables and the territorial location (Budapest headquarters - rural headquarters), we used the method of widespread cross-tabulation analysis. The method shows how the enterprises located in Budapest and the countryside are distributed within the clusters formed on the basis of an environmental goal and whether there is a significant correlation between the cluster variables and the regional variables. The method examines the relationship between two or more variables in the form of percentage distributions. The significance level of the chi-square statistics and the adjusted standardized residuals were also examined during the cross-tabulation analysis, based on which it can be determined whether there is a significant relationship between the individual clusters and the geographical location of companies.

RESULTS

When completing the questionnaire, companies had to rank their answers on a Likert scale from 1 to 6, in terms of the extent to which their company achieves the following environmental goals:

- Reducing input and use of natural resources;
- Increasing share of renewable and recyclable resources;
- Reducing emission levels;
- Reducing valuable materials losses;
- Increasing the value durability of products.

These issues are the measurable requirements of the circular economy framework already described in the literature section.

The reliability of the questionnaire was examined with the Cronbach's alpha index, the values of which are given in the following table (Tab. 1).

Table 1 - Values of Cronbach-alfa index.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,800	,805	5

	Cronbach's Alpha if Item Deleted
Reducing input and use of natural resources	0,762
Increasing share of renewable and recyclable resources	0,776
Reducing emission levels	0,747
Reducing valuable materials losses	0,747
Increasing the value durability of products	0,778

Source: own research

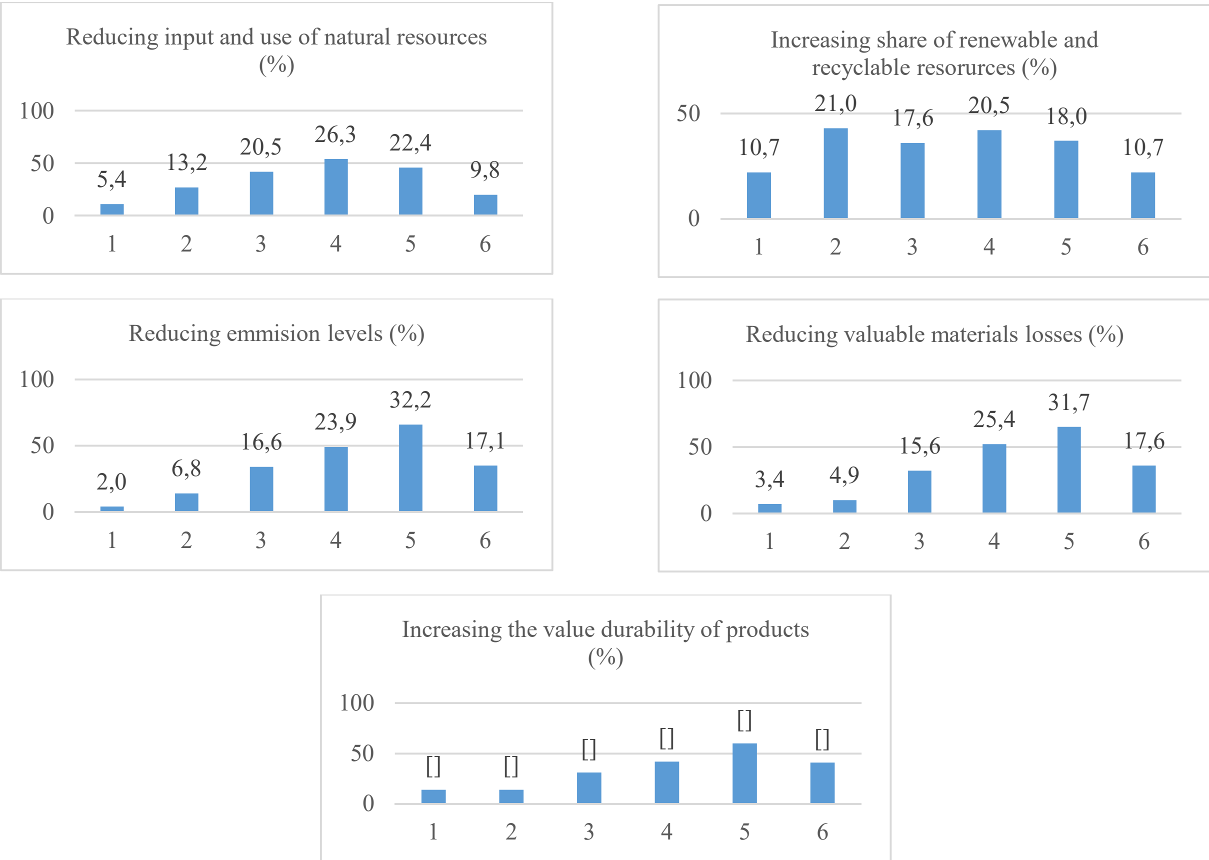
The value of Cronbach's alpha can be between 0 and 1. Scales with an alpha of at least 0.7 can be considered reliable and stable, but at the same time a very high alpha value of 0.9 can also indicate redundancy. (Takács & Kárász, 2015; Gliem, & Gliem, 2003).

The value of Cronbach's alpha in our case is 0.8, which indicates good internal consistency of the items in the scale.

The Alpha values in the second half of the table show what would happen if that variable were removed. We can see that the value of Alpha would decrease in each case (if the value would be higher for one of the variables, the stability would increase if that variable was omitted).

The frequency of answers to each question is shown in Fig. 2.

Figure 2 Distribution of responses to environmental objectives on a scale of 1 to 6 (%).



We found significant differences in the ranking of each issue, suggesting that perceptions of the environmental objectives are quite different. Based on the bar charts in Figure 2, our first conclusion was that a certain proportion of companies do not consider the degree of achievement of the environmental goals given in the questionnaire to be high.

In the answers given to each question, the values of 5 occur in the highest proportion (on a scale of 6). There are two exceptions to this:

- the use of renewable and recyclable resources, in case of which the ranking 2 being the most common.
- the other goal, which has a slightly lower value, is the reduction of the acquisition and use of natural resources (ranking mode: 4).

For the other goals given, businesses ranked 5 most often. However, it is striking that a smaller proportion of firms rated these elements of the circular economy as being their primary goal. In the total sample, there were only five companies that rated each of the environmental objectives at the highest level (6), all of which are operating in the manufacturing industry, and there is a big difference between them in terms of headcount and sales revenue (difference in turnover is more than HUF 11 billion ~ EUR 29.3 million and the difference in headcount of almost 400 people). However, there was only one company in the sample, operating in the construction industry, which does not perceive any of the stated environmental goals among the strongly prevailing goals. Based on all this, it cannot be concluded that the responding companies are oriented towards a circular economy or not based on their environmental practices. Based on the responses, the authors of this article used two assumptions:

- Businesses do not place the same emphasis on each circular economic goal, yet well-identifiable groups with similar attitudes can be defined.
- There is a difference in the affiliation to each group between enterprises located in the capital and in the countryside.

To support the first assumption, we chose to use the method of cluster analysis. Before performing the cluster analysis, we examined Spearman's rank correlation coefficients, during which we did not find any strongly correlating variables that could have biased the result of the cluster analysis. The magnitudes of the coefficients ranged from 0.332 to 0.595, showing a moderate to weak positive relationship at the 1% significance level.

Based on the cluster analysis, the authors' assumptions were confirmed, as three clusters were clearly identified among the enterprises. The clusters were formed with standardized variables, the expected value of which is zero and the variance is 1, so the individual clusters can be characterized by the relative differences. Based on the cluster analysis, companies with similar environmental goals were included in the same cluster.

Table 2 - Cluster centers for clusters based on the achievement of environmental objectives.

	1 – environmentally goal-oriented	**2 – resource-oriented**	**3 – non-environmentally goal-oriented**
Reducing input and use of natural resources	0,53207	0,30135	-1,02910
Increasing share of renewable and recyclable resources	0,50962	0,23983	-0,90195
Reducing emission levels	0,72787	-0,07794	-0,91154
Reducing valuable materials losses	0,73781	-0,08443	-0,89072
Increasing the value durability of products	0,83180	-0,38196	-0,75410

Source: own research

Based on the general environmental objectives, three significantly different clusters were formed (the significance level of the F test was 0 for all three clusters):

In the first cluster, which was named environmentally goal-oriented, each of the examined environmental goals appears strongly, which is shown by the positive values in the table. These enterprises are committed to the practical application of the circular economy approach and can be considered at the forefront of other enterprises.

The second cluster can be called resource-oriented, as for the companies belonging to this group the reduction of the acquisition and use of natural resources and the use of renewable and recyclable resources appear as important goals (positive values in the table), the other goals have negative values, their appearance is lower compared to other companies in the sample. In this group, the emphasis on environmental aspects can already be felt, but the economic organizations belonging to this cluster mostly determine their environmental goals based on the resource approach, so they can be considered progressive among other companies.

In the third cluster, called non-environmentally goal-oriented, each goal appears with a negative value, so they gave each goal a lower value on a scale of 1 to 6 than the other companies in the sample in general. These companies have not yet put the environmental approach into practice, as none of the environmental targets received a high ranking when completing the questionnaires. Based on the analyses, they can be considered lagging behind the previous two groups.

Figure 3 Number and distribution of enterprises belonging to clusters based on general environmental objectives. Source: Own editing

A total of 39% of the responding companies belong to the (1) environmentally goal-oriented cluster, i.e. most companies are included here. Their characteristic is that each of the environmental goals plays an important role on a practical level, so they have already transposed the circular economy approach into their activities. Nearly half of the group's businesses are involved in the manufacturing industry, which is not surprising given the over-representation of this sector. However, several businesses operate in transportation, warehousing, trade, vehicle repair, water supply, waste water collection and treatment, waste management and decontamination sectors. In terms of turnover, there is a big difference between companies. There is a difference of almost HUF 205 billion between the largest and the smallest sales revenue (~ EUR 54.7 million). In the case of the number of employees we find a similar difference, the range here is 37 thousand people. All this means that the companies with the highest turnover and the largest number of employees fall into this category, but there are also a number of companies that are much smaller among the pioneers.

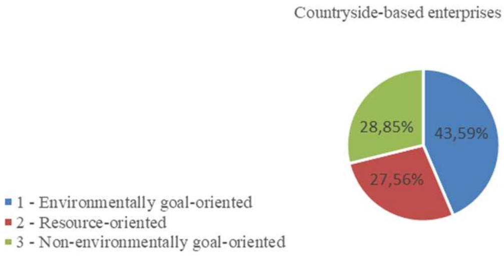
In the group called (2) resource-oriented, we find 31% of the enterprises included in the sample. These companies have identified the reduction in the acquisition and use of natural resources and the use of renewable and recyclable resources as a priority for the business, the other environmental goals not yet being emphasized. The proportion of enterprises operating in the manufacturing industry is also high in this group (35%), but it is already lower than in the case of the pioneers. Companies in sectors that use mainly natural resources, such as agriculture, forestry and fishing, were included in this group in a larger number. In addition, as in the case of the pioneers, in this cluster we can find companies involved in the water supply, wastewater collection and treatment, waste management and decontamination sectors. The range of sales revenues in this group is HUF 117 billion ~ EUR 312 million, which is less than in the case of group 1 and similarly the differences in the number of employees is much smaller (10 thousand people). All this means that this group has a more homogeneous composition and, it appears that smaller enterprises have been included in this group.

In the non-environmentally goal-oriented sector (3), the share of enterprises operating in the manufacturing industry is even lower (32%), and in addition to transport and storage, water supply, wastewater collection and treatment, waste management and decontamination, a larger number of companies performing administrative and service support activities are also appearing. The range of sales revenue realized in the business year is the highest in this group (HUF 342 billion ~ EUR 912 million), and the range of headcount is the same as in the first group (37 thousand people).

Based on the above, it cannot be stated unequivocally that a large enterprise (in terms of turnover, number of employees) clearly belongs to the environmentally goal-oriented cluster. The characterization of the clusters reveals that there are several such companies in the lagging group.

The authors hypothesized that - as in most spatial analyzes in general-, the majority of enterprises based in the capital belong to the cluster of environmentally goal-oriented, front-line pioneers. However, the results did not confirm this assumption, as the largest proportion of companies with headquarters in the capital city (43.18%) belong to the second, resource-oriented group. In contrast, almost half of the enterprises with headquarters outside the capital (43.59%) can be included among the pioneers in the group of environmentally goal-oriented cluster (Fig. 4).

Figure 4 - Clustering of capital-based and countryside-based businesses in environmental clusters. Source: Own editing



After the cluster analysis, the method of cross-tabulation analysis was applied to examine whether there is a relationship between belonging to environmentally goal-oriented clusters and the capital or rural location. The adjusted standardized residuals of the cross-tabulation analysis show a correlation between the Budapest-based enterprises and the resource-oriented cluster, and between the rural-based enterprises and the cluster called the environmentally goal-oriented cluster. A value of +2 or above for the adjusted standardized residual proves the existence of a significant relationship, and for values below -2 or below, there is certainly no correlation between the two variables. Based on this, we can state the opposite of the previous statement that there is certainly no correlation between the Budapest-based enterprises and the environmentally goal-oriented cluster or between the rural-based enterprises and the resource-oriented cluster. In the cross-tabulation, the correlations are highlighted in green and the absence of correlations is highlighted in red.

Table 3 - Distribution of companies included in different environmental orientation clusters in relation to those based in Budapest and the countryside.

		1 – environmentally goal-oriented	**2 – resource-oriented**	**3 – non-environmentally goal-oriented**	**Total**
Budapest	Companies (pcs)	11	19	14	44
	% distribution	25,00%	43,18%	31,82%	100,00%
	Adjusted standardized residual	-2,2	2,0	0,4	
Countryside	Companies (pcs)	68	43	45	156
	% distribution	43,59%	27,56%	28,85%	100,00%
	Adjusted standardized residual	2,2	-2,0	-0,4	
Total	Companies (pcs)	79	62	59	200
	% of Total	39,50%	31,00%	29,50%	100,00%

Source: own research

At the same time, it cannot be statistically proven that the capital-countryside relationship determines which company belongs to which group. We base this finding on the following:

According to the significance rule, if the significance level ($p < 0.05$) of Pearson's $\chi 2$ (chi-square) statistic, we can reject the null hypothesis that there is no correlation between the two variables. In the present research, the significance level of the $\chi 2$ (chi-square) statistic in the cross-tabulation study is 0.55. Cramer's “V” showed a low value (0.17) with a significance level of 0.55, i.e., the first type of error, although slightly above 5% ($p = 5.5\%$).

CONCLUSION

Looking at the results, we can see that the practical application of the principles of the circular economy prevails in the case of the enterprises included in the survey. However, the questionnaire survey did not reveal the extent to which they are characteristic and which divisions are affected. It is also questionable whether this practical activity stems from the company's environmental strategy, or whether the importance of operational efficiency and the company's external judgment directs companies towards the application of environmental aspects.

Based on the responses given to the environmental questions, it appears that companies view these issues in a coherent manner, as the calculated rank correlation coefficients generally showed moderately strong (in some cases weak) and positive correlations with reliable significance values.

As a result of our research, we classified the responding enterprises into three clusters based on the application of the principles of the circular economy. The (1) environmentally goal-oriented cluster (pioneers) is the most environmentally conscious and all of the objectives of the circular economy are present. The greatest improvements are in the durability of the products, the reduction of material loss and the reduction of pollutant emissions. In the (2) resource-oriented cluster (progressives), the resource-related objectives prevail: reducing the acquisition and use of natural resources and increasing the use of renewable/recyclable resources. In the (3) non-environmentally goal-oriented cluster (laggards), none of the five goals of the circular economy prevails.

Based on the net sales realized in the business year and the average number of employees, as indicators characterizing the size of the company, the largest enterprises were mostly classified as (1) “pioneers” or (3) “laggards”. The authors intend to investigate the reasons for the inclusion of large enterprises in cluster 3 in the framework of further research.

Nearly 50% of companies in the manufacturing industry belong to the first group, which clearly indicates the environmentally oriented strategy of these companies. This is mainly due to the fact that the activities of companies operating in the manufacturing industry are closely linked to and have an impact on the natural environment.

Based on the results of the questionnaire survey, the companies with a rural headquarters are the ones that can be classified in a higher proportion in the group of "pioneers" (1). It is likely that these businesses have realized that their territorial competitiveness position will be strengthened if they carry out environmental management. Although it should be noted that these studies were not statistically verifiable in all cases. In this case, according to the authors, by increasing the number of companies included in the research, a more reliable result is expected.

Acknowledgement

The research was supported by the Management and Organizational Science Research Center of the Faculty of Economics of the University of Pannonia (PE-GTK-GSKK A095000000-6).

REFERENCES

Alshehhi, A., Nobanee, H., & Khare, N. (2018). The impact of sustainability practices on corporate financial performance: Literature trends and future research potential. *Sustainability*, *10*(2), 494, 1-25. http://dx.doi.org/10.3390/su10020494

Antikainen, M., & Valkokari, K. (2016). A framework for sustainable circular business model innovation. *Technology Innovation Management Review*, 6 (7), 5-12. http://dx.doi.org/10.22215/timreview/1000

Barbaritano, M., Bravi, L., & Savelli, E. (2019). Sustainability and quality management in the Italian luxury furniture sector: A circular economy perspective. *Sustainability*, 11(11), 3089. http://dx.doi.org/10.3390/su11113089

Bedenik, N. O., Prebežac, D., Strugar I., & Barišić, P. (2019). The Challenges of Controlling and IT Support in Non-financial Reporting. *International Journal of Industrial Engineering and Management (IJIEM)*, 10, (1) 21-29. http://doi.org/10.24867/IJIEM-2019-1-021

Briem, A. K., Betten, T., Held, M., Wehner, D., & Baumann, M. (2019). Environmental Sustainability in the Context of Mass Personalisation – Quantification of the Carbon Footprint with Life Cycle Assessment. *International Journal of Industrial Engineering and Management (IJIEM)*, 10 (2), 171-180. DOI http://doi.org/10.24867/IJIEM-2019-2-237:

Chodkowska-Miszczuk, J., Kulla, M., Novotný, L. (2019). Biogas energy - a chance for agriculture and rural development? Insight from the post-communist Central Europe. *Deturope*,11(2), 30-53 https://doi.org/10.32725/det.2019.014

Csizmásné Tóth, J. et al. (2018). Energy and renewable energy use in EU28 and Hungary ohttps://www.deturope.eu/savepdfs/det/2019/02/03.pdf

n the basis of statistics. *Analecta Technica Szegedinensia* 12 : 2 pp. 51-56. 6 p. https://doi.org/10.14232/analecta.2018.2.51-56

www.analecta.hu/index.php/analecta/article/download/31577/31266

Elia, V., Gnoni, M. G., & Tornese, F. (2016). Measuring circular economy strategies through index methods: A critical analysis. *Journal of Cleaner Production*, 142, 2741-2751. https://doi.org/10.1016/j.jclepro.2016.10.196

Engel, H., Stuchtey, M. & Vanthournout, H. (2016). *Ahead of the curve: Innovative models for waste management in emerging markets.* In: L. Rahilly (Ed.) McKinsey Center for Business and Environment: The Circular Economy: Moving from Theory to Practice. Special edition, (pp. 11-16). from https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/The%20circular%20economy%20Moving%20from%20theory%20to%20practice/The%20circular%20economy%20Moving%20from%20theory%20to%20practice.ashx

Fernando, Y., Shaharudin, M. S., & Abideen, A. Z. (2022). Circular economy-based reverse logistics: dynamic interplay between sustainable resource commitment and financial performance. *European Journal of Management and Business Economics*, Vol. ahead-of-print No. ahead-of-print, pp. 1-22. https://doi.org/10.1108/EJMBE-08-2020-0254

Fianko, S. K., Amoah, N., Afrifa, S. Jnr, & Dzogbewu, T. C. (2021). Green Supply Chain Management and Environmental Performance: The moderating role of Firm Size. *International Journal of Industrial Engineering and Management*, 12 (3), 163 – 173. http://doi.org/10.24867/IJIEM-2021-3-285

Franco-García, M-L., Carpio-Aguilar, J. C., & Bressers, H. (2019). *Towards zero waste, circular economy boost: waste to resources.* In Franco-García, M-L., Carpio-Aguilar, J. C. & Bressers H. (Ed.), Towards Zero Waste pp. 1-8 New York, (USA): Springer, https://doi.org/10.1007/978-3-319-92931-6

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016) A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner production*, vol. 114, 11-32. https://doi.org/10.1016/j.jclepro.2015.09.007

Gliem, J. A. & Gliem, R. R. (2003). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. In 2003 Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education, 82-88. from https://www.semanticscholar.org/paper/Calculating%2C-Interpreting%2C-And-Reporting-Cronbach%E2%80%99s-Gliem-Gliem/42147770ce652e700e5623d4611f315addfeee2a

Hollósy, Zs. et al. (2021a). Az energia és megújuló energia termelésének és felhasználásának aktualitásai, várható tendenciái a világon és az EU-ban: Energy, renewable energy, current issues of production and use - expected trends in the world and in the EU. *Tér-Gazdaság-Ember* 9 : 1 pp. 35-49. , 15 p.

https://tge.sze.hu/images/dokumentumok/K%C3%B6tetek%20%C3%B6sszes%20cikkel/2021.%20IX.%20%C3%A9vfolyam%201.%20sz%C3%A1m_cikkek/2021_9_evfolyam_1_szam_Hollosy_Kiss_Poor.pdf

Hollósy, Zs. et al. (2021b). Napelemes áramtermelő rendszerek aktuális ökonómiai és környezeti szempontú értékelése. *Studia Mundi - Economica* 8 : 1 pp. 37-48. , 12 p. https://doi.org/10.18531/studia.mundi.2021.08.01.37-48

http://real.mtak.hu/136200/1/studia_mundi_vol_8_no_1_4.pdf

Janik, A., & Ryszko, A. (2019). Circular economy in companies: an analysis of selected indicators from a managerial perspective. *Multidisciplinary Aspects of Production Engineering*, 2 (1), 523-535. http://dx.doi.org/10.2478/mape-2019-0053

Johl, S. K., & Toha, M. A. (2021). The nexus between proactive eco-innovation and firm financial performance: A circular economy perspective. *Sustainability*, *13*(11), 6253, 1-25. https://doi.org/10.3390/su13116253

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, conservation and recycling*, 127, 221-232. http://dx.doi.org/10.1016/j.resconrec.2017.09.005

Kiss, L. B. et al. (2021). Megújuló energiák az EU közlekedésében. *Studia Mundi - Economica* 8 : 2 pp. 47-59. , 13 p.
https://doi.org/10.18531/studia.mundi.2021.08.02.47-59
http://real.mtak.hu/136210/1/studia_mundi_vol_8_no_2_4.pdf

Kiss, T. et al. (2019). Termelőüzem ökológiai szempontú tervezése. *Közgazdasági Szemle* 66 : 7-8 pp. 863-886. , 24 p. http://dx.doi.org/10.18414/KSZ.2019.7-8.863 http://real.mtak.hu/95073/1/08KissTiborstb.pdf

Kozma, D. E., Barna, K. M., & Molnár, T. (2021). Rangsoroljunk vagy nem? A körforgásos gazdaság mérési lehetőségei és azok összehasonlítása az EU-tagországokban. *Vezetéstudomány - Budapest Management Review*, 52 (8), 63-77. http://dx.doi.org/10.14267/VEZTUD.2021.09.05

Kravchenko, M., McAloone, T. C., & Pigosso, D. C. A. (2020). To what extent do circular economy indicators capture sustainability? *Procedia CIRP*, vol. 90, 31-36. https://doi.org/10.1016/j.procir.2020.02.118

Kristensen, H. S., & Mosgaard, M. A. (2020). A review of micro level indicators for a circular economy - moving away from the three dimensions of sustainability? *Journal of Cleaner Production*, vol. 243, 118531, 1-20. https://doi.org/10.1016/j.jclepro.2019.118531

Kwarteng, A., Simpson, S. N. Y., & Agyenim-Boateng, C. (2021). The effects of circular economy initiative implementation on business performance: the moderating role of organizational culture. *Social Responsibility Journal,* Vol. ahead-of-print No. ahead-of-print. http://dx.doi.org/10.1108/SRJ-01-2021-0045

Lengyel, P., Bai, A., Gabnai, Z., Mustafa, O. M. A, Balogh, P., Péter, E., Tóth-Kaszás, N., & Németh, K. (2021). Development of the Concept of Circular Supply Chain Management - A Systematic Review. *Processes*, 9, 1740, 1-20. https://doi.org/10.3390/pr9101740

Lindgreen, R.E., Salomone, R., & Reyes, T. (2020). A critical review of academic approaches, methods and tools to assess circular economy at the micro level. *Sustainability*, 12(12), 4973. 1-27. https://doi.org/10.3390/su12124973

Lu, W., Shen, L. & Yam, M.C. (2008). Critical success factors for competitiveness of contractors: China study. *Journal of construction engineering and management*, 134 (12), 972-982. DOI: 10.1061/ASCE0733-93642008134:12972

MacArthur, E. (2013). *From linear to circular - Accelerating a proven concept.* In Potocnik J. (Ed.), Towards the circular economy, economic and business rationale for an accelerated transition (pp. 21-34). Cowes (UK): Ellen MacArthur Foundation. https://www.werktrends.nl/app/uploads/2015/06/Rapport_McKinsey-Towards_A_Circular_Economy.pdf

Mancini, E., & Raggi, A. (2021). A review of circularity and sustainability in anaerobic digestion processes. *Journal of Environmental Management* vol. 291, 11269. https://doi.org/10.1016/j.jenvman.2021.112695

McGregor, J.A., & Pouw, N. (2017). Towards an economics of well-being. *Cambridge Journal of Economics*, 41, 1123–1142. http://dx.doi.org/10.1093/cje/bew044

Molnár, T. (2015). Empirikus területi kutatások. Budapest (Hungary): Akadémiai Kiadó, https://doi.org/10.1556/9789634540229

Moraga, G., Huysveld, S., Mathieux, F., Blengini, G. A., Alaerts, L., VanAcker, K., de Meester, S., & J. Dewulf (2019). Circular economy indicators: What do they measure? *Resources, Conservation and Recycling*, vol. 146, 452-461. https://doi.org/10.1016/j.resconrec.2019.03.045

Moric, I., Jovanović, J. Š., Đoković, R., Peković, S., & Perović, Đ. (2020). The effect of phases of the adoption of the circular economy on firm performance: evidence from 28 EU countries. *Sustainability*, *12*(6), 2557. 1-12. http://dx.doi.org/10.3390/su12062557

Neumanné, V. I., & Varga-Dani, B. (2020). The Principle of Circular Economy in Tourism at Lake Balaton. *Pannon Management Review*, vol. 9, Special Issue, 25-42. from https://pmr.uni-pannon.hu/articles/pmr_9_1.pdf#page=25

Neumanné, V. I., & Varga-Dani, B., (2021). Fenntarthatóság és körforgásos gazdaság szemlélete a Balaton Turisztikai Térségben. *Comitatus: Önkormányzati szemle*, vol. 31, Special Issue, 150-162. http://www.mrtt.hu/files/comitatus/comitatus_2021_kulonszam.pdf

Parchomenko, A., Nelen, D., Gillabel, J., & Rechberger, H. (2019). Measuring the circular economy - A Multiple Correspondence Analysis of 63 metrics. *Journal of cleaner production*, vol. 210, 200-216. https://doi.org/10.1016/j.jclepro.2018.10.357

Philp, J., & Winickoff, D. E. (2018). *Realising the circular bioeconomy*. OECD Science, Technology and Industry Policy Papers, November 2018 no. 60, Paris (France): OECD Publishing. https://doi.org/10.1787/31bb2345-en

Rehman Khan, S. A., Yu, Z., Sarwat, S., Godil, D. I., Amin S., & Shujaat, S. (2021). The role of block chain technology in circular economy practices to improve organisational performance. *International Journal of Logistics Research and Applications*, Vol. 24, 1-18. https://doi.org/10.1080/13675567.2021.1872512

Rizos, V., Behrens, A., Kafyeke, T., Hirschnitz-Garbers, M. & Ioannou, A. (2015). The circular economy: Barriers and opportunities for SMEs. *CEPS Working Documents*, 412, 1–22. from http://aei.pitt.edu/67297/1/WD412_GreenEconet_SMEs_Circular_Economy.pdf

Saidani, M., Yannou, B., Leroy, Y., Cluzel, F., & Kendall, A. (2019). A taxonomy of circular economy indicators. *Journal of Cleaner Production* vol. 207, 542-559. https://doi.org/10.1016/j.jclepro.2018.10.014

Sariatli, F. (2017) Linear Economy Versus Circular Economy: A Comparative and Analyzer Study for Optimization of Economy for Sustainability. *Visegrad Journal on Bioeconomy and Sustainable Development*, 6(1), 31-34. DOI: 10.1515/vjbsd-2017-0005

Schönborn, G., Berlin, C., Pinzone, M., Hanisch, C., Georgoulias, K., & M. Lanz. (2019). Why social sustainability counts: The impact of corporate social sustainability culture on financial success. *Sustainable Production and Consumption*, 17, 1-10. https://doi.org/10.1016/j.spc.2018.08.008

Szép, S.T. (2016). Energy convergence of the European Union toward 2020. *Deturope*, 8, 3: 88-107 https://doi.org/10.32725/det.2016.024
https://www.deturope.eu/pdfs/det/2016/03/07.pdf

Takács, Sz., & Kárász, J. (2015). Egy egyszerű, újfajta kereszt-validálási eljárás bemutatása. *Psychologia Hungarica*, II/1, 65–77. From https://epa.oszk.hu/02400/02497/00003/pdf/EPA02497_PsychologiaHungaricaCaroliensis_2014_01_65-77.pdf

Uhrenholt, J. N., Kristensen, J. H., Gil, M. C. R., Jensen, S. F., & Waehrens, B. V. (2022). Circular economy: Factors affecting the financial performance of product take-back systems. *Journal of Cleaner Production*, 335, 130319, 1-12. https://doi.org/10.1016/j.jclepro.2021.130319

Wells, P., & Seitz, M. (2005). Business models and closed-loop supply chains: a typology. *Supply Chain Management: An International Journal*, 10 (4), 249–251. http://dx.doi.org/10.1108/13598540510612712